



REPORT

Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond

Submitted to:

Public Services and Procurement Canada on behalf of Transport Canada

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CA0007867.5135-004-R-Rev0

2 February 2024



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Executive Summary

WSP Canada Inc. (WSP) was retained by Public Services and Procurement Canada (PSPC), on behalf of Transport Canada, to conduct a detailed human health and ecological risk assessment (HHERA) in support of risk management for KÉLSET (KÉLSET, also known as Reay Creek) downgradient of KÉLSET Pond and the Victoria International Airport in British Columbia. WSP understands this HHERA was prepared to facilitate more in-depth engagement with other stakeholders and rightsholders that need to be consulted about the long-term risk management approach for KÉLSET.

This report was prepared in accordance with the terms and conditions of the Public Works and Government Services Canada Contaminated Sites Risk Assessment Contract with Task Authorizations (CTA) No. EZ897-191436/002/VAN, dated 9 August 2019, the Notice to Readers, and within the scope of work outlined in WSP's document titled "Workplan and Cost Estimate—Post-Remediation Site Visit, Finalization of the Risk Assessment, and Preparation of a Closure Report for KÉLSET, BC" dated 29 June 2023. Approval to proceed was provided under Task Authorization 700728007 on 30 June 2023, PSPC Project Number R.087575.009, and Transport Canada Project Number 51DJ E239.

KÉLSET originates at the Victoria International Airport, which is located on federal land leased to the Victoria Airport Authority. The airport has been in operation since 1939, and has included a variety of aircraft manufacturing, electroplating, and other industrial activities operations; stormwater and groundwater influences from these industrial activities drain towards KÉLSET.

KÉLSET Pond and KÉLSET have been the subject of considerable investigation. Sediment remediation and habitat restoration programs were completed by PSPC and Transport Canada for KÉLSET (the portion within the airport property) in 2019/20 and at KÉLSET Pond in 2020/21. This current investigation provides the results from supplemental investigation and HHERA for select portions of KÉLSET below KÉLSET Pond where intrusive remediation has not been completed. The objective of the HHERA was to assess the potential human health and ecological risks associated with the residual concentrations of airport-related contaminants in KÉLSET. The Study Area for the HHERA included the portions of KÉLSET between KÉLSET Pond to Patricia Bay Highway, and between Lochside Drive to Bazan Bay. The portions of KÉLSET that flow through privately-owned land (i.e., between Patricia Bay Highway and Lochside Drive) were not part of this assessment.

Based on current and future use of KÉLSET as a creek located within a forested ravine that runs through municipal parks bordered predominantly by private residential housing, the conclusions resulting from the HHERA within the Study Area are summarized as follows:

- **Human Health**—There were no contaminants of concern identified in surface water, sediment, or riparian soils that would indicate an issue with respect to human receptors who might use the area as an urban park. Data were compared to conservative standards and guidelines (i.e., BC CSR numerical standards and federal guidelines for the protection of human health) and no contaminants of concern were identified. The human health risk assessment ended at the problem formulation stage.

- **Terrestrial Ecological Health**—There were no contaminants of concern with respect to surface water or soils that would indicate that risks to wildlife would be present. BC CSR numerical soil standards and federal guidelines for the protection of soil invertebrates and plants (urban park land use) were used for this screening as a reality check that if the soil concentrations were lower than the applicable criteria, it would be highly unlikely that intrusive remediation of riparian soils would be needed. The terrestrial ecological risk assessment ended at the problem formulation stage.
- **Aquatic Ecological Health**—Several metals (i.e., cadmium, chromium, copper, and zinc) were identified as contaminants of concern in sediment or surface water, and therefore, the aquatic ecological risk assessment proceeded to a quantitative risk analysis. This risk analysis used a weight-of-evidence approach where the data about total metal concentrations were supplemented by information about bioavailability (peeper chemistry) and effects (sediment toxicity testing, elutriate toxicity testing). Benthic community analysis is another commonly used line of evidence but was not considered for KÉLSET because any sampling would have been conducted after a significant release by a third party that would presumably have caused adverse effects to aquatic organisms. Each individual line of evidence was discussed individually, but as an overall narrative, WSP concludes that risks to aquatic organisms from historical contamination associated with the industrial activities at the airport are low.

WSP has a high degree of confidence in the conclusions of the HHERA but notes the following areas of uncertainty:

- **Human Health**—The key area of uncertainty with respect to human health relates to whether a park user is the appropriate receptor to evaluate the risks that may be important to rightsholders or stakeholders. We note that the default assumption is that the riparian areas of KÉLSET are not being used as a source of food, which is consistent with urban park land use, but we appreciate that there may be alternative land uses that the custodial agency and rightsholders may agree should be evaluated.
- **Terrestrial Ecological Health**—Although soil concentrations throughout the riparian areas of KÉLSET were lower than the urban park land use standards and were also lower than the agricultural standards (which includes a bioaccumulation check for uptake by plants to protect livestock), we recognize that cadmium can bioaccumulate in plants and soil invertebrates, and there is not currently a specific risk calculation to show that bioaccumulation is in fact negligible. Stakeholders and rightsholders may have specific receptors that they would wish to see reflected in a food chain model. However, our observation is that it is important to have alignment about how a wildlife risk assessment would be used to help make informed site management decisions before initiating that type of analysis.
- **Aquatic Ecological Health**—The key uncertainty for aquatic ecological health is similar to that for terrestrial ecological health in that the uptake of cadmium (and to a lesser extent, chromium) has not been directly measured, and therefore, it is not possible to complete a quantitative risk analysis for semi-aquatic wildlife pathways. The finding from the sediment peepers (and surface water) that cadmium and chromium are not fluxing into the overlying water suggests that bioaccumulation may be limited, but direct evidence for that pathway is not currently available.

As a result of the uncertainties identified above, WSP presented the results of the draft HHERA to the W̱SÁNEĆ Leadership Council (WLC) Technical Advisory Committee during a virtual meeting held on 19 January 2023. In addition to presenting the objectives, methods, and results of the draft HHERA, WSP described the uncertainties with the assessment and requested input into future risk assessment activities at KÉLSET, if required. During the engagement meeting, the WLC expressed concerns with bioaccumulation of contaminants/pollutants into food items and with cumulative effects on food sources/food security. Based on the feedback received during the meeting, the WLC Technical Advisory Committee had no concerns with the results of the draft HHERA, and the HHERA was finalized (this document).

Notice to Readers

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The inferences concerning the Site conditions contained in this report are based on information obtained during the assessment conducted by WSP personnel and are based solely on the condition of the property at the time of the investigation timeline, as described in this report.

This report was prepared, based in part, on information obtained from historic information sources. In evaluating the subject Site (KÉLSET), WSP has relied in good faith on information provided. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The recommendations documented in this report have been prepared for the specific application to this project and have been developed in a manner consistent with that level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction.

With respect to regulatory compliance issues, regulatory statutes are subject to interpretation. These interpretations may change over time and should be reviewed with time.

If new information is discovered during future work, the conclusions of this report should be re-evaluated and the report amended, as required, prior to any reliance upon the information presented herein.

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1.0 INTRODUCTION

WSP Canada Inc. (WSP, formerly Golder Associates Ltd. [Golder]¹) was retained by Public Services and Procurement Canada (PSPC), on behalf of Transport Canada, to conduct a detailed human health and ecological risk assessment (HHERA) in support of risk management for KÉLSET (also known as Reay Creek) downgradient of KÉLSET Pond and the Victoria International Airport in British Columbia (shown on Figure 1).

This report was prepared in accordance with the terms and conditions of the Public Works and Government Services Canada Contaminated Sites Risk Assessment Contract with Task Authorizations (CTA) No. EZ897-191436/002/VAN, dated 9 August 2019, the Notice to Readers, and within the scope of work outlined in WSP's document titled "Workplan and Cost Estimate—Post-Remediation Site Visit, Finalization of the Risk Assessment, and Preparation of a Closure Report for KÉLSET, BC" dated 29 June 2023. Approval to proceed was provided under Task Authorization 700728007 on 30 June 2023, PSPC Project Number R.087575.009, and Transport Canada Project Number 51DJ E239.

1.1 Project Context and Objectives

KÉLSET originates at the Victoria International Airport, which is located on federal land leased to the Victoria Airport Authority. The airport has been in operation since 1939, and historically included a variety of aircraft manufacturing, electroplating, and other industrial activities operations. SLR (2018a) provides a detailed review of the expansion and environmental management of the airport industrial areas, but broadly, stormwater and groundwater influences from industrial activities drain towards KÉLSET. KÉLSET Pond was constructed circa 1950 and acted as a sediment trap. Migration of contaminated sediment downward from the industrial activities to the remainder of KÉLSET would have occurred prior to construction of the water impoundment structure; regardless, there was a partial breach in 1997 which would have likely remobilized material. Elevated concentrations of cadmium, chromium, and zinc have been recorded (as well as other contamination) in sediment samples collected from KÉLSET Pond and KÉLSET, which is consistent with the known historical industrial activities (i.e., cadmium and chromium compounds were used to electroplate aircraft parts, and zinc chromate paint was commonly used).

KÉLSET Pond and KÉLSET have been the subject of considerable investigation. Sediment remediation and habitat restoration programs were completed by PSPC and Transport Canada for KÉLSET (the portion within the airport property) in 2019/20 and at KÉLSET Pond in 2020/21, and confirmatory sampling showed that the remediation programs were successful. This current investigation provides the results from supplemental investigation and HHERA for select portions of KÉLSET below KÉLSET Pond where intrusive remediation has not been completed. The objective of the HHERA was to assess the potential human health and ecological risks associated with the residual concentrations of airport-related contaminants in KÉLSET. The Study Area for the HHERA included the portions of KÉLSET between KÉLSET Pond to Patricia Bay Highway, and between Lochside Drive to Bazan Bay. The portions of KÉLSET that flow through privately-owned land (i.e., between Patricia Bay Highway and Lochside Drive) were not part of this assessment. The overall objective of the HHERA is to assist PSPC and Transport Canada in developing an appropriate risk management strategy for KÉLSET within the Study Area.

¹ Golder Associates Ltd was acquired by WSP Canada Inc. (WSP) and between January 2022 and 31 December 2022, was known as Golder, a member of WSP (WSP Golder). As of 1 January 2023, Golder was fully amalgamated with WSP.

1.2 Report Organization

The main body of this document has been organized to emphasize readability for a broad audience, with technical information placed in the appendices to the extent possible. The HHERA is structured as follows:

- Section 1 provides an introduction to the HHERA along with the project context and objectives, report organization, and an overview of the regulatory and risk assessment framework used to conduct the HHERA.
- Section 2 provides relevant site information used to conduct the HHERA.
- Section 3 provides the problem formulation that describes how the available site information was used to determine which substances, receptors (human and ecological), and exposure pathways were evaluated in the HHERA. The purpose of the problem formulation is to identify contaminants of potential concern (COPCs), if any, for further quantitative analysis.
- Section 4 provides the aquatic ecological risk assessment, which summarizes how risks were evaluated for aquatic organisms (i.e., aquatic plants, invertebrates, and fish) from exposure to the COPCs identified in the problem formulation.
- Section 5 summarizes the overall results and conclusions and discusses the degree of confidence in those conclusions, as well as the implications for future risk management planning.

1.3 Regulatory Framework

Although KÉLSET originates at the Victoria International Airport on federal land, the Study Area evaluated in the HHERA is located entirely on provincial lands. Therefore, for the purposes of the HHERA, provincial soil, sediment, and water standards² and guidelines³ were used to evaluate the available chemistry data. For information purposes, the available chemistry data (soil, sediment, and water) were also screened against federal criteria, as described below. WSP understands that there is no intent to pursue a provincial Certificate of Compliance.

1.3.1 Provincial Criteria

Sediment data were screened against the following:

- Aquatic Life—Sediment data were screened using BC CSR Schedule 3.4 Generic Sediment Standards for Sensitive Use (BC ENV 2023a). Samples collected between KÉLSET Pond and Patricia Bay Highway were compared to freshwater standards (SedFS) and samples collected from locations downstream of Lochside Drive, which were collected below the high-tide line, were compared to marine and estuarine standards (SedMS).
- Human Health—Human health screening values are not available for sediment. Therefore, as per Technical Guidance 15 (BC ENV 2017), sediment data were screened against BC CSR Schedule 3.1 Part 1 Matrix

² Contaminated Sites Regulation (CSR; BC Reg. 375/96 [includes BC Reg 128/2022, App 2 and BC Reg 133/2022 amendments effective March 1, 2023, as amended by BC Reg 2/2023 and BC Reg 35/2023]); BC ENV (2023a and 2023b).

³ BC approved and working water quality guidelines (BC ENV 2023b and BC ENV 2021).

Numerical Soil Standards for intake of contaminated soil or Schedule 3.1 Part 2 Generic Numerical Soil Standards to Protect Human Health (BC ENV 2023a). Urban park land use (PL) was assumed.

Surface water and porewater data were screened against the following:

- **Aquatic Life**—Surface water and porewater data were screened against BC Working and Approved Water Quality Guidelines (WQGs) for long-term chronic protection of freshwater aquatic life (BC ENV 2021; BC ENV 2023c). Where WQGs for dissolved metals were unavailable, WQGs for total metals were applied.
- **Human Health**—Although surface water in KÉLSET is not used as a drinking water source, it could be incidentally ingested during recreation. Therefore, as a conservative measure, surface water data were screened against the health-based drinking water guidelines from the BC Working and Approved WQGs (BC ENV 2021; BC ENV 2023c). Drinking water guidelines based on aesthetic considerations such as colour, taste, or odour were not selected.

Soil data were screened against the following:

- **Ecological Health**—Soil data were screened against BC CSR Schedule 3.1 Part 1 Matrix Numerical Soil Standards for toxicity to soil invertebrates and plants or Schedule 3.1 Part 3 Generic Numerical Soil Standards to protect ecological health (BC ENV 2023a). Urban park land use (PL) was assumed. Pathway-specific soil standards protective of groundwater flow to surface water used by aquatic life were not used to screen the soil data since surface water and porewater data were available for the evaluation of this exposure pathway.
- **Human Health**—Soil data were screened against BC CSR Schedule 3.1 Part 1 Matrix Numerical Soil Standards for intake of contaminated soil or Schedule 3.1 Part 2 Generic Numerical Soil Standards to protect human health (BC ENV 2023a). Urban park land use (PL) was assumed. Pathway-specific soil standards protective of groundwater used for drinking water were not used since groundwater in the Study Area is not used as a source of drinking water (Section 2.1) and surface water data were available for evaluation of incidental ingestion of water in KÉLSET during recreational activities.
- **Background**—If the screening criteria was less than the local background estimate, per Protocol 4 (BC ENV 2023d), the background estimate was applied in place as the screening criteria.

1.3.2 Federal Guidelines

Sediment data were screened against the following:

- **Aquatic Life**—Sediment data were screened using CCME Sediment Quality Guidelines for the protection of aquatic life (CCME 1999). The guidelines are divided into freshwater and marine water categories within which interim sediment quality guidelines (ISQG) and probable effect levels (PEL) are provided. Samples collected between KÉLSET Pond and Patricia Bay Highway were compared to freshwater guidelines and samples collected from locations downstream of Lochside Drive, which were collected below the high-tide line, were compared to marine and estuarine guidelines.

- Human Health—Human health screening values are not available for sediment. Therefore, sediment data were screened against CCME Soil Quality Guidelines for the protection of human health. Residential/parkland (RL/PL) land use was assumed. Per- and polyfluoroalkyl substances (PFAS) data were screened against Health Canada (2019) Soil Screening Values (SSVs).

Surface water and porewater data were screened against the following:

- Aquatic Life—Surface water and porewater data were screened against CCME Water Quality Guidelines for the protection of freshwater aquatic life (CCME 2007).
- Human Health—Although surface water in KÉLSET is not used as a drinking water source, it could be incidentally ingested during recreation. Therefore, as a conservative measure, surface water data were screened against the health-based Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada 2022). Drinking water guidelines based on aesthetic considerations such as colour, taste, or odour were not selected.

Soil data were screened against the following:

- Ecological Health—Soil data were screened against CCME Soil Quality Guidelines for the protection of environmental health (CCME 1999). Residential/parkland land use (RL/PL) was assumed. Pathway-specific soil guidelines protective of groundwater flow to surface water used by aquatic life were not used to screen the soil data since surface water and porewater data were available for the evaluation of this exposure pathway.
- Human Health—Soil data were screened against CCME Soil Quality Guidelines for the protection of human health (CCME 1999). Residential/parkland land use (RL/PL) was assumed. Pathway-specific soil guidelines protective of groundwater used for drinking water were not used since groundwater in the Study Area is not used as a source of drinking water (Section 2.1) and surface water data were available for evaluation of incidental ingestion of water in KÉLSET during recreational activities.

1.3.3 Risk Assessment Guidance and Framework

WSP considered both provincial and federal guidance in the preparation of the HHERA:

- BC Ministry of Environment and Climate Change Strategy (BC ENV 2021e) Protocol 1 for Contaminated Sites: Detailed Risk Assessment.
- Health Canada. 2021. Federal Contaminated Sites Risk Assessment in Canada, Part I Guidance on Human Health Preliminary Quantitative Risk Assessment, Version 3.0. March 2021.
- CCME. 2020. Ecological Risk Assessment Guidance Document. Canadian Council of Ministers of the Environment, 2020.

These guidance manuals may have minor differences in how policy decisions are applied to the technical process of the risk assessment, but both federal and provincial guidance share the same process:

- **Problem formulation.** The problem formulation consolidates the available site information in order to identify the contaminants of potential concern, the relevant human and ecological receptors, and the exposure pathways that connect contaminants and receptors. The problem formulation provides a structured approach for which contaminant-pathway-receptor combinations need to move forward for quantitative analysis in the exposure and effects assessment. A contaminant would not carry forward for risk analysis if it was present at concentrations less than standards or if there was no operable pathway for that contaminant to reach the relevant receptors.
- **Exposure and effects assessment.** For those combinations of contaminants and pathways that carry forward from the problem formulation, the exposure assessment involves estimating the exposure dose while the effects (toxicity) assessment involves comparing the results of the exposure assessment to “safe” concentrations specified by regulatory guidance or informed by the available and appropriate scientific literature.
- **Risk characterization.** The information from the exposure and effects assessments is combined in the risk characterization to produce numerical estimates of human and ecological risks. These numerical estimates include hazard quotients, or incremental lifetime cancer risks for human exposure to carcinogenic contaminants, which are then compared to acceptable risk limits specified in regulatory guidance. The ecological risk assessment can integrate those numerical estimates with other lines of evidence such as biological surveys, bioaccumulation models, or toxicity testing to arrive at an overall conclusion based on the totality of the data. Regardless of the risk characterization method, the uncertainty in the conclusion is described to assist risk managers reach an informed decision about next steps.

2.0 SITE INFORMATION

The following sections provide a summary of relevant information regarding the general site setting, land use, and ecological resources in KÉLSET, relevant information regarding the background creek (TENTEN) used in the HHERA, and a summary of previous investigations to highlight topics that were relevant in the design and execution of the HHERA. WSP acknowledges that KÉLSET is within the areas of interest of the Tsartlip, Tseycum, Tsawout, Pauquachin, and Malahat First Nations, and the Te'Mexw Treaty Association (Millennia Research Limited 2021).

2.1 Site Context

KÉLSET is a freshwater creek that originates at the Victoria International Airport and terminates in Bazan Bay (Figure 1). From the airport, KÉLSET flows east through a culvert at Canora Road and into KÉLSET Pond. From KÉLSET Pond, the water flows through two municipal parks (Reay Creek Park and Peter Grant Park) toward a culvert under Patricia Bay Highway. From Patricia Bay Highway, KÉLSET flows through privately-owned land and terminates in Bazan Bay. The total length is approximately one kilometre from KÉLSET Pond to Bazan Bay. There are no other surface water bodies within 500 m of the Study Area, and groundwater is not currently used as a source of drinking water. There are no drinking water wells within 500 m of KÉLSET (Government of British Columbia 2022).

Land Use and Ecological Setting

The current (and expected future) land use is urban park (e.g., the creek cuts through a ravine with walking trails that are used by park users and dog walkers). There is signage posted along KÉLSET and at KÉLSET Pond that warns park users from contacting the sediment because of elevated metal concentrations.

KÉLSET provides important ecological habitat. KÉLSET is located in the Coastal Douglas Fir biogeoclimatic zone, moist maritime subzone (CDFmm), which is characterized by mild winters with lots of precipitation and a relatively dry summer season (BC Ministry of Forests 1999). The park land adjacent to KÉLSET is relatively flat and consists of dense shrubs and mature trees with grassy banks in portions of the creek. Camosun College (2018) reported riparian flora and fauna observations along KÉLSET downstream of the dam to Bazan Bay and identified occurrences of provincially red- and blue-listed plant species combinations (additional information with respect to species at risk provided in Section 3.3.1). The following flora and fauna were identified by Camosun College (2018):

- 14 distinct tree species, 29 shrub species, 58 non-woody species, and 26 non-vascular plant species; the majority of which were native to KÉLSET.
- 46 bird species, including Mallard Duck [*Anus platyrhynchos*], Great Blue Heron [*Ardea Herodias*], and American Robin [*Turdus migratorius*].
- Six mammal species, including American Mink [*Neovison vison*], Deer Mouse [*Peromyscus maniculatus*], Northern Raccoon [*Procyon lotor*], Eastern Cottontail [*Sylvilagus floridanu*], North American River Otter [*Lontra canadensis*].

Other Stressors

ƘELSET is subject to multiple stressors (i.e., factors that affect natural stream processes) that are consistent with urbanized creeks. Camosun College (2018) identified 26 non-native plant species and 12 invasive species (e.g., Himalayan blackberry [*Rubus armeniacus*] and English ivy [*Hedera helix*]). The presence of the water impoundment structure that forms ƘELSET Pond will have altered the normal sediment transport patterns within the creek, which is further altered by stormwater inputs. These stormwater inputs have resulted in seven individual documented fish kills since 1982 (Macdonald and Bruce 2015, SLR 2018a). Some of these incidents are attributed to industrial activities on airport property, but there have also been releases from other sources (e.g., a suspected discharge of bleach to stormwater in July 2021).

TENTEN (located northwest of ƘELSET on airport lands; see Figure 1), was identified as a representative urbanized background creek for comparison. TENTEN has also been subject to multiple remediation projects including construction of a wetland complex to provide treatment for nutrient-laden water from nearby farming operations, enhancement of existing facilities, and creation of a diversion channel to direct pond overflow into a retention area to reduce sediment from entering TENTEN (Victoria International Airport 2018). The objective of the background creek is not to compare ƘELSET to a pristine environment—it is to provide context to differentiate potential effects from the key metal contaminants of concern related to the industrial activities from potential effects from habitat alteration and urbanization.

2.2 Summary of Previous Investigations

Environmental investigations have been occurring at ƘELSET since the 1980s (MB Laboratories 2005). Summaries of the historical reports prior to 2017 are provided in the Phase I ESA conducted by SLR (2018a). Table 1 provides a brief summary of those historical investigations over the last 5 years. WSP has relied on the chemistry data from these reports, which has been integrated into the current HHERA where applicable.

Table 1: Summary of Previous Investigations at ƘELSET

Reference	Key Findings
Upstream ƘELSET and ƘELSET Pond	
SLR 2018a – Phase I ESA Reay Creek	<ul style="list-style-type: none"> ▪ Phase I ESA of ƘELSET and ƘELSET Pond identified areas of potential environmental concern (APECs) and confirmed three of those APECs (Upper ƘELSET and Side Channel; Mid ƘELSET; ƘELSET Pond) as areas of environmental concern (AECs) based on the presence of metals related to historic and current airport activities. ▪ Hydrocarbons, PAHs, VOCs, metals, glycols, and PFAS were identified as PCOCs in soil, groundwater, sediment, surface water, and/or vapour in the identified APECs.
SLR 2019a – Phase II ESA Reay Creek	<ul style="list-style-type: none"> ▪ Phase II ESA included the advancement of 12 boreholes (8 of which were completed as monitoring wells) and the collection of soil, groundwater, sediment, and surface water samples from the AECs and APECs. ▪ The three AECs from the Phase I ESA were retained and two other APECs were confirmed as AECs. Metals, hydrocarbons, and PAHs were identified as COCs in sediment, surface water, soil and/or groundwater. Soil vapour was eliminated as a media of concern. ▪ Work was conducted in conjunction with sediment remediation as well as construction of a stormwater retention pond by the Victoria Airport Authority in the vicinity of AEC 2 (upper mid ƘELSET).

Reference	Key Findings
SLR 2019b – Reay Creek Remediation Project: Supplemental Sediment Sampling and Probing on Airport Lands	<ul style="list-style-type: none"> ■ Supplemental sediment sampling of KÉLSET on airport lands to advance the remedial strategy. Metal contamination (cadmium, chromium, copper, lead, and zinc) greater than applicable sediment standards was identified. ■ PAH exceedances greater than applicable standards were identified in a small area of sediment but SLR concluded the exceedances were the result of a recent release rather than historical airport activities.
SLR 2020 – Confirmation of Remediation KÉLSET (Reay) Creek (Victoria International Airport)	<ul style="list-style-type: none"> ■ Remediation of contaminated sediment from upstream reaches of KÉLSET on airport lands resulted in removal of approximately 187 m³ of contaminated sediment followed by backfilling and site restoration. Confirmatory samples were less than applicable standards for metals, PAHs, hydrocarbons, and VOCs.
SLR 2021a – Confirmation of Remediation KÉLSET (Reay Creek) Pond	<ul style="list-style-type: none"> ■ Remediation of contaminated sediment from KÉLSET Pond resulted in removal of approximately 5,100 m³ of metal and PAH-contaminated material followed by backfilling and site restoration. ■ With the exception of marginal cadmium exceedances (i.e., less than 2x) in three samples collected along the pond boundary (adjacent to 9461 Braun Crescent), confirmatory samples were less than applicable standards for metals, PAHs, hydrocarbons, VOCs, and PCBs.
SLR 2021b – Characterization of Soil and Sediment from KÉLSET (Reay) Creek Pond Bank Adjacent to 9461 Braun Crescent	<ul style="list-style-type: none"> ■ Targeted investigation to delineate residual contamination adjacent to 9461 Braun Crescent. Samples from four of eight test pits had concentrations of arsenic, cadmium, and/or zinc greater than applicable standards. SLR concluded the potential source of this contamination was sediment from KÉLSET Pond, fill material encountered within the pond bank, or a combination of both.
KÉLSET (Downstream of KÉLSET Pond; Study Area for the HHERA)	
SLR 2018b – Reay Creek Downstream Sediment and Surface Water Assessment	<ul style="list-style-type: none"> ■ SLR conducted sediment and surface water sampling within the lower reaches of KÉLSET and collected a total of 23 sediment samples and six surface water samples from 17 locations downstream of KÉLSET Pond and Patricia Bay Highway. ■ Sediment samples were analyzed for a broad list of potential COC including metals, PAHs, hydrocarbons, PFAS, pesticides, and PCBs. Water samples were analyzed for total metals, PAHs, and hydrocarbons. ■ Concentrations of cadmium, chromium, lead, and zinc exceeded applicable standards in multiple samples. One sample exceeded the applicable standard for DDT. ■ There were no exceedances in surface water, and hydrocarbon concentrations in water were below laboratory detection limits.
Thurber 2019 – Reay Creek Environmental Testing and Analytical Results	<ul style="list-style-type: none"> ■ Thurber collected soils from shallow test pits excavated on the creek banks downstream of KÉLSET dam to determine if contaminated sediments had impacted the creek side areas downstream of the dam. Cadmium and zinc were identified at concentrations exceeding applicable soil standards.
Golder 2021a – Data Review and Gap Analysis Report	<ul style="list-style-type: none"> ■ Golder rescreened the sediment chemistry results to current numerical standards (i.e., BC CSR Stage 13 amendments made on February 1, 2021) and found no change in the conclusions reached by SLR (2018b).
Golder 2021b – Supplemental Sediment Sampling Report	<ul style="list-style-type: none"> ■ Golder conducted supplemental sediment sampling from 24 locations and analyzed samples for metals, PAHs, and/or DDT. There were no exceedances noted in samples taken from the intertidal or marine environments below Lochside Drive. There were no exceedances of PAHs or DDT freshwater sediment standards in samples collected between KÉLSET Pond and the Patricia Bay Highway, but there were exceedances for arsenic, cadmium, chromium, and zinc.

Notes:

AEC = area of environmental concern; APEC = area of potential environmental concern; BC CSR = British Columbia Contaminated Sites Regulation; COC = contaminant of concern; DDT = dichlorodiphenyltrichloroethane; ESA = environmental site assessment; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenyl; PFAS = Per- and Polyfluoroalkyl Substances; VOC = volatile organic compound.

Based on the results of the supplemental sediment sampling conducted in June 2021 (Golder 2021b; summarized in Table 1), WSP conducted an additional supplemental sampling program in October and November 2021. A detailed report describing the sample collection methods, analytical approaches, and quality assurance/quality control measures, as well as the laboratory certificates of analysis, is provided in Appendix A.

3.0 PROBLEM FORMULATION

The purpose of the problem formulation is to develop a focused understanding of what human and ecological receptors are likely to be present at KÉLSET, to determine which substances constitute COPCs at KÉLSET, and to describe how the COPCs migrate from the source(s) and ultimately reach, and are taken up by, receptors at KÉLSET. The results of the problem formulation are summarized in conceptual exposure models for both human and ecological health.

3.1 Focus on Metals

WSP has included relevant post-remedial soil, sediment, and surface water chemistry data in this HHERA, including data reported by SLR (2018b) and Thurber (2019). These reports include information about a wide range of potential contaminants (e.g., PAHs, PCBs, pesticides, PFAS, BTEX). This data was compiled and screened against applicable pathway-specific criteria as shown in Tables B-1 through B-5 in Appendix B and described in Section 1.3.

WSP screened the available data and concluded that metals were the primary contaminants of interest that warranted discussion in the following sections of this problem formulation. The following parameters were considered, but not retained in the problem formulation:

- PAHs were commonly analyzed in sediment by SLR (2018b) and there have been no sediment samples with PAH concentrations that exceeded provincial numerical standards. However, there were exceedances of the CCME ISQGs (but not the PELs). ISQGs are consistent with a threshold effect level and represent a level below which adverse effects are expected to rarely occur. Concentrations between the ISQG and the PEL are considered representative of a potential for occasional adverse effects; however, the PELs provide a recommended assessment tool for the identification of sediments with a greater likelihood of being associated with adverse effects (CCME 1999) and were used to identify parameters that were carried forward in the problem formulation.
- PCBs and PFAS had a more limited sampling program but concentrations were typically less than analytical detection limits and were consistently less than standards and guidelines, with the exception of one total PCB exceedance greater than the CCME ISQG (but less than the PEL and applicable BC CSR standards).
- SLR (2018b) measured exceedances of total dichlorodiphenyldichloroethane (DDD) and the sum of total dichlorodiphenyltrichloroethane (DDT) + total dichlorodiphenyldichloroethylene (DDE) + total DDD in two sediment samples collected immediately west of Patricia Bay Highway, but confirmatory and step-out sampling conducted by Golder (2021b) found no evidence of pesticides (i.e., concentrations were less than analytical detection limits), and the original sampling from SLR (2018b) found no evidence of other pesticides in sediment.

As a result, WSP has focused the remainder of the discussion about identification of COPCs on metals. Metals are the primary contaminant of concern associated with the industrial activities on the airport property, and the remediation programs for the upper reaches of KÉLSET and KÉLSET Pond were focused on removing cadmium and chromium.

3.2 Human Health Problem Formulation

3.2.1 Identification of Potential Human Receptors

KÉLSET is a freshwater creek in a forested ravine that runs through two municipal parks bordered predominantly by private residential housing within the Town of Sidney, before running through privately-owned lands and terminating at Bazan Bay within the District of North Saanich. The ravine is approximately 30 to 100 m wide, with a public walking trail adjacent to KÉLSET where the creek runs through the parks. Based on current and anticipated future land use, the primary human receptor involves recreational use. People can access KÉLSET and its riparian areas throughout the municipal park area on a year-round basis. These people can be of any age and could include members of local First Nations. The assumed frequency for a recreational user is also likely to be protective of how owners of residential lots below Patricia Bay Highway might use their land for recreational purposes, but we note that those areas are outside the scope of this risk assessment, and we have not included a residential land use scenario. The recreational user is also expected to be protective of park workers who would work in the municipal park areas to remove litter, but a construction worker scenario was not evaluated because any work at KÉLSET would be expected to be of limited duration (i.e., less than 90 days). These short-term exposures are regulated by WorkSafeBC and are not included in a contaminated sites risk assessment unless the exposure is expected to be longer than 90 days (BC ENV 2021e).

3.2.2 Identification of Potential Exposure Pathways

Exposure pathways for human receptors are routes by which receptors could potentially be exposed to COPCs in environmental media. The area around KÉLSET consists of a creek and surrounding riparian environment and is anticipated to remain as such in the future. Current and future human receptors include recreational users who may access KÉLSET year-round. As a result, the following exposure pathways were evaluated in the human health risk assessment (HHRA):

- Direct contact (incidental ingestion, dermal contact, and inhalation of dry particulate) with soil along the banks of KÉLSET.
- Direct contact (incidental ingestion, dermal contact, and inhalation of dry particulate) with sediment in KÉLSET.
- Direct contact/incidental ingestion of surface water in KÉLSET.

Note that a recreational scenario does not include organized foraging of berries, fish, or other foodstuffs for casual, subsistence, or cultural uses. Harvesting activities are not generally permissible in municipal parks. WSP recognizes that this decision in the risk assessment may need to be revisited as the custodial agency continues with engagement and consultation efforts.

The land use scenario also assumes that groundwater or surface water in KÉLSET is not used as a source of potable water. Inhalation pathways (vapour generated from sediment, soil or groundwater) were not evaluated because metals are not volatile contaminants.

3.2.3 Identification of Contaminants of Potential Concern

The initial list of COPCs is based on a comparison of the maximum concentrations to the lowest applicable standard or guideline value for human health.

Initial Screening

As described in Section 1.3, provincial standards for the intake of contaminated soil and pathway-specific CCME human health guidelines for soil ingestion or direct contact were used to screen the soil and sediment data, and drinking water quality guidelines were used to screen the available surface water data for the evaluation of risks to human health from the recreational pathway (e.g., incidental consumption during play). Screening results for the individual samples are provided in Appendix B (shown in Table B-1a for freshwater sediment, Table B-1b for estuarine/marine sediment, Table B-2 for surface water, and Table 5 for soil). The screening of the maximum observed concentrations for the initial list of contaminants of potential concern (i.e., those metal parameters that exceed human health or ecological screening criteria in sediment) to the applicable human health criteria is summarized in Table 2 for sediment and soil and in Table 3 for surface water.

Table 2: Screening Results for the Metals of Concern in Sediment and Soil for Human Health

Parameter	Maximum Sediment Concentration	Maximum Soil Concentration	BC CSR Soil Standard ^a	CCME Soil Guideline ^b	Retained as a COPC?
Arsenic	22.4	8	40	31 ^c	No
Cadmium	35	14.8	40	14	No – See text
Chromium	154	100	250	220	No
Iron	45,900	38,500	35,000	NG	No – see text
Lead	60.2	84.8	120	140	No
Zinc	502	464	25,000	10,000	No

Notes:

All units in milligrams per kilogram (mg/kg).

BC CSR = British Columbia Contaminated Sites Regulation; CCME = Canadian Council of Ministers of the Environment; COPC = contaminant of potential concern.

- BC CSR Schedule 3.1 Part 1 Numerical Soil Standards for intake of contaminated soil or Part 2 Generic Numerical Soil Standards to protect human health (urban park; PL).
- CCME Soil Quality Guidelines for the protection of human health; soil ingestion or direct contact pathways (residential/parkland land use).
- Environment Canada (1999) supporting documentation for the arsenic soil guideline based on a 10⁻⁵ cancer risk.

Bold = exceeds screening criteria

Table 3: Screening Results for the Total Metals of Concern in Surface Water for Human Health

Parameter	Maximum Surface Water Concentration	BC WQG for Drinking Water ^a	Health Canada Drinking Water Guideline ^c	Retained as a COPC?
Arsenic	0.53	10	10	No
Cadmium	0.084	5	7	No
Chromium	0.7	50	50	No
Iron	484	6,500 ^b	Not applicable ^d	No
Lead	0.42	5	5	No
Zinc	17.6	3,000	Not available	No

Notes:

All units in micrograms per litre (µg/L).

BC CSR = British Columbia Contaminated Sites Regulation; COPC = contaminant of potential concern; WQG = water quality guideline.

- BC Approved Water Quality Guidelines for protection of drinking water.
- BC CSR Schedule 3.2 Generic Numerical Water Standards for protection of drinking water; applied in lieu of an available WQG drinking water standard.
- Health Canada Guidelines for Canadian Drinking Water Quality.
- The available Health Canada guideline is based on an aesthetic objective, which is not considered applicable (see Section 1.3).

Further Consideration of Cadmium

Although the maximum concentrations of cadmium in sediment and soil exceeded the applicable CCME soil ingestion guideline, cadmium was not carried forward as a COPC for the following reasons:

- The screening was based on maximum concentrations, which is highly conservative since the actual direct contact exposure with respect to a contaminant is not based on the maximum concentration. Consistent with Health Canada and provincial risk assessment guidance, the 95% upper confidence limit of the mean (95% UCLM) is considered a more realistic worst-case exposure concentration. As a result, the 95% UCLMs for cadmium in sediment and soil were calculated using ProUCL 5.1 (US EPA 2016) and the statistical outputs are provided in Appendix D. The 95% UCLMs were 7.9 mg/kg and 5.8 mg/kg for sediment and soil, respectively, which are lower than the CCME soil ingestion guideline of 14 mg/kg.
- KELSET is considered a provincial site and federal criteria were only considered for information purposes. There were no BC CSR exceedances of cadmium in sediment or soil for the protection of human health.

Further Consideration of Iron

Although the maximum concentrations of iron in sediment and soil exceeded the applicable BC CSR human health screening value, iron was not carried forward as a COPC for the following reasons:

- As described above, the screening was based on maximum concentrations, which is highly conservative since the actual direct contact exposure with respect to a contaminant is not based on the maximum concentration. As a result, the 95% UCLMs for iron in sediment and soil were calculated using ProUCL 5.1 (US EPA 2016) and the statistical outputs are provided in Appendix D. The 95% UCLMs were 28,078 mg/kg and 28,823 mg/kg for sediment and soil, respectively, which are lower than the BC CSR intake of contaminated soil standard of 35,000 mg/kg.

- WSP notes that exceedances of the iron standard were also found in sediment in the background creek (TENTEN), and there is a regional background value of 70,000 mg/kg in soil (Region 1, Vancouver Island; BC ENV 2023d). As a result, WSP concludes that the iron concentrations in sediment and soil at KÉLSET are consistent with natural background concentrations.

3.2.4 Human Health Conceptual Exposure Model

A conceptual exposure model showing a diagrammatic representation of the relationships between the receptors, COPCs, and exposure pathways is provided in Figure 1 (in-text). The conceptual exposure model describes how a stressor might affect human health and provides a graphical representation of exposure pathways. The stressors considered in this assessment are the toxicological effects of COPCs on human receptors.

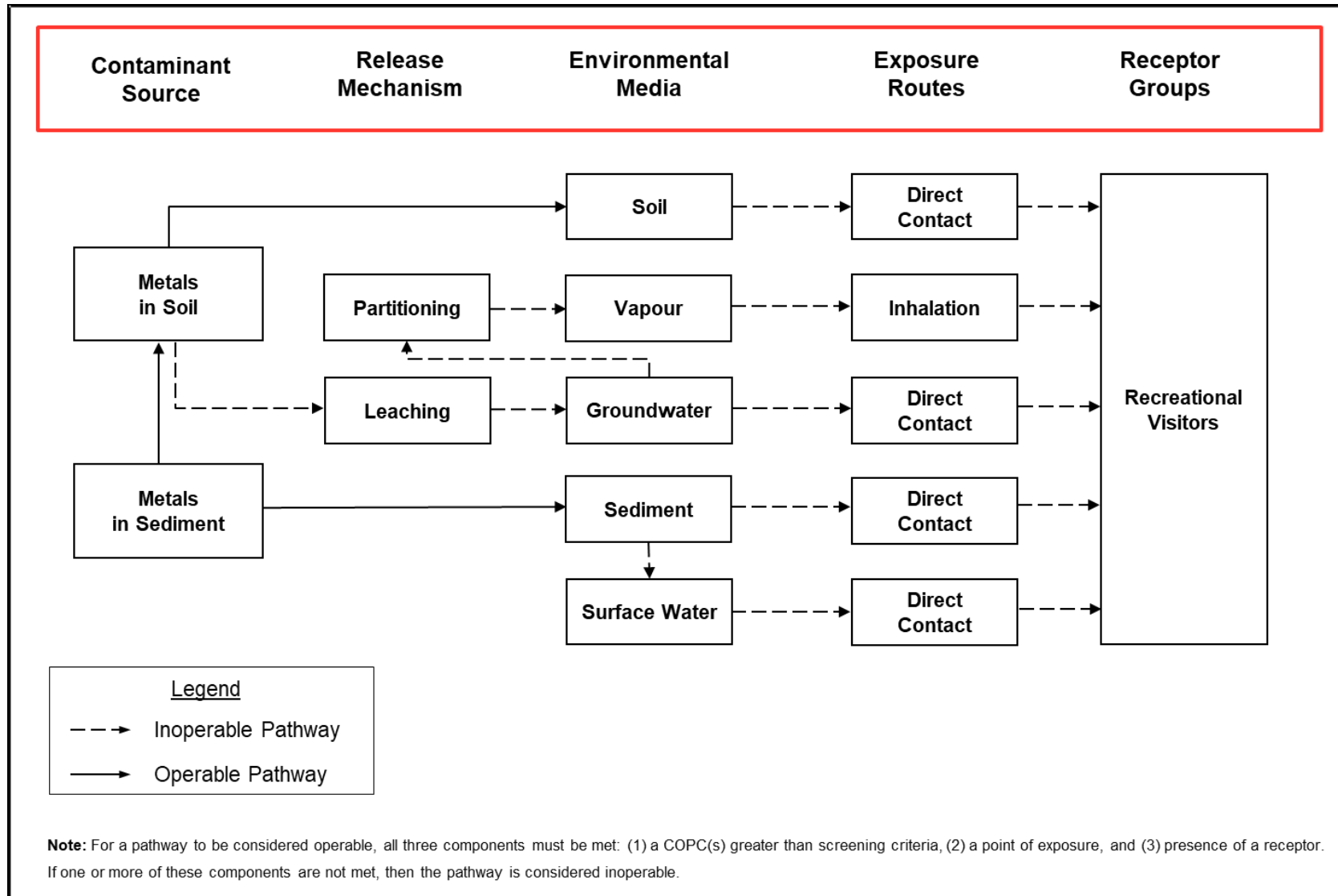


Figure 1: Human Health Conceptual Exposure Model

3.3 Ecological Problem Formulation

3.3.1 Identification of Potential Ecological Receptors

As noted in Section 3.2.1, KÉLSET is a freshwater creek located in a forested ravine that runs through two municipal parks before running through privately-owned lands and terminating at Bazan Bay. The following ecological receptor groups were evaluated in the ecological risk assessment (ERA) based on the information about the ecological setting summarized in Section 2.1:

- Terrestrial plants and soil invertebrates
- Wildlife (including terrestrial and semi-aquatic birds and mammals)
- Aquatic life receptors (including aquatic plants, pelagic and benthic invertebrates, and fish)

Consideration of Listed Species

As described in Section 2.1 (Ecological Setting), Camosun College (2018) identified a number of designated, sensitive, plant communities in the Study Area, including provincially red- and blue-listed plant species combinations⁴. As a result, WSP conducted a search of the BC Conservation Data Centre (BC CDC 2022a) database and iMap (BC CDC 2022b) to identify provincially- and federally-listed species that could occur at KÉLSET (results provided in Appendix C).

The BC CDC search returned a total of 234 records, which was queried by a “user defined polygon” with an approximate 500 m buffer around KÉLSET. To narrow the search results, iMap was queried, which identified one provincially blue-listed ecological community occurring within the vicinity of KÉLSET (i.e., black cottonwood – red alder/salmonberry).

3.3.2 Identification of Potential Exposure Pathways

Exposure pathways for ecological receptors are routes by which receptors could potentially be exposed to COPCs in environmental media. Potential ecological receptors include soil invertebrates, terrestrial plants, terrestrial and semi-aquatic wildlife, and aquatic life receptors. As a result, the following exposure pathways were evaluated in the ERA:

- Direct contact with and uptake of contaminants in soil by terrestrial plants and soil invertebrates.
- Direct contact with and uptake of contaminants in sediment, porewater, and surface water by aquatic life receptors.
- Ingestion of dietary items by terrestrial and semi-aquatic wildlife.

⁴ Based on conservation status rank, species in BC are assigned to a list that sets out the status and conservation priorities. A red-listed species is defined as *any species or ecosystem that is at risk of being lost (extirpated, endangered, or threatened)*; a blue-listed species is defined as *any species or ecosystem that is of special concern*.

Note there are no BC CSR soil, sediment, or surface water standards for the protection of wildlife receptors, which means that chemistry data cannot be readily screened for the wildlife exposure pathways. Instead, a check on the potential for bioaccumulation was completed in Section 3.3.3.

3.3.3 Identification of Contaminants of Potential Concern

Applicable criteria were used to screen the data using a tiered approach:

- **Primary Screening:** Maximum concentrations were compared to the applicable screening values as described in Section 1.3. If the maximum concentration was below the applicable screening value, the parameter was not evaluated further. If the maximum concentration was above the screening value, the parameter was carried forward for secondary screening.
- **Secondary Screening for Aquatic Life and Terrestrial Plants and Soil Invertebrates:** The 90th percentile concentrations were compared to the same screening values used in the primary screening as described above. The 90th percentile is intended to confirm that at least 90% of the samples are lower than the screening value, which is generally appropriate to protect non-mobile receptors at a population or community level. A parameter was retained as a COPC in the ERA if the 90th percentile concentration exceeded the selected screening value.
- **Check on Bioaccumulation in Wildlife:** The 95% UCLM soil and sediment concentrations were compared to agricultural soil standards/guidelines intended to protect livestock for risks associated with ingestion of soil and crop fodder. This screening tool was used in the absence of wildlife-specific soil screening values. A parameter was retained as a COPC in the ERA if the 95% UCLM concentration exceeded the selected screening value.

Primary Screening

The screening results for the individual samples are provided in Appendix B (shown in Table B-1a for freshwater sediment, Table B-1b for estuarine/marine sediment, Table B-2 for surface water, and Table 5 for soil). Based on the results, Table 4 summarizes the parameters that were retained for secondary screening in sediment, surface water, and porewater for the protection of aquatic life, and Table 5 summarizes the parameters that were retained for secondary screening in soil for the protection of terrestrial plants and soil invertebrates.

As described previously, CCME ISQGs are consistent with a threshold effect level and represent a level below which adverse effects are expected to rarely occur. Concentrations between the ISQG and the PEL are considered representative of a potential for occasional adverse effects; however, the PELs provide a recommended assessment tool for the identification of sediments with a greater likelihood of being associated with adverse effects (CCME 1999). Therefore, for sediment screening against federal guideline, PELs were applied to identify parameters carried forward for secondary screening.

Table 4: Parameters Retained for Secondary Screening for Aquatic Life

Parameter	Maximum Concentration	Provincial Freshwater Aquatic Life Screening Value	Federal Freshwater Aquatic Life Screening Value
Sediment			
Arsenic	22.4	11 ^a	17 ^d
Cadmium	35	2.2 ^a	3.5 ^d
Chromium	154	56 ^a	90 ^d
Lead	60.2	57 ^a	91.3 ^d
Zinc	502	200 ^a	315 ^d
Surface Water			
Copper, dissolved	3.7	0.6 – 1.8 ^b	2.0 – 2.55 ^e
Zinc, total	17.6 ^c	33 – 69 ^b	17 – 68 ^e
Porewater			
Aluminium, dissolved	169	100 ^b	100 ^e
Beryllium, dissolved	<1.5	0.13 ^b	NG
Cadmium, dissolved	<1.6	0.11 – 0.24 ^b	0.11 – 0.18 ^e
Chromium, dissolved	<13	8.9 ^b	8.9 ^e
Chromium, hexavalent, dissolved	<440	1 ^b	1 ^e
Cobalt, dissolved	20.8	4 ^b	NG
Copper, dissolved	4.1	1.4 – 2.8 ^b	2.0 – 2.8 ^e
Manganese, dissolved	31,774	882 – 1,130 ^b	350 – 470 ^e
Silver, dissolved	<0.62	0.05 – 1.5 ^b	0.25 ^e
Zinc, dissolved	13	7.5 – 30 ^b	8.9 – 31 ^e

Notes:

All sediment units in milligrams per kilogram (mg/kg) and water units in micrograms per litre (µg/L).

- BC CSR Schedule 3.4 Generic Numerical Sediment Standards; freshwater sediment standards for sensitive use.
- BC Approved and Working Water Quality Guidelines for long-term chronic protection of freshwater aquatic life; hardness, pH, and/or dissolved organic carbon-dependent.
- Although the maximum total zinc concentration in surface water was 17.6 µg/L, only the concentration of 11 µg/L at SW21-07 exceeded the applicable hardness-dependant guideline.
- CCME Sediment Quality Guidelines for the protection of aquatic life; probable effects level (PEL).
- CCME freshwater aquatic life guidelines for long-term chronic protection of freshwater aquatic life; hardness, pH, and/or dissolved organic carbon-dependent.

Table 5: Parameters Retained for Secondary Screening for Terrestrial Plants and Soil Invertebrates

Parameter	Maximum Concentration	BC CSR Soil Direct Contact Standard ^a	CCME Soil Direct Contact Guideline ^b
Soil			
Cadmium	14.8	30	10
Chromium	100	200	65 ^c
Zinc	464	450	250

Notes:

All units in milligrams per kilogram (mg/kg)

BC CSR = British Columbia Contaminated Sites Regulation; CCME = Canadian Council of Ministers of the Environment

a. BC CSR Schedule 3.1 Part 1 Numerical Soil Standards for toxicity to soil invertebrates and plants or Part 2 Generic Numerical Soil Standards to protect ecological health (urban park; PL).

b. CCME Soil Quality Guidelines for the protection of environmental health; soil contact pathway (residential/parkland land use).

c. BC ENV (2023d). Protocol 4 for Contaminated Sites – Establishing Local Background Concentrations in Soil; Region 1, Vancouver Island.

Secondary Screening

The 90th percentile and 95% UCLM concentrations are more realistic measures of the exposure that receptors may experience at KÉLSET. Summary statistics are provided in Appendix D, along with the output from ProUCL 5.1. The results of the secondary screening for aquatic life and terrestrial plants and soil invertebrates are presented in Table 6 and Table 7, respectively. Secondary screening could not be conducted for the surface or porewater data due to insufficient sample size (i.e., n<10).

Table 6: Secondary Screening of Sediment for Aquatic Life Receptors

Parameter	Maximum Concentration	90 th Percentile Concentration	BC CSR Sediment Standard for Freshwater Aquatic Life ^a	CCME Sediment Guideline for Freshwater Aquatic Life ^b	Retained as a COPC?
Arsenic	22.4	7.4	11	17	No
Cadmium	35	14	2.2	3.5	Yes
Chromium	154	86	56	90	Yes
Lead	60.2	43	57	91.3	No
Zinc	502	356	200	315	Yes

Notes:

All units in milligrams per kilogram (mg/kg).

BC CSR = British Columbia Contaminated Sites Regulation; CCME = Canadian Council of Ministers of the Environment; COPC = contaminant of potential concern

a. BC CSR Schedule 3.4 Generic Numerical Sediment Standards; freshwater sediment standards for sensitive use.

b. CCME Sediment Quality Guidelines for the protection of aquatic life; probable effects level (PEL).

Bold / Shaded = 90th percentile concentration exceeds screening criteria and the parameter is carried forward as a COPC in the ERA.

Table 7: Secondary Screening of Soil for Terrestrial Plants and Soil Invertebrates

Parameter	Maximum Concentration	90 th Percentile Concentration	BC CSR Soil Direct Contact Standard ^a	CCME Soil Direct Contact Guideline ^b	Retained as a COPC?
Cadmium	14.8	10	30	10	No
Chromium	100	80	200	65 ^c	No ^d
Zinc	464	242	450	250	No

Notes:

All units in milligrams per kilogram (mg/kg).

BC CSR = British Columbia Contaminated Sites Regulation; CCME = Canadian Council of Ministers of the Environment; COPC = contaminant of potential concern

- BC CSR Schedule 3.1 Part 1 Numerical Soil Standards for toxicity to soil invertebrates and plants or Part 2 Generic Numerical Soil Standards to protect ecological health (urban park; PL).
- CCME Soil Quality Guidelines for the protection of environmental health; soil contact pathway (residential/parkland land use).
- BC ENV (2023d). Protocol 4 for Contaminated Sites – Establishing Local Background Concentrations in Soil; Region 1, Vancouver Island.
- Not carried forward as a COPC since the 90th percentile concentration does not exceed the applicable provincial standard. Federal guidelines provided for information purposes only.

Bold = 90th percentile concentration exceeds screening criteria.

Check on Bioaccumulation for Wildlife

Several metals of concern had a 95% UCLM concentration in sediment or soil that exceeded the regional soil background concentrations from Protocol 4 (arsenic, cadmium, and zinc; statistics provided in Appendix D). These regional background values represent a value that would be highly unlikely to present unacceptable risks to populations of wildlife given that they would be exposed to that threshold on a continued basis even in the absence of point-source industrial uses. The 95% UCLM concentrations, regional estimates for background, and soil and food/fodder ingestion criteria are presented in Table 8, which shows that the 95% UCLM concentrations of arsenic and zinc are not substantially different from the regional background concentrations. There is uncertainty with respect to cadmium given that both the sediment and soil 95% UCLMs exceed that regional background value; however, the concentrations are still lower than the provincial soil criteria to protect cattle and livestock from full-time grazing where they are ingesting plants and incidental amounts of soil.

Table 8: Secondary Screening of Soil and Sediment for Terrestrial and Semi-Aquatic Wildlife

Parameter	Maximum Concentration	95% UCLM Concentration	Regional Soil Background ^a	BC CSR Soil and Fodder Ingestion Standard ^b	CCME Soil and Food Ingestion Guideline ^c	Retained as a COPC?
Soil						
Arsenic	8	4.9	4	25	380	No
Cadmium	14.8	5.8	0.95	10	3.8	No ^d
Zinc	464	193	150	200	960	No
Sediment						
Arsenic	22.4	6.3	Not applicable	25	380	No
Cadmium	35	8.0	Not applicable	10	3.8	No ^d
Zinc	502	225	Not applicable	200	960	No ^e

Notes on the following page

Notes:

All units in milligrams per kilogram (mg/kg).

BC CSR = British Columbia Contaminated Sites Regulation; CCME = Canadian Council of Ministers of the Environment; COPC = contaminant of potential concern; UCLM = upper confidence limit of the mean.

- a. BC ENV (2023d). Protocol 4 for Contaminated Sites – Establishing Local Background Concentrations in Soil; Region 1, Vancouver Island.
- b. BC CSR Schedule 3.1 Part 1 Numerical Soil Standards for livestock ingesting soil and fodder (agricultural land use; AL).
- c. CCME Soil Quality Guidelines for the protection of environmental health; soil and food ingestion pathway (agricultural land use).
- d. Not carried forward as a COPC since the 90th percentile concentration does not exceed the applicable provincial standard. Federal guidelines provided for information purposes only.
- e. Not carried forward as a COPC since the 90th percentile concentration only marginally exceeds the applicable provincial standard.

Bold = 95th UCLM concentration exceeds screening criteria.

Conclusions

The final summary of COPCs for the ERA is provided in Table 9. This includes all the COPCs identified in Tables 6 through 8, as well as the surface water and porewater parameters from Table 4, which were also carried forward because there was not a large enough sample size to calculate summary statistics for secondary screening.

A final check was applied to aluminum, beryllium, cobalt, manganese, and silver. These parameters were identified in the primary screening of the available porewater chemistry using the conservative assumption that porewater should be screened against surface water guidelines for the protection of aquatic life. However, these parameters did not exceed ambient water quality guidelines in the available surface water data, and concentrations in sediment were both unremarkable and did not show any visual evidence of correlations with cadmium concentrations. Aluminum, cobalt, and manganese are typically elevated in soil in the region (BC ENV 2023d) and none of these parameters are considered related to historical airport activities. As a result, WSP concluded that aluminum, beryllium, cobalt, manganese, and silver should not be retained as COPCs for the ERA and did not include them in Table 9.

Table 9: Summary of Ecological COPCs

Parameter	Sediment	Porewater	Surface Water	Soil
Cadmium	Yes	Yes	No	No
Chromium	Yes	Yes	No	No
Copper	No	Yes	Yes	No
Zinc	Yes	Yes	Yes	No

3.3.4 Ecological Conceptual Exposure Model

A conceptual exposure model showing a diagrammatic representation of the relationships between the receptors, COPCs, and exposure pathways is provided in Figure 2 (in-text). The conceptual exposure model describes how a stressor might affect ecological health and provides a graphical representation of exposure pathways. The stressors considered in this assessment are the toxicological effects of COPCs on ecological receptors.

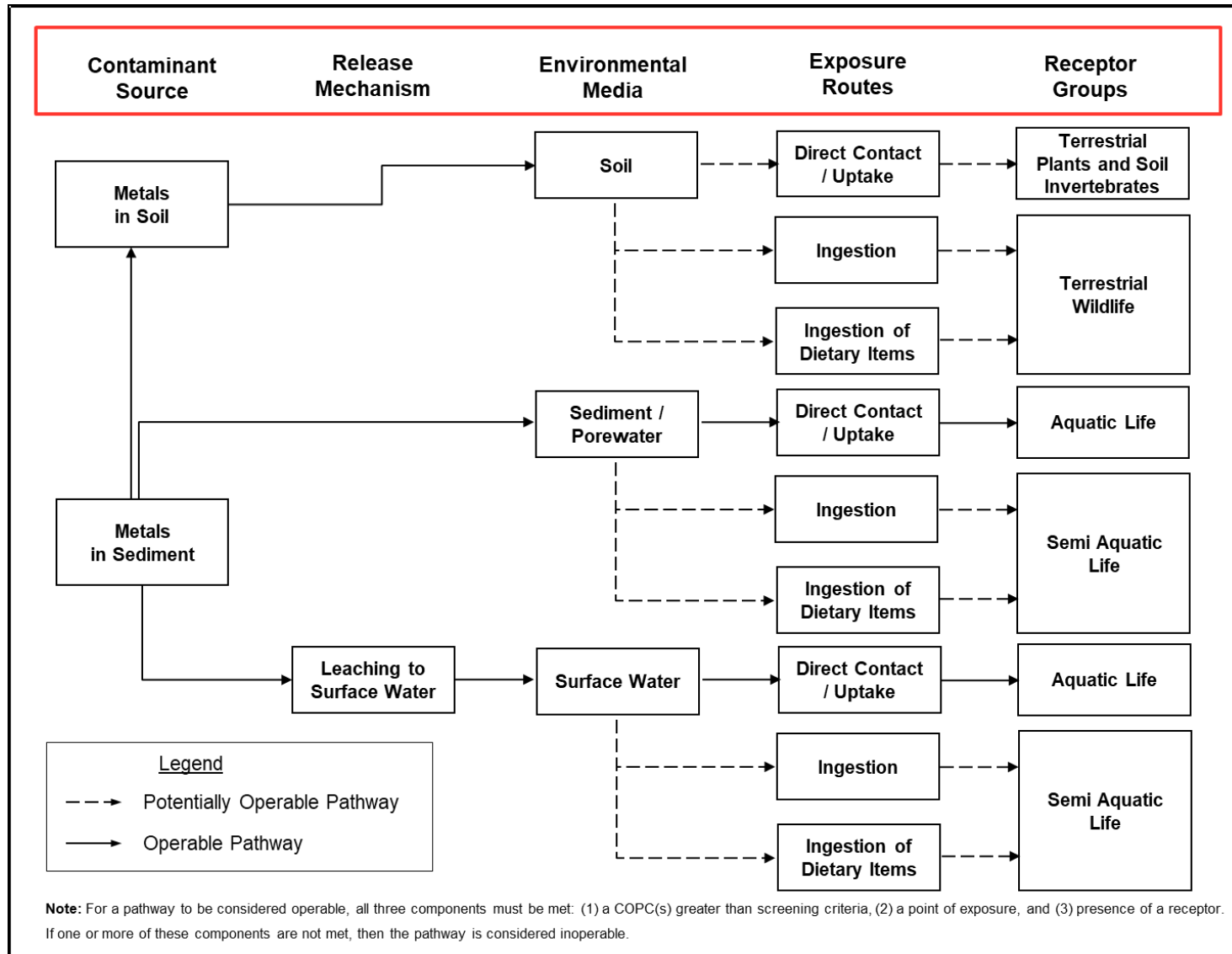


Figure 2: Ecological Conceptual Exposure Model

3.4 Problem Formulation Conclusions

WSP concludes:

- For human health, there were no COPCs identified in sediment, surface water, or soil based on the assumed recreational use scenario, and therefore, risks for that scenario are acceptable. A detailed quantitative risk assessment for human health does not appear to be warranted.
- For ecological health, there were several COPCs identified for sediment (cadmium, chromium, and zinc) and water (cadmium, chromium, copper, and zinc), and these were retained for quantitative analysis in the aquatic ecological risk assessment (Section 4.0).

4.0 AQUATIC ECOLOGICAL RISK ASSESSMENT

This section provides an overview of the aquatic ecological risk assessment (Aquatic ERA). This overview section is intended to provide sufficient information to demonstrate that the approaches used in the Aquatic ERA are technically defensible and consistent with regulatory guidance and common practice, but otherwise acts as a plain-language summary to assist in risk communication and risk management planning.

4.1 Problem Formulation Overview

The ecological problem formulation (Section 3.3) identified four metals for quantitative risk analysis based on the screening of sediment, porewater, and surface water chemistry data. These three media are connected in terms of the potential hazards to aquatic organisms that use KÉLSET and are connected to the source and transport pathways in the conceptual exposure model. To recap:

- Historical industrial activities in the headwaters of KÉLSET resulted in releases to stormwater and groundwater. The primary industrial sources of those releases were electroplating and various fabrication processes for aircraft manufacturing and maintenance, which date back to circa 1945. The identification of cadmium, chromium, and zinc as COPCs is consistent with those sources.
- The construction of the water impoundment structure and the formation of KÉLSET Pond created a sink where metals would tend to accumulate and sorb to sediment, thus reducing the loading to the remainder of the KÉLSET system. Extreme rain events may have resulted in redistribution of some material from KÉLSET Pond. Sediment deposited to the downstream reaches of KÉLSET would have been subject to sediment transport mechanics like erosion, resuspension, and distribution.
- Contamination is likely sorbed to fine-grained organic particles that will accumulate in areas of slower-moving water. Sediment contamination can dissociate back into the porewater in a predictable way, and then flux into the overlying water. The relationships between sediment and porewater are important factors that control the bioavailable fraction (i.e., the amount of metal actually able to cause adverse effects or accumulate in tissues).
- The exposure pathways and receptor groups for the Aquatic ERA include the following:
 - Direct contact and uptake of COPCs from surface water and porewater by aquatic plants and invertebrates.
 - Direct contact and uptake of COPCs in sediment by benthic invertebrates.
 - Direct contact and uptake of COPCs in surface water by fish.

4.2 Summary of Approach

The assessment endpoint for the Aquatic ERA is to maintain a healthy aquatic community of aquatic invertebrates, aquatic plants, and fish that are not impacted by unacceptable effects from the residual contamination from the industrial activities in the headwaters of the creek. The Aquatic ERA used a weight-of-evidence approach to evaluate this assessment endpoint.

Weight-of-evidence approaches are well-documented in federal risk assessment guidance (e.g., CCME 2020) as well as BC provincial guidance for detailed ecological risk assessment under the Contaminated Sites Regulation (e.g., SABCS 2011). In brief, weight-of-evidence involves a categorical evaluation of different lines of evidence. The data from each line of evidence is evaluated against a decision criterion and the relative “weight” of each line of evidence is then considered as part of a narrative conclusion about the overall conclusion about risk. The rules for assigning “weight” are largely common-sense, particularly in the current application because the main lines of evidence were limited to chemistry measurements and toxicity testing.

In this application, a measure of exposure (e.g., sediment chemistry) will get less weight than a measure of effect (e.g., sediment toxicity testing). The total concentration of contaminants in sediment or water will get less weight than a chemical measurement focusing on the bioavailable fraction; abiotic media (the non-living components found in sediment and water) are not necessarily indicative of risk because the bulk concentration does not typically provide information about the bioavailable fraction. The lines of evidence that were collected for KÉLSET for the assessment endpoint are summarized in Table 10 and discussed in more detail in the subsequent sections, following a source-pathway-receptor framework.

Table 10: Assessment Endpoints, Lines of Evidence, Measurement Endpoints, and Relevant Risk Decision Criteria for the Aquatic Life Receptors of Concern

Line of Evidence	Basis of Risk Evaluation	Decision Criteria
Sediment chemistry	Compare sediment chemistry to provincial standards with context about how those standards are derived.	A hazard quotient greater than 10x the sensitive standard would be considered to indicate a potential risk.
	Evaluate spatial distribution of sediment contamination in KÉLSET.	Hazard quotients greater than 10x the sensitive standard would be considered more likely to indicate a potential risk if present on a wide-spread basis.
Surface water chemistry	Compare water chemistry data to provincial ambient water quality guidelines with context about how those guidelines are derived.	A hazard quotient greater than 10x the chronic water quality guideline would be considered to indicate a potential risk.
Peeper (porewater) chemistry	Compare sediment peeper data (porewater) to provincial ambient water quality guidelines with context about how those guidelines are derived.	Evidence that sediment contaminants are dissociating into porewater at elevated concentrations would be considered to indicate a potential risk.
Sediment toxicity testing	Evaluate effects of field-collected sediments using standardized toxicity tests (<i>Chironomus dilutus</i> survival and growth) and comparing the toxicological performance of field-collected sediments to negative controls.	Risks are considered negligible if survival and growth are not reduced by more than 20% relative to the negative control. Samples that have more than a 20% reduction may be considered to indicate a potential risk, subject to consideration of how background samples are performing.
Elutriate toxicity testing	Evaluate effects of field-collected sediments and lab prepared elutriates using standardized toxicity tests (fathead minnow survival and biomass) and comparing the toxicological performance of field-collected sediments to negative controls.	Risks are considered negligible if survival and growth in the 100% (v/v) elutriate are not reduced by more than 20% relative to the negative control.

4.3 Sediment Chemistry

Maximum sediment concentrations were screened against the BC CSR Schedule 3.4 Generic Sediment Standards for Sensitive Use for the purpose of identifying sediment COPCs (as outlined in Section 1.3). Based on the results, cadmium, chromium, and zinc were identified as sediment COPCs (Table 9). The evaluation of hazard associated with cadmium, chromium, and zinc in this section is based on a more in-depth evaluation of the magnitude and frequency of observed exceedances relative to the underlying toxicology data used to derive the BC sediment standards.

4.3.1 Basis of Guidelines

Provincial (and federal) sediment quality standards are derived using a statistical analysis of a database of field-collected sediment samples with synoptic chemistry and toxicity test data (Macdonald Environmental Sciences 2003). A summary of the derivation method is needed to illustrate the degree of conservatism inherent in the sediment quality standards:

- A database of approximately 300 samples with synoptic amphipod (28-d or 42-d *Hyalella azteca*) toxicity test and sediment chemistry samples was assembled from the literature.
- Chemistry data for each sample was reduced to a representative surrogate value. This was calculated for each sample by dividing the measured concentration of each contaminant by an interim guideline value (typically, the CCME PEL). The average hazard quotient was determined for metals, PAHs, and PCBs separately and then the geometric mean of those three values was calculated (PEL-Q)
- Each sample is also classified as being toxic or not toxic in the chronic *H. azteca* test based on whether it had a statistically significant reduction in endpoint performance ($p < 0.05$) relative to the laboratory-supplied negative control. Two thirds of the samples in the toxicity database are not toxic.
- The database was sorted in ascending order by PEL-Q and then divided in groups of roughly 15 samples with similar PEL-Q. The geometric mean of the PEL-Q and the incidence of toxicity (i.e., the proportion of the 15 samples that were classified as toxicity) were plotted. The relationship between geomean PEL-Q and the incidence of toxicity was evaluated with a three parameter regression model. Macdonald Environmental Science (2003; Figure 3) provides this equation and notes that it was both highly significant ($p = 0.0001$) and explained nearly all of the variability in the geomean PEL-Q/incidence of toxicity dataset ($R^2 = 0.99$).
- The geometric mean PEL-Q that corresponded to a 20% chance of observing an effect in a toxicity test was determined to be 0.62, and the geometric mean PEL-Q that corresponded to a 50% chance of observing an effect in a toxicity test was determined to be 1.2.
- Therefore, the CCME PEL values for each individual contaminant (e.g., chromium, cadmium, and zinc) were adjusted downward by 0.6 to create the provincial standard for sensitive sites and were adjusted upwards by 1.2 to create the provincial standard for typical sites.

4.3.2 Magnitude and Pattern of Exceedances

The derivation process described in Section 4.3.1 results in highly conservative sediment standards that are not directly connected to the underlying concentration-response relationship for any individual contaminant. The use of a mean PEL-Q to represent sediment concentration means that there are many samples with complex mixtures of contaminants that contain multiple metals as well as PAHs and PCBs. All these contaminants are part of the PEL-Q calculation which will tend to create an upward bias that means that the effects of a simple mixture (i.e., KÉLSET, which does not have elevated concentrations of PAHs or PCBs) are being over-estimated in the derivation process. The decision to use the 20% and 50% probability of observing a statistically significant effect relative to a negative control is also a highly conservative measurement because the toxicity test is generally considered to be highly sensitive to most major contaminants despite having high variability in test performance based on laboratory conditions (Ivey et al. 2016).

Figure 3 (in-text) provides a ranked-order presentation of the concentration of the three sediment COPCs for context about the magnitude and pattern of exceedances. In brief:

- Chromium and zinc rarely exceed the sediment standards for typical use that correspond to a 50% probability of observing a statistically significant difference in a conservative sediment toxicity test. Cadmium is more commonly greater than this 50% probability threshold, but that does not mean that effects in a sediment toxicity test are likely to occur, given that cadmium was not observed in the porewater peepers (see below for context).
- There is a pattern where concentrations appear to be decreasing in the upper portions of KÉLSET. This is consistent with typical sediment transport dynamics whereby sediment will be gradually transported downstream during high stream flow events. The removal of contaminated sediment from KÉLSET within the airport property and at KÉLSET Pond has removed the source of the metal-rich sediment and thus, sediment transport is gradually reducing sediment in the creek with cleaner material over time.
- There was no evidence that sediment was accumulating in the estuarine area at the mouth of KÉLSET. Marine sediment samples were collected from surface (0 – 20 cm) and depth (35 – 45 cm) at three locations and concentrations were well below the provincial standards for sensitive marine sites. Note that the derivation of those standards used a similar process as described above and therefore, those standards are highly conservative in terms of screening sediment chemistry data.

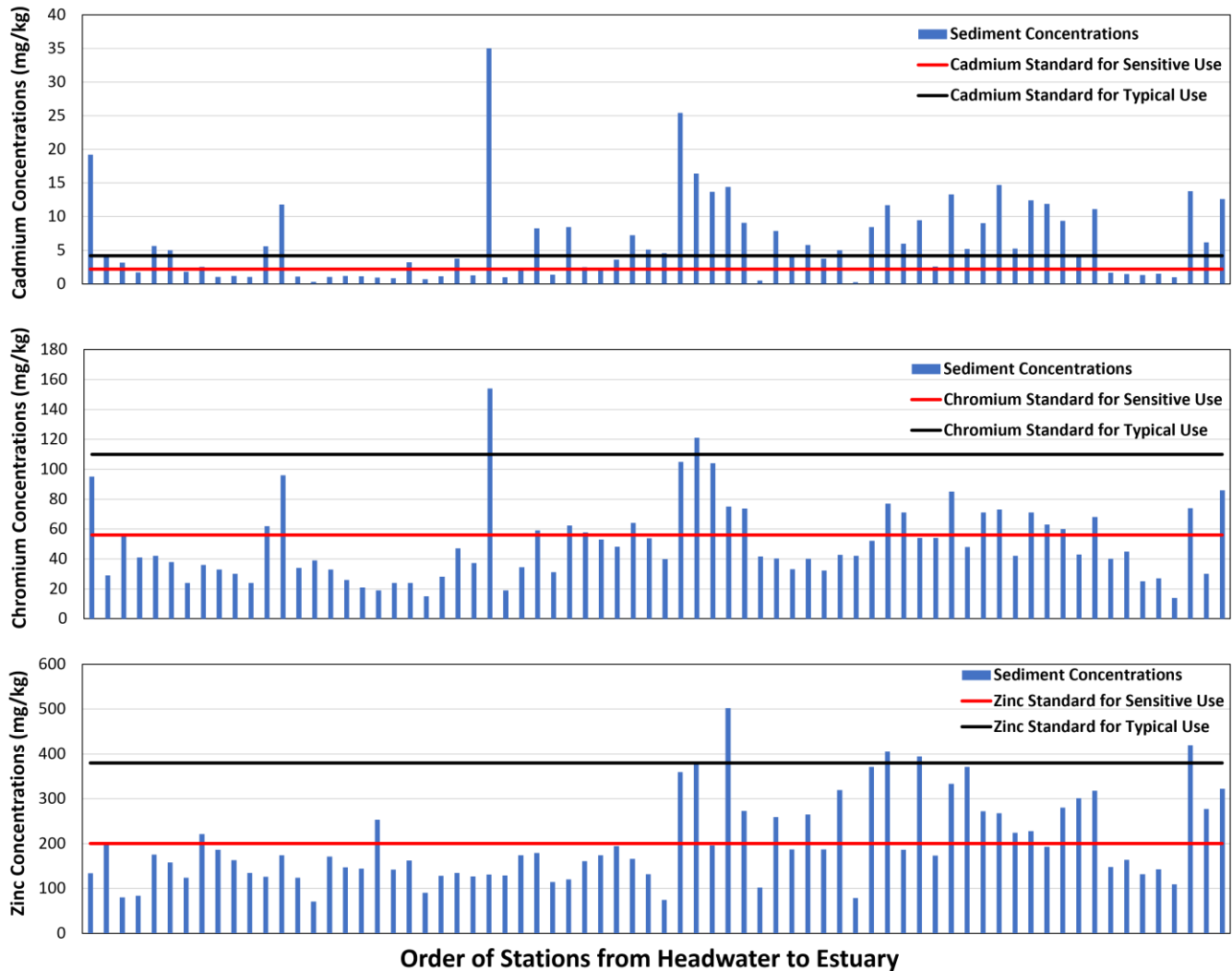


Figure 3: Sediment Concentrations of Cadmium, Chromium, and Zinc from Headwater to Estuary Locations

4.4 Surface Water Chemistry

Maximum surface water concentrations were screened against the BC Approved Water Quality Guidelines for long-term chronic protection of freshwater aquatic life for the purpose of identifying surface water COPCs (as outlined in Section 1.3). Based on the results, copper and zinc were the only surface water COPCs that were identified (Table 9). The evaluation of hazard associated with copper and zinc in this section is based on a more in-depth evaluation of the magnitude and frequency of observed exceedances relative to the underlying toxicology data used to derive the BC water quality guidelines. A total of nine surface water samples have been collected from KÉLSET (six by SLR in 2017 and three by WSP in 2021).

4.4.1 Copper

In British Columbia, ambient water quality guidelines for copper are derived using the biotic ligand⁵ model and are expressed in terms of dissolved copper concentrations (BC ENV 2019). In brief, the biotic ligand model predicts the amount of bioavailable copper using site-specific data for pH, hardness, and dissolved organic carbon (Paquin et al., 2002). The bioavailable fraction of copper (M in Figure 4 in-text, also called C_{free}) is what causes adverse effects to aquatic organisms.

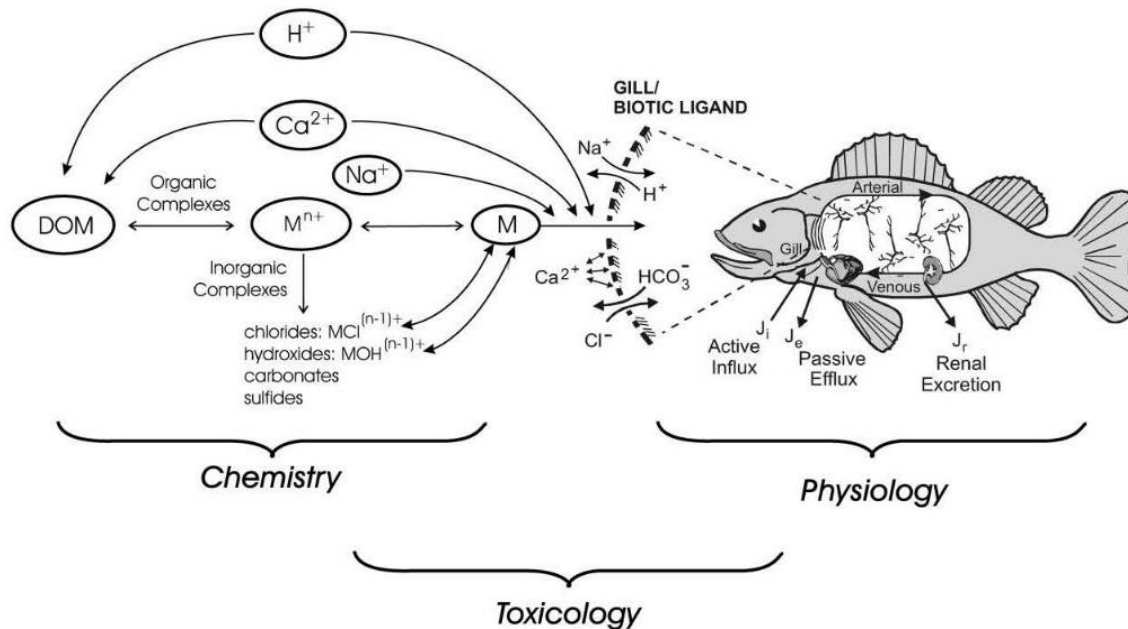


Figure 4: Biotic Ligand Model (from Paquin et al. 2002)

Hazard quotients for copper concentrations were determined as follows:

- Dissolved copper concentrations, which were only available in the three samples collected by WSP in 2021, ranged from 2.5 to 3.7 µg/L. Total metal concentrations were also measured in the same three samples and the dissolved to total copper fraction was approximately 66%. This fraction was used to estimate the likely dissolved concentrations for the other six samples collected by SLR in 2017 (i.e., 2.1 to 2.6 mg/L dissolved copper).
- The provincial water quality guideline derived in the biotic ligand model using the geometric mean of the available hardness, pH, and dissolved organic carbon (DOC) measurements for KÉLSET (hardness = 90 mg/L CaCO₃; pH = 7.2; DOC = 5.5 mg/L) is 1.3 µg/L for the chronic water quality guideline, and 7.8 µg/L for the acute water quality guideline.
- As a result, the likely range of hazard quotients for KÉLSET is between 1.6 and 2.8 using the range of dissolved copper concentrations and the estimated chronic water quality guideline.

⁵ A biotic ligand is a specific receptor within an organism where metal complexation leads to acute toxicity (Santore et. al 2001).

WSP concludes that chronic hazard quotients in this range are unlikely to represent adverse effects on aquatic organisms because of the conservatism in the biotic ligand model. The model used to generate the water quality guidelines incorporates BLM-based toxicity data from 51 different species (i.e., there is a mathematical relationship between pH, hardness, and DOC and a chronic toxicity endpoint like an EC_{20} for growth). The model uses the site-specific variables to estimate the threshold toxicity value for each individual species in the toxicity dataset, takes the lowest value, and then applies a 2x safety factor (BC ENV 2019, p32). BC ENV (2019) also summarizes background dissolved copper concentrations from 42 stations throughout Vancouver Island and reports that the 90th percentile of the average concentration is 1.25 µg/L—in other words, natural sources of copper can account for concentrations that are at the water quality guideline.

4.4.2 Zinc

Water quality guidelines for zinc are hardness-dependent and based on total metal concentrations. One sample (SW21-07) had a measured hardness value of 62 mg/L $CaCO_3$ which means that its total zinc concentration of 11 µg/L exceeded the calculated provincial guideline value of 7.5 µg/L. The other eight samples collected from KÉLSET consistently had hardness concentrations greater than 100 mg/L $CaCO_3$ and therefore, WSP concludes that the low value measured in SW21-07 is not representative. The water quality guideline also embeds a 2x safety factor, which means that the marginal exceedance of the water quality guideline is not likely to exceed the toxicity thresholds that the water quality guideline is based on.

4.5 Peeper Chemistry (Porewater and Surface Water)

4.5.1 Rationale

Passive samplers are intended to measure the bioavailable fraction of metals (metal ions; C_{free}) that can cause adverse effects to aquatic organisms as those metal ions are absorbed. Meyer et al. (2014) provide an overview of the C_{free} conceptual model for sediment and overlying waters, which is shown below in Figure 5 (in-text). In brief, metals are bound to organic material in sediment in equilibrium with the porewater concentration. This equilibrium is influenced by many variables including the amount of organic carbon, the presence of iron and sulphides (which form insoluble metal precipitates), pH, hardness, and the rates of water movement. There are chemical measurements which can provide insight about the degree of bioavailability (e.g., measuring AVS-SEM can give insight about the relative proportions of extractable metals to sulphides; porewater can be extracted and dissolved metal concentrations measured) but C_{free} can also be directly measured by passive sampling techniques such as peepers. A key advantage to peepers over the extraction of porewater is that peepers provide in situ measurement without the confounding effect of sediment sample collection, homogenization, and centrifugation that would occur in an ex situ porewater chemistry sample. Peepers also provide a time-weighted average of the exposure conditions because concentrations in the vial are constantly moving towards an equilibrium concentration with the surrounding water.

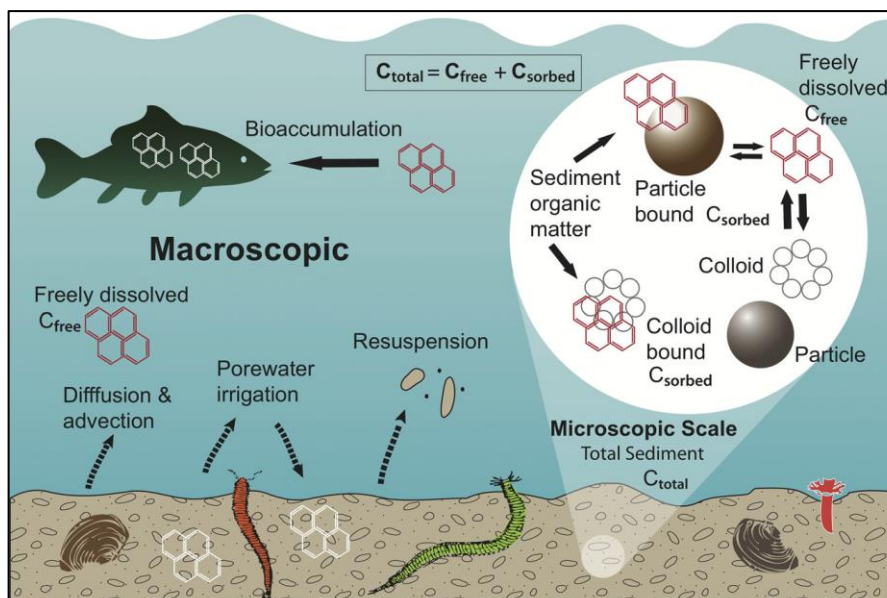


Figure 5: Conceptual Model for Role of C_{free} in Risk Assessment (from Meyer et al. 2014)

4.5.2 Methods

Passive samplers (peepers) were deployed at seven locations in KÉLSET using SPeepers™ provided by SiREM (Saskatoon, SK). A detailed report is provided in Appendix A, but in brief, a peeper is a small vial of ultra-pure de-oxygenated water with a 0.45 μm membrane cap. The vials are deployed to the field location for 28 days and then returned to the analytical laboratory for dissolved metals analysis.

Equilibrium is measured using a bromide spike. The change in bromide concentration is used to determine if the peeper reached a steady state equilibrium with the surrounding water (i.e., bromide is not present at detected concentrations in most water; therefore, if there is no bromide in the peeper after 28-days, the peeper was able to reach 100% equilibrium because the bromide must have diffused out into the surrounding water). Note that it is not a requirement for the peeper to reach equilibrium for the data to be valid. Peeper concentrations are normalized to an assumed 100% equilibrium for consistency, but equilibrium is simply a measure of how the peeper is interacting with the surrounding water to provide context for data interpretation. As an example, a peeper may have a lower-than-expected equilibrium if it is inserted into sediment with a high clay content that would tend to reduce flow across the membrane.

Seven locations were identified in KÉLSET to provide spatial coverage and to target known areas of elevated sediment concentrations, as shown in Table 11. Peepers were deployed in two ways to investigate different parts of the sediment-porewater-surface water pathway as shown on the conceptual model in Figure 5 (in-text). A peeper was inserted into sediment to measure the in situ porewater concentrations at all seven locations. A second peeper was placed at the sediment-water interface at three locations (upper, middle, and lower KÉLSET) to measure the flux of metals that might be passing from sediment into the overlying water column. These overlying water peepers were also co-located with surface water samples as a check on whether the snap-shot water concentrations are representative of the long-term chronic concentrations measured over the 28-d exposure period.

Table 11: Peeper Summary of Locations and Comments

Station	Sample Location	Chemistry Sample ID	Percent Steady-State	Comments
01	PS21-01	06169-02	71.3%	Data representative of porewater
	PW21-01	06169-04	51.1%	Data representative of surface water
02	PS21-02	06169-01	34.9%	Location damaged by high water flow. Data more likely representative of surface water conditions.
03	PS21-03	06169-03	100%	Location damaged by high water flow. Data more likely representative of surface water conditions.
	PW21-03	06169-06	48.2%	Data representative of surface water
04	PS21-04	06169-05	100%	Data representative of porewater
05	PS21-05	06169-08	99.4%	Data representative of porewater
06	PS21-06	06169-09	100%	Data representative of porewater
07	PS21-07	06169-07	47.1%	Data representative of porewater
	PW21-07			Lost during flooding event

Note that peepers were deployed in late October 2021, which meant that they were in place during the extreme rainfall event that started in the middle of November and extended over several weeks. WSP was able to retrieve the majority of peepers safely, but several peepers were scoured from their original locations. WSP opted to submit all retrieved peepers for analysis. Note that movement of the peeper does not mean that the data are invalid—it only means that there may be some uncertainty about whether the concentrations are representative of the original sample location.

4.5.3 Results and Interpretation

Peeper chemistry data are provided in Table B-3 and discussed in the sections below.

Evidence of Sediment as Contaminant Source

The five peepers (PS21-01, PS21-04, PS21-05, PS21-06 and PS21-07) that are considered representative of in situ porewater concentrations provide information about the role of sediment as a source of metals. Cadmium, chromium, and zinc were identified as sediment contaminants of concern and all three metals are consistent with the known industrial source. However, chromium was not detected in any of the five peepers. The detection limit in the peeper was 1.5 µg/L for total chromium (relative to a working ambient water quality guideline of 8.9 µg/L). No cadmium or zinc was detected in any of the five porewater peepers. WSP concludes that the porewater peeper data indicates that the total concentrations of these metals in sediment is unlikely to be bioavailable (i.e., it is not dissociating into porewater at elevated concentrations).

Evidence of Surface Water Influences

Two peepers (PW21-01 and PW21-03) were deployed in surface water and an additional two peepers (PS21-02 and PS21-03) are likely to be more representative of surface water conditions because they were scoured from their original porewater placement because of extreme water flows. These peepers tended to have detectable concentrations of copper consistent with the observed surface water chemistry samples which provides further context that copper is present from natural background issues and is not a site-specific contaminant. Copper concentrations should be interpreted in the context of the ambient water quality guideline described in the preceding section, and these observed water concentrations in the surface water peepers had a consistent (and low) level of hazard, as did the surface water chemistry. Zinc was also detected in three of the surface water peepers which provides further context that surface water quality is being influenced by sources other than sediment (i.e., zinc is not detected in sediment porewater but is detected in surface water).

4.6 Sediment Toxicity Testing

A detailed discussion of the sample collection and toxicity test method is provided in Appendix A, but in brief,

- Fifteen sediment samples were collected from KÉLSET for concurrent chemistry and toxicity assessment. These sediment locations were selected to provide spatial coverage of KÉLSET and included the areas with known sediment contamination. Samples were collected from areas with similar grain size distributions (e.g., fine-grained sand) to minimize this potential confounding effect.
- A background sample was selected from TENTEN from amongst three samples with a similar grain size as the samples from KÉLSET. Note that the concentrations of cadmium and chromium (i.e., the contaminants of concern that originate from the historical industrial activities) in the sample were 0.17 and 26 mg/kg, respectively, both below most other samples collected in KÉLSET. The TENTEN background location was not intended to be representative of pristine conditions---it was intended to be representative of an urbanized creek that does not have the same point sources of contamination as KÉLSET.
- All sixteen samples were tested using the 10-d *Chironomus dilutus* survival and growth sediment toxicity test according to procedures described by Environment Canada (1997, EPS 1/RM/32). WSP opted to focus on the chironomid test because chironomids burrow into fine-grained sediment and are exposed via direct contact and ingestion. Another common freshwater sediment toxicity test is the *Hyalella azteca* 14-d survival and growth test (Environment Canada 2017, EPS 1/RM/33), but this species lives on the sediment surface with less interaction with sediment. A more intensive sampling program with one test species was selected so that statistical analyses to correlate sediment chemistry and toxicity could be conducted if necessary.

The results of the sediment toxicity testing are provided in Table 12 and Table 13. The recommended decision criterion for sediment toxicity tests is whether a sample has more than a 20% reduction in endpoint performance (Environment Canada 1997) relative to the negative control. For the samples collected from KÉLSET, the range of reduction in chironomid survival ranged from 8% to a 2% increase relative to the negative control, while chironomid growth increased from 2% to 49% relative to the negative control; none of the samples were reduced by more than 20% relative to the negative control. Chironomid growth was consistently higher in the KÉLSET samples than in the laboratory-provided negative control. Chironomid survival and growth in the KÉLSET samples were also not different than what was observed in the TENTEN background samples. Note that the same background sample was used in both batches of samples, and the minor reduction in survival observed in the November 19 batch of samples was not duplicated in the November 26 sample. WSP concludes that these toxicity test data indicate a potential for low risk based on the decision criteria described in Table 10. It was not

necessary to pursue a detailed statistical analysis to determine if cadmium, chromium, or the other metal COPCs were contributing to an adverse effect because no effects in the toxicity tests were observed.

Table 12: Results: *Chironomus dilutus* Survival and Growth Toxicity Test Results (November 19, 2021)

Sample ID	Mean ± Standard Deviation	
	Survival (%)	Dry Weight (mg/organism)
Control Sediment	100 ± 0.0	1.88 ± 0.09
06188-04 (TENTEN)	84.0 ± 11.4 ^a	2.76 ± 0.37
06186-01 (SED21-28)	96.0 ± 5.5	2.66 ± 0.46
06186-02 (SED21-29)	94.0 ± 8.9	2.80 ± 0.57
06186-03 (SED21-30)	92.0 ± 13.0	2.69 ± 0.61
06186-04 (SED21-31)	94.0 ± 5.5	2.45 ± 0.64
06186-05 (SED21-32)	98.0 ± 4.5	2.28 ± 0.12
06186-06 (SED21-33)	100.0 ± 0.0	2.52 ± 0.29
06186-07 (SED21-34)	92.0 ± 8.4	2.71 ± 0.23
06186-08 (SED21-35)	98.0 ± 4.5	2.52 ± 0.25

Notes: mg = milligrams; ^a Indicates a statistically significant effect relative to the negative control sediment.

Table 13: *Chironomus dilutus* Survival and Growth Toxicity Test Results (November 26, 2021)

Sample ID	Mean ± Standard Deviation	
	Survival (%)	Dry Weight (mg/organism)
Control Sediment	98.0 ± 4.5	1.94 ± 0.22
06188-04 (TENTEN)	94.0 ± 8.9	2.08 ± 0.37
06186-09 (SED21-36)	94.0 ± 5.5	1.98 ± 0.21
06186-10 (SED21-37)	94.0 ± 8.9	2.34 ± 0.36
06186-11 (SED21-38)	88.0 ± 4.5	2.21 ± 0.57
06186-12 (SED21-39)	100.0 ± 0.0	2.43 ± 0.20
06188-01 (SED21-40)	96.0 ± 8.9	2.51 ± 0.33
06188-02 (SED21-41)	94.0 ± 8.9	2.51 ± 0.29
06188-03 (SED21-42)	100.0 ± 0.0	2.61 ± 0.44

Notes: mg = milligrams

4.7 Sediment Elutriate Toxicity Testing

An additional check on potential toxicity associated with sediment was conducted for larval fish. A detailed discussion of the sample collection and toxicity test method is provided in Appendix A, but in brief:

- A sediment elutriate⁶ was prepared by mixing sediment from the location with the highest cadmium concentration (SED21-40) with surface water collected from KÉLSET from sampling location SW-21A. The elutriate was a ratio of 1:4 sediment:water by volume which was stirred continuously for 30 minutes. The mixture was allowed to settle for 30 minutes, the overlying water was extracted using a siphon, and that volume of water was centrifuged to reduce the suspended solids. The net effect is that the water sample represents a worst-case estimate of the dissolved metal loading to the water column that might occur if an area of contaminated sediment was disturbed (e.g., during freshet).
- The elutriate was tested using the 7-d *Pimephales promelas* survival and biomass toxicity test (Environment Canada 2011, EPS 1/RM/22). This is a chronic test that measures effects to larval fish that have recently hatched (i.e., the fish are less than 24 hours old at the start of the test). There were several different test concentrations, including:
 - A laboratory-provided negative control
 - A site control (i.e., 100% KÉLSET water without any sediment)
 - The 100% (v/v) test concentration (i.e., the full-strength elutriate)

The results from the elutriate toxicity test are summarized below in Table 14. Subsamples of water were collected from each test concentration prior to test initiation and analyzed for total and dissolved metals. Chemistry data from the elutriate test are provided in Appendix B-4. Total concentrations of multiple metals in the 100% (v/v) test concentration exceeded ambient water quality guidelines, which is unsurprising for an elutriate made from a fine-grained sample. SED21-40 consisted of 16% clay, 39% silt, and 42% sand (see Appendix B-1 for grain size data) and the elutriate sample would have been relatively turbid despite the 30-min settling and centrifugation steps. Concentrations of dissolved cadmium and copper in the 100% (v/v) test concentration also exceeded ambient water quality guidelines and were higher than the dissolved concentrations in the site control, which confirms that the elutriate was successful in simulating the desired worst-case scenario where metals were remobilized to the water column.

There were no significant effects in the 100% (v/v) test concentration, notwithstanding the presence of total metals (and dissolved concentrations of cadmium and copper) that exceeded ambient water quality guidelines. The minor reductions in larval fish growth in the 100% and 50% (v/v) test concentrations were less than the decision criteria (i.e., a 20% reduction in endpoint performance) and all samples made from KÉLSET water resulted in larval fish growth that was higher than the laboratory negative control. WSP concludes that these toxicity test data indicate a potential for low risk based on the decision criteria described in Table 10.

⁶ Elutriation is the process of separating lighter particles from heavier ones by suspension in an upward flow of liquid or gas.

Table 14: Fathead Minnow Survival and Biomass Toxicity Test Results (November 19, 2021)

Concentration (% v/v)	Mean \pm SD	
	Survival (%)	Biomass (mg/organism)
Laboratory Control	100.0 \pm 0.0	0.22 \pm 0.01
Site Control	100.0 \pm 0.0	0.54 \pm 0.03
1.56	100.0 \pm 0.0	0.50 \pm 0.02
3.12	100.0 \pm 0.0	0.50 \pm 0.05
6.25	90.0 \pm 10.0	0.45 \pm 0.05
12.5	100.0 \pm 0.0	0.50 \pm 0.08
25	100.0 \pm 0.0	0.56 \pm 0.11
50	96.7 \pm 5.8	0.47 \pm 0.04
100	96.7 \pm 5.8	0.48 \pm 0.02

Notes: SD = Standard Deviation, mg = milligrams.

5.0 CONCLUSIONS

This section provides the overall conclusions about human health and ecological risks for KÉLSET and its riparian area below the water containment structure (i.e., KÉLSET Pond). A portion of KÉLSET where the riparian areas are privately owned was not directly sampled in this current scope of work. These conclusions are based on the problem formulation and the detailed quantitative risk assessment conducted for aquatic receptors. The conclusions should take into consideration the uncertainty analysis which is also provided in this section. These conclusions are written in a narrative format to assist the custodial agency in risk management and risk communication efforts with stakeholders and rightsholders.

Human Health

There were no contaminants of concern identified in surface water, sediment, or riparian soils that would indicate an issue with respect to human receptors who might use the area as an urban park. Data were compared to conservative standards and guidelines (i.e., BC CSR numerical standards and federal guidelines for the protection of human health) and no contaminants of concern were identified. The human health risk assessment ended at the problem formulation stage.

The key area of uncertainty with respect to human health relates to whether a park user is the appropriate receptor to evaluate the risks that may be important to rightsholders or stakeholders. We note that the default assumption is that the riparian areas of KÉLSET are not being used as a source of food, which is consistent with urban park land use, but we appreciate that there may be alternative land uses that the custodial agency and rightsholders may agree should be evaluated. The current data are not sufficient for that additional level of evaluation (i.e., no plant chemistry samples have been analyzed). A small number of plant samples were collected and are available for analysis if needed, but we caution that rightsholders may focus on specific plants or locations that are not reflected by our initial sampling. No tissue samples have been collected for fish or shellfish—there was a significant chemical release by an unknown third party to KÉLSET during our investigation, which would have been a major confounding factor in terms of sampling.

Terrestrial Ecological Health

There were no contaminants of concern with respect to surface water or soils that would indicate that risks to terrestrial ecological receptors would be present. BC CSR numerical soil standards and federal guidelines for the protection of soil invertebrates and plants (urban park land use) were used for this screening as a reality check that if the soil concentrations were lower than the applicable criteria, it would be highly unlikely that intrusive remediation of riparian soils would be needed. The terrestrial ecological risk assessment ended at the problem formulation stage.

The key area of uncertainty is similar to that for the human health risk assessment. Although soil concentrations throughout the riparian areas of KÉLSET were lower than the urban park land use standards/guidelines and were also lower than the agricultural standards (which includes a bioaccumulation check for uptake by plants to protect livestock), we recognize that cadmium can bioaccumulate in plants and soil invertebrates, and there is not currently a specific risk calculation to show that bioaccumulation is in fact negligible. A small number of plant samples were collected and are available for analysis if needed. Our general practice is that we would only pursue food chain modelling if there was site-specific tissue chemistry data available for each of the major food

items that could be consumed by wildlife receptors. No tissue samples were available for fish or aquatic invertebrates, which would make food chain modelling impractical for many of the wildlife receptors who are feeding in KÉLSET and its riparian areas. Our observation is that it is important to have alignment about how a wildlife risk assessment would be used to help make informed site management decisions before initiating that type of analysis. Most wildlife risk assessments involve a hazard quotient approach where highly conservative assumptions about exposure are compared to highly conservative assumptions about toxicity reference values. These screening-level calculations tend to have minimal value for making site management decisions. Stakeholders and rightsholders may have specific receptors that they would wish to see reflected in a food chain model.

Aquatic Ecological Health

Several metals (i.e., cadmium, chromium, copper, and zinc) were identified as contaminants of concern in sediment or surface water, and therefore, the aquatic ecological risk assessment proceeded to a quantitative risk analysis. This risk analysis used a weight-of-evidence approach where the data about total metal concentrations were supplemented by information about bioavailability (peeper chemistry) and effects (sediment toxicity testing, elutriate toxicity testing). Benthic community analysis is another commonly used line of evidence but was not considered for KÉLSET because any sampling would have been conducted after a significant release by a third party that would presumably have caused adverse effects to aquatic organisms. Each individual line of evidence was discussed separately in the preceding section, but as an overall narrative, WSP concludes that risks to aquatic organisms from historical contamination associated with the industrial activities at the airport are low based on the following:

- Sediment concentrations were not grossly elevated relative to numerical standards. The numerical standards are highly conservative in terms of their ability to predict adverse effects. There was one location (RC17-11) that had a cadmium concentration of 35 mg/kg (i.e., it is greater than 10x the lowest applicable standard), but this location was sampled in 2017 and six additional step-out samples collected by Golder (2021b) were unable to duplicate the high concentration. There is a pattern where ongoing sediment transport from the upper reaches of KÉLSET appears to be reducing concentrations over time—we would expect that long-term reduction in sediment concentrations to continue now that the main source of sediment contamination has been removed.
- Notwithstanding the presence of cadmium, chromium, and zinc in sediment, there was limited evidence of those metals in porewater. Sediment peepers provide a direct measurement of this important part of the bioavailability pathway, and peeper concentrations were not detectable for these key metals. We are obliged to comment that peepers were deployed during the extreme rainfall event in mid November 2021, which scoured out several embedded locations. It is not clear if the peepers in surface water would be representative of typical water concentrations given that the water flows during that time were considered to exceed a 1:50 year flood event, but regardless, the general absence of the key metals in the porewater peepers is still considered reliable and representative.
- Notwithstanding the presence of cadmium, chromium, and zinc in sediment, we note that there were no significant effects on chironomid survival or growth. This is a key observation given the number of samples collected for toxicity tests and how those samples captured the range of observed sediment concentrations. The worst-case sediment sample collected by WSP was used to simulate a resuspension event where

metals were released back into the water column because of sediment disturbance. There were no significant effects in the 100% (v/v) elutriate sample observed.

- There were no exceedances of numerical sediment standards/guidelines observed in marine samples collected at the mouth of KÉLSET.

WSP has a high degree of confidence in the conclusion that sediment concentrations in KÉLSET are not likely to result in adverse effects to sediment-dwelling organisms and juvenile fish given the findings described above. The key uncertainty is similar to that for the terrestrial ecological risk assessment in that the uptake of cadmium (and to a lesser extent, chromium) has not been directly measured, and therefore, it is not possible to complete a quantitative risk analysis for semi-aquatic wildlife pathways. The finding from the sediment peepers (and surface water) that cadmium and chromium are not fluxing into the overlying water suggests that bioaccumulation may be limited, but direct evidence for that pathway is not currently available.

5.1 Engagement Activities

As a result of the uncertainties identified above, WSP presented the results of the draft HHERA to the W̱SÁNEĆ Leadership Council (WLC) Technical Advisory Committee during a virtual meeting held on 19 January 2023. In addition to presenting the objectives, methods, and results of the draft HHERA, WSP described the uncertainties with the assessment and requested input into future risk assessment activities at KÉLSET, if required. During the engagement meeting, the WLC expressed concerns with bioaccumulation of contaminants/pollutants into food items and with cumulative effects on food sources/food security. Based on the feedback received during the meeting, the WLC Technical Advisory Committee had no concerns with the results of the draft HHERA, and the HHERA was finalized (this document). A technical memorandum summarizing the results of the engagement meeting is provided in Appendix E.

6.0 CLOSURE

We trust this information is sufficient for your needs at this time. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

WSP Canada Inc.



Alexis Fast, MEDES, RPBio, PMP
Project Manager, Lead Environmental Scientist



Erik von Krogh, RPBio, PMP
Project Director, Senior Principal Environmental Scientist

AF/EVK/asd

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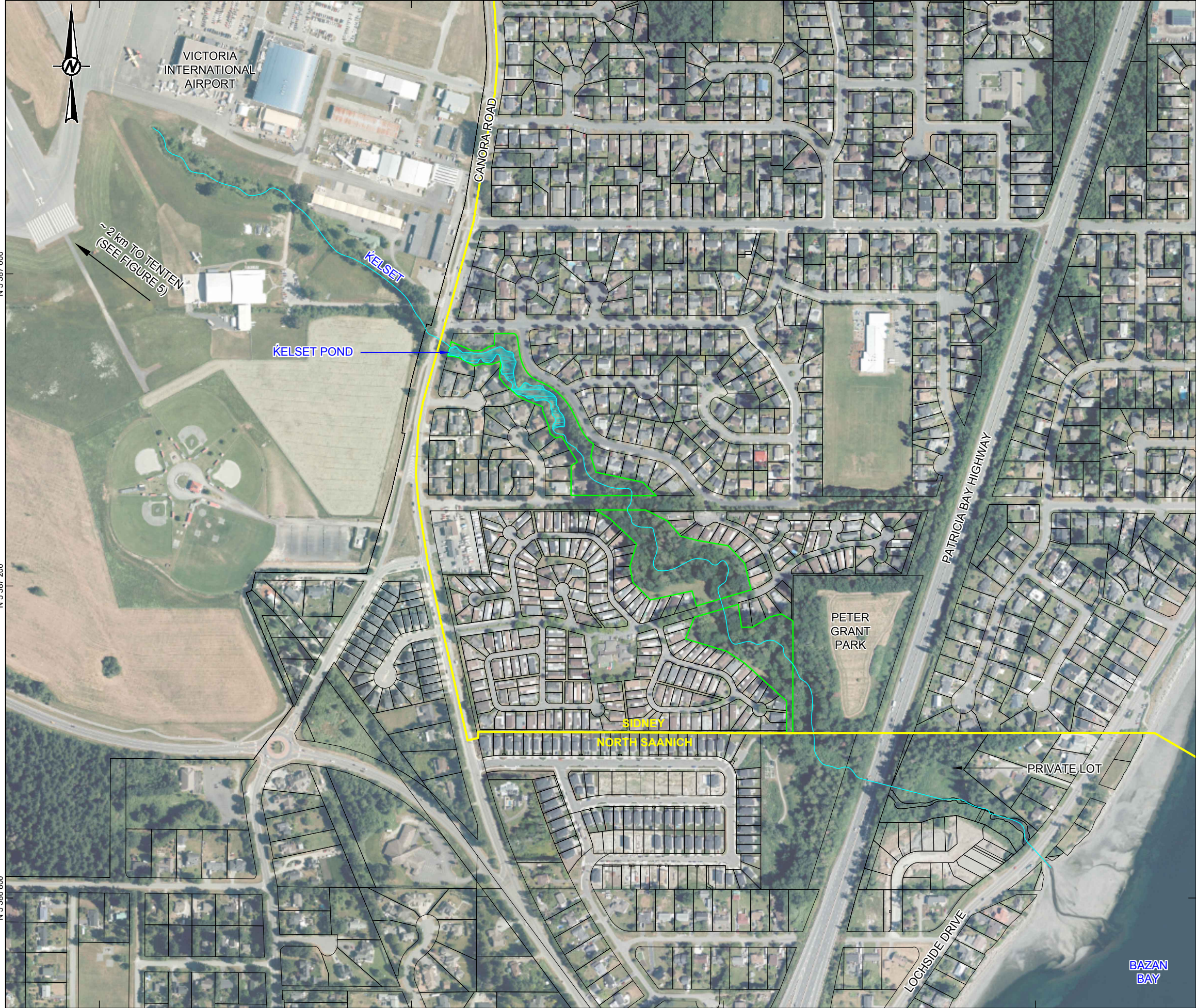
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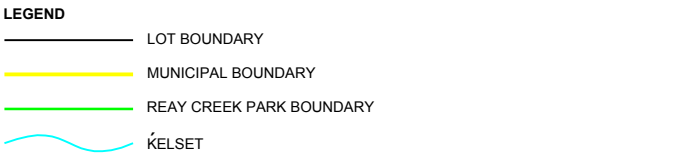
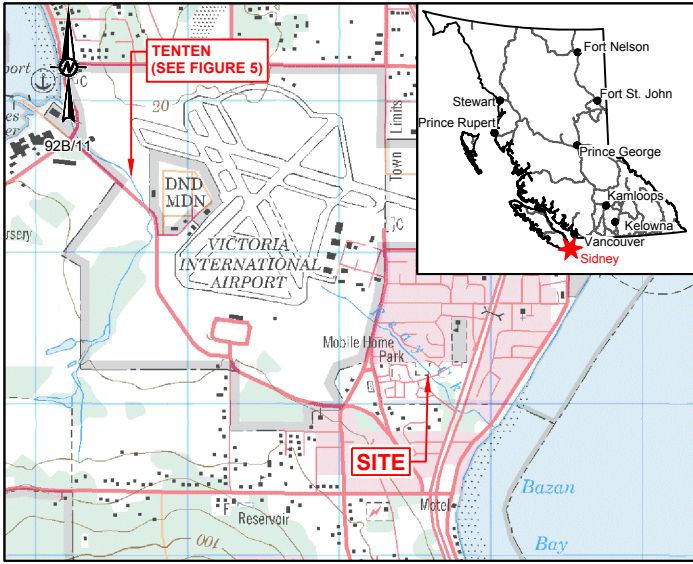
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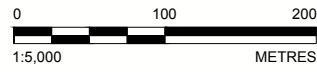
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KEY MAP - NOT TO SCALE



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 - KEY PLAN BACKGROUND AND BASE MAPPING FROM CANMATRIX 1: 50000 NTS - 92B/11
 - WATERCOURSE IS BASED ON SLR REPORT (2018a) AND IS APPROXIMATE
 - DATUM: NAD83, PROJECTION: UTM ZONE 10



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PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
DETAILED HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
KELSET, DOWNSTREAM OF KELSET POND

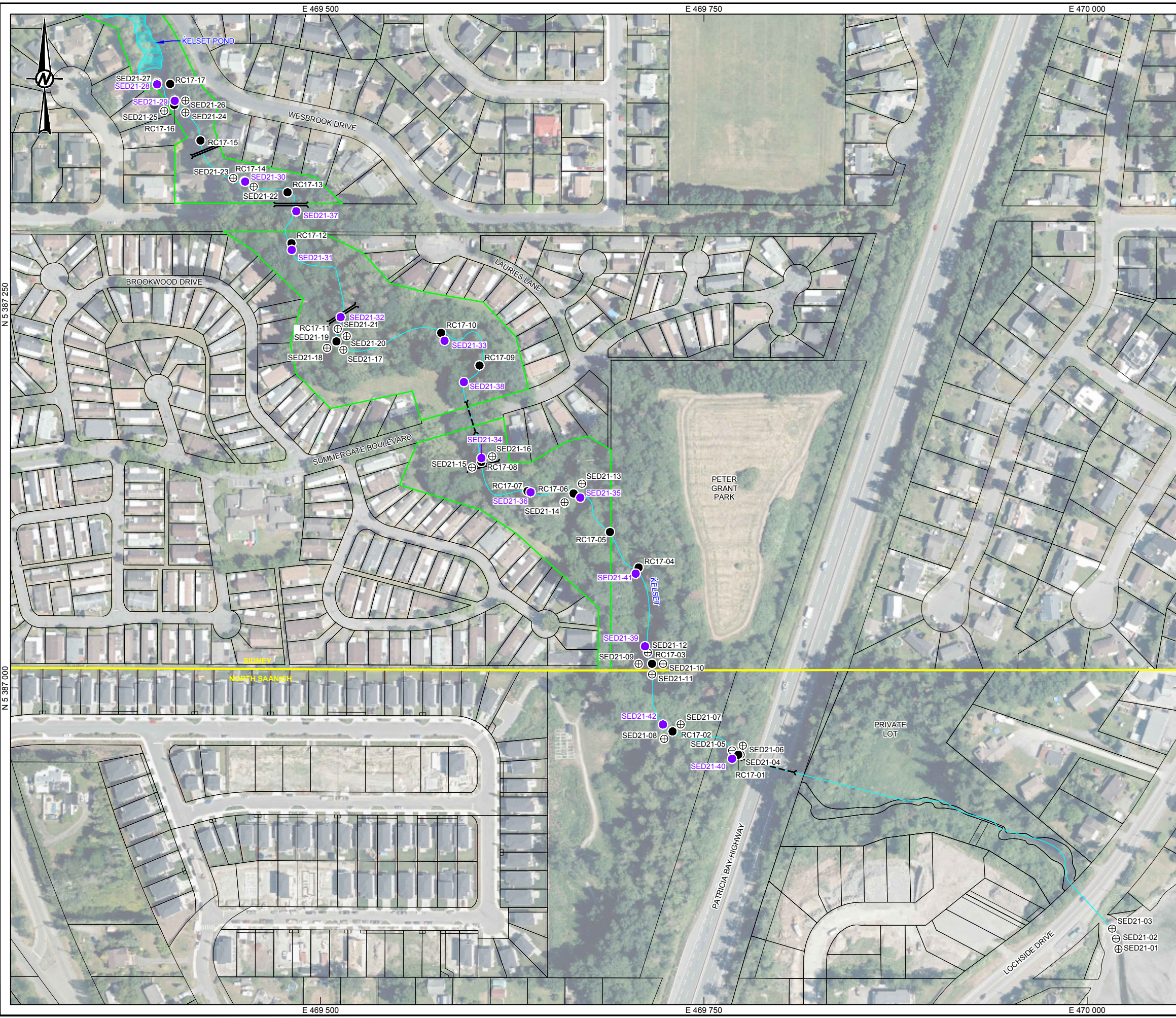
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SITE LOCATION PLAN

CONSULTANT	YYYY-MM-DD	2023-11-09
	DESIGNED	DR
	PREPARED	RTJ
	REVIEWED	AF
	APPROVED	BGM

PROJECT NO. CA007867.5135 PHASE/TASK 3000/4000 REV. 0 FIGURE 1

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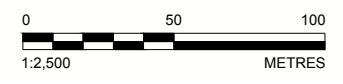
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LEGEND

- LOT BOUNDARY
- MUNICIPAL BOUNDARY
- REAY CREEK PARK BOUNDARY
- ~ KÉLSET
- BRIDGE
- CULVERT
- APPROXIMATE SEDIMENT SAMPLING LOCATION (SLR 2018a)
- APPROXIMATE SEDIMENT SAMPLING LOCATION (GOLDER, JUN. 2021)
- APPROXIMATE SEDIMENT SAMPLING LOCATION (GOLDER, OCT. 2021)

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 2. LOT BOUNDARIES OBTAINED FROM BC LAND TITLE AND SURVEY ON 2018-03-24
 3. WATERCOURSE, SAMPLE LOCATIONS, AND SITE FEATURES ARE BASED ON SLR REPORT (2018a) AND ARE APPROXIMATE
 4. DATUM: NAD83, PROJECTION: UTM ZONE 10



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PROJECT
DETAILED HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
KELSET, DOWNSTREAM OF KÉLSET POND

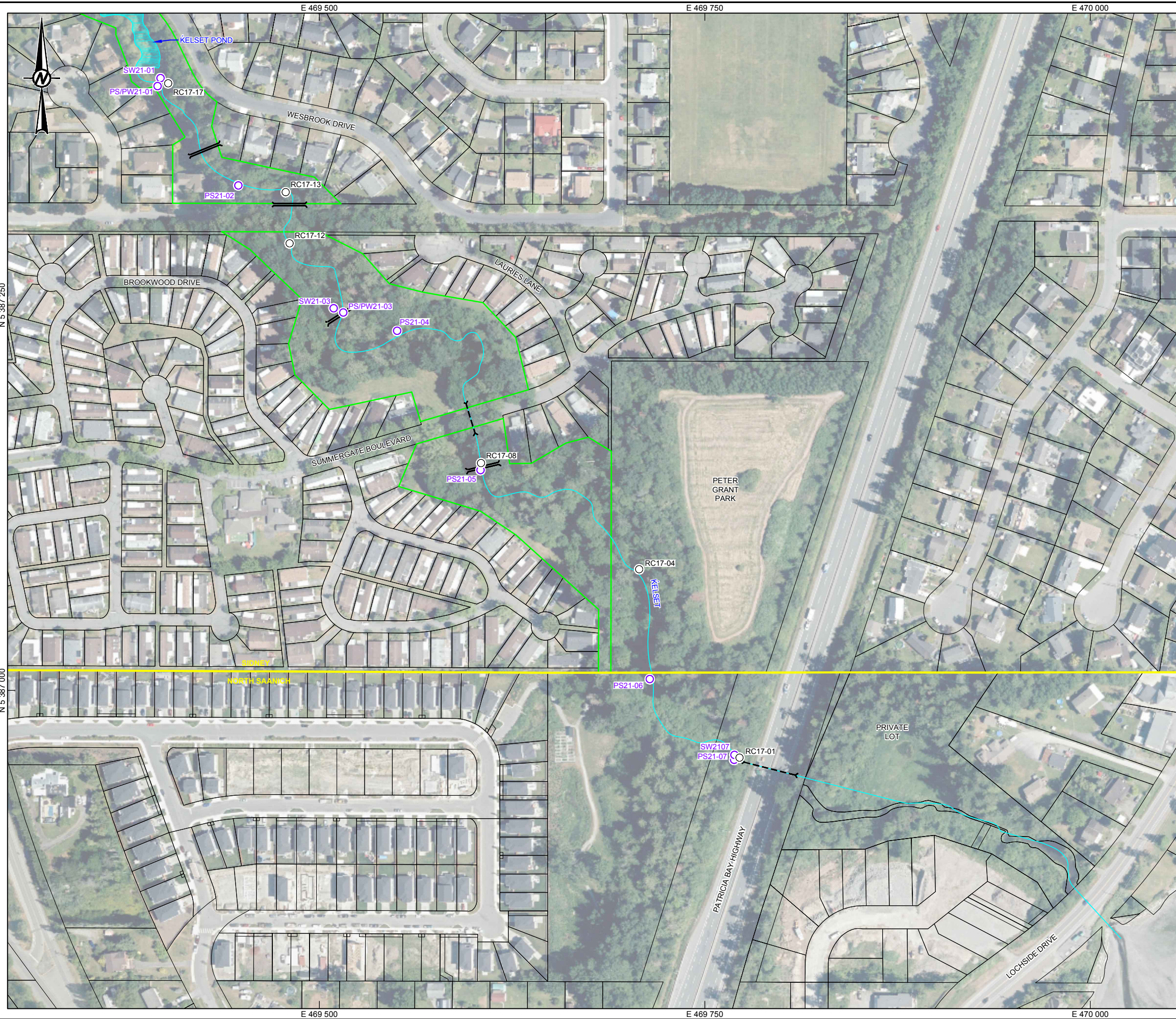
TITLE
SEDIMENT SAMPLING LOCATIONS IN KÉLSET

CONSULTANT	YYYY-MM-DD	2023-11-09
	DESIGNED	DR
	PREPARED	RTJ
	REVIEWED	AF
	APPROVED	BGM

PROJECT NO. CA007867.5135	PHASE/TASK 3000/4000	REV. 0	FIGURE 2
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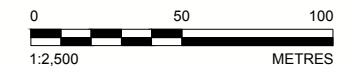


LEGEND

- LOT BOUNDARY
- MUNICIPAL BOUNDARY
- REAY CREEK PARK BOUNDARY
- ~ KELSET
- ≡ BRIDGE
- ≡≡≡ CULVERT
- APPROXIMATE SURFACE WATER SAMPLING LOCATION (SLR 2018a)
- APPROXIMATE SURFACE WATER AND POREWATER SAMPLING LOCATION (GOLDER, OCT. 2021)

REFERENCE(S)

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3. WATERCOURSE, SAMPLE LOCATIONS, AND SITE FEATURES ARE BASED ON SLR REPORT (2018a) AND ARE APPROXIMATE
4. DATUM: NAD83, PROJECTION: UTM ZONE 10



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PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT

DETAILED HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
KELSET, DOWNSTREAM OF KELSET POND

TITLE

SURFACE WATER AND POREWATER SAMPLING LOCATIONS IN
KELSET

CONSULTANT



YYYY-MM-DD	2023-11-09
DESIGNED	DR
PREPARED	RTJ
REVIEWED	AF
APPROVED	BGM

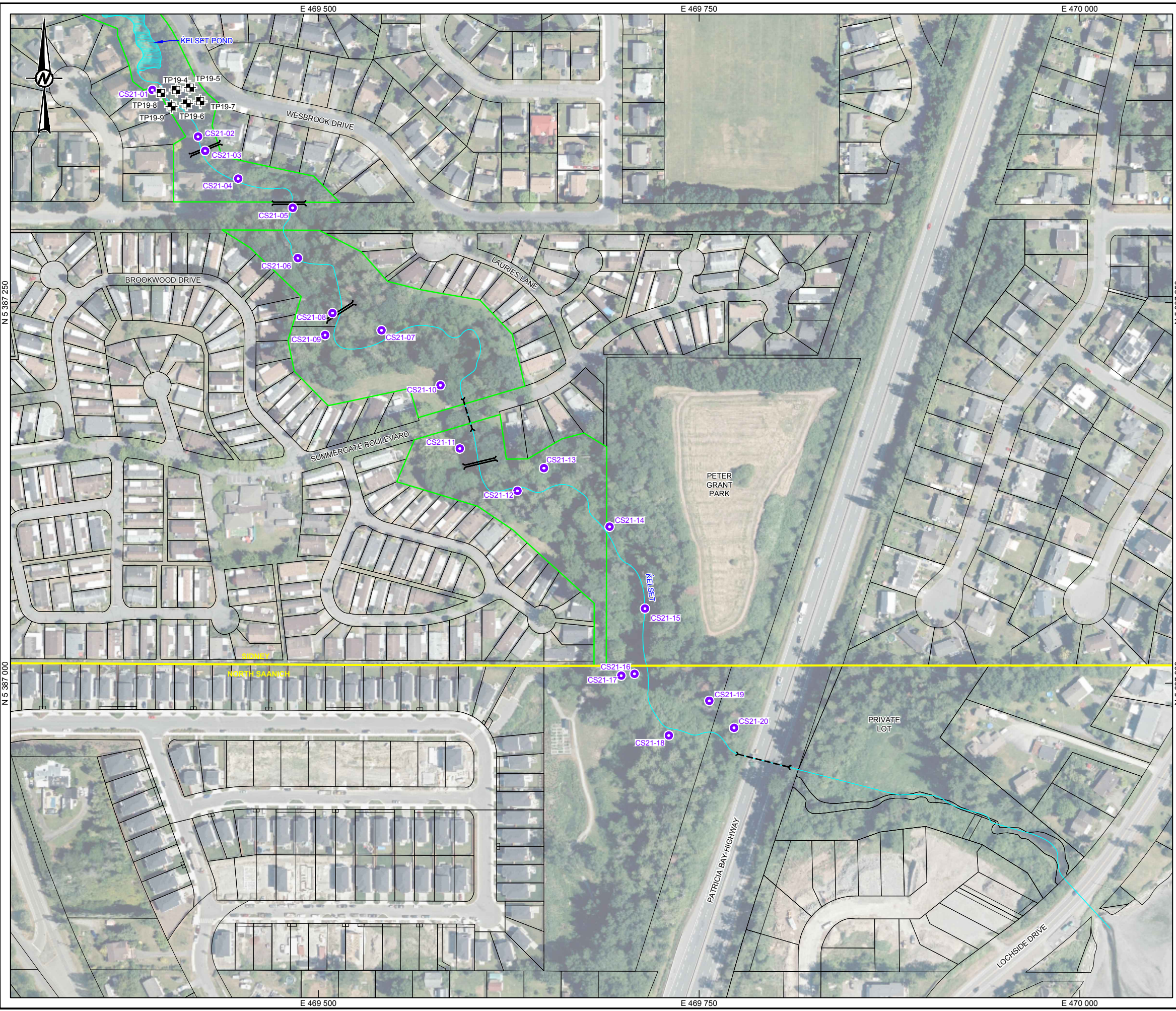
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REV. 0

FIGURE 3

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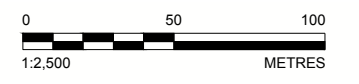
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LEGEND

- LOT BOUNDARY
- MUNICIPAL BOUNDARY
- REAY CREEK PARK BOUNDARY
- ~ KÉLSET
- BRIDGE
- CULVERT
- APPROXIMATE SOIL SAMPLING LOCATION (GOLDER, JUN. 2021)
- APPROXIMATE SOIL SAMPLING LOCATION (GOLDER, OCT. 2021)
- APPROXIMATE TEST PIT LOCATION (THURBER, 2019)

- REFERENCE(S)**
1. AERIAL IMAGE (2019) OBTAINED FROM THE CAPITAL REGIONAL DISTRICT ON 2021-03-24 IMAGE GEOREFERENCED BY WSP AND INTENDED FOR INDICATIVE PURPOSES ONLY
 2. LOT BOUNDARIES OBTAINED FROM BC LAND TITLE AND SURVEY ON 2018-03-24
 3. WATERCOURSE, SAMPLE LOCATIONS, AND SITE FEATURES ARE BASED ON SLR REPORT (2018a) AND ARE APPROXIMATE
 4. DATUM: NAD83, PROJECTION: UTM ZONE 10



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CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
DETAILED HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
KÉLSET, DOWNSTREAM OF KÉLSET POND

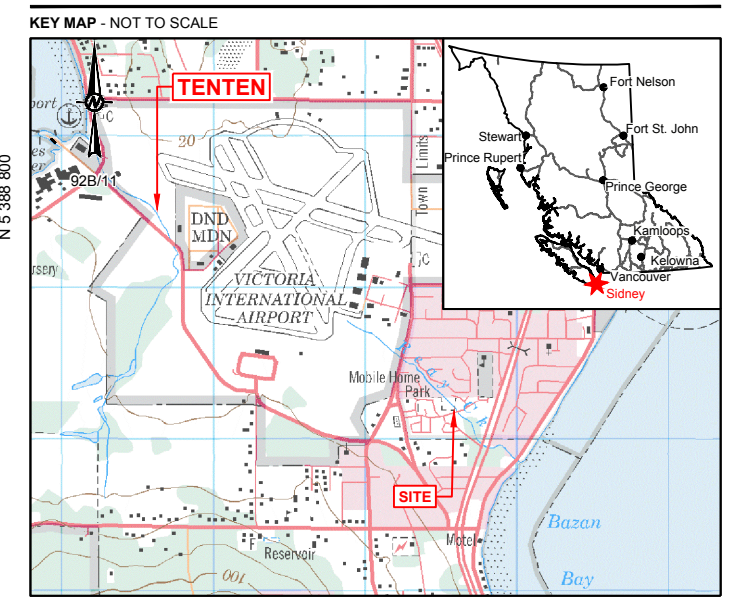
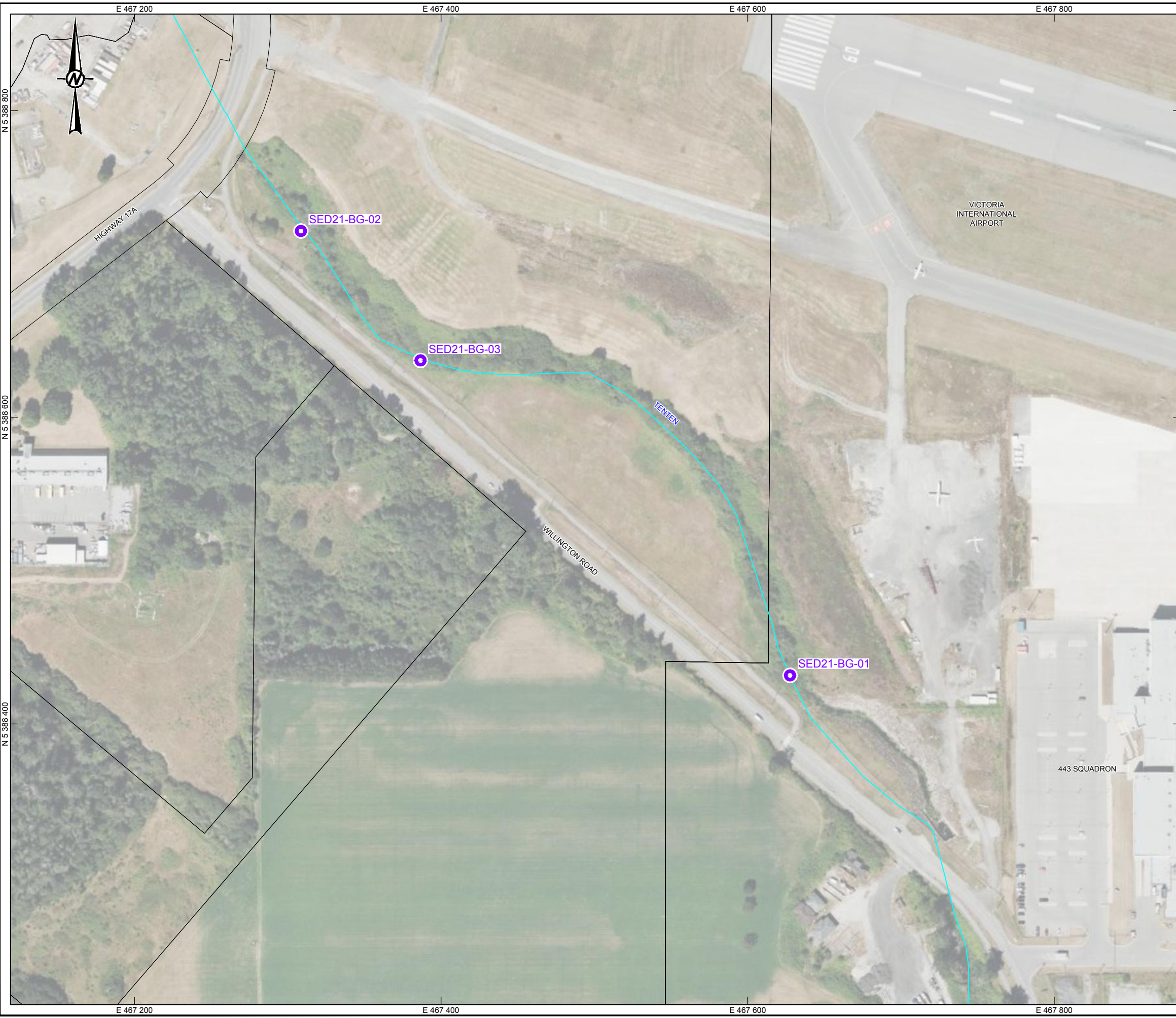
TITLE
SOIL SAMPLING LOCATIONS ALONG KÉLSET

CONSULTANT		YYYY-MM-DD	2023-11-09
		DESIGNED	DR
		PREPARED	RTJ
		REVIEWED	AF
		APPROVED	BGM

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA007867.5135	3000/4000	0	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3/B3 TO A2/B2

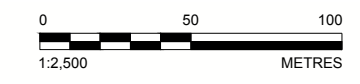
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LEGEND

	LOT BOUNDARY
	TENTEN
	BACKGROUND SEDIMENT SAMPLING LOCATION (GOLDER, OCT. 2021)

- REFERENCE(S)**
1. AERIAL IMAGE (2019) OBTAINED FROM THE CAPITAL REGIONAL DISTRICT ON 2021-03-24 IMAGE GEOREFERENCED BY WSP AND INTENDED FOR INDICATIVE PURPOSES ONLY
 2. LOT BOUNDARIES OBTAINED FROM BC LAND TITLE AND SURVEY ON 2018-03-24
 3. DATUM: NAD83, PROJECTION: UTM ZONE 10



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CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
DETAILED HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
KELSET, DOWNSTREAM OF KELSET POND

TITLE
SEDIMENT SAMPLING LOCATIONS IN TENTEN

	CONSULTANT	YYYY-MM-DD	2023-11-09
	DESIGNED	DR	
	PREPARED	RTJ	
	REVIEWED	AF	
	APPROVED	BGM	

PROJECT NO. CA0007867.5135	PHASE/TASK 3000/4000	REV. 0	FIGURE 5
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANS/B 28 mm

APPENDIX A

**Data Collection Activities
Completed by WSP in Fall 2021**

1.0 BACKGROUND

KEŁSET originates at the Victoria International Airport, which is located on federal land leased to the Victoria Airport Authority; Transport Canada operated the airport from 1939 to 1997 prior to the current leasing arrangement. From the airport, KEŁSET flows east through a culvert at Canora Road and into KEŁSET Pond. The water flows out of KEŁSET Pond towards the southeast through the Town of Sidney, crossing through two municipal parks bordered predominantly by private residential housing toward a culvert under Patricia Bay Highway, within the District of North Saanich. From Patricia Bay Highway, KEŁSET flows through privately owned land and terminates in Bazan Bay.

Historical activities at the airport reportedly contributed to metal contamination in KEŁSET. As such, sediment remediation and habitat restoration programs were completed by PSPC on behalf of Transport Canada for KEŁSET within the airport property in 2019/20 and at KEŁSET Pond in 2020/21. Golder conducted a data review and data gap analysis of the sediment and surface water assessment conducted by SLR Consulting (Canada) Ltd. in KEŁSET downstream of KEŁSET Pond (SLR 2018) and developed a tiered strategy for supplemental site characterization and detailed risk assessment (Golder 2021a). In June 2021, Golder conducted an initial supplemental sampling investigation (SSI) to collect sediment data from 27 locations and presented those results in the report, “*Supplemental Sediment Sampling in Support of Risk Management at KEŁSET (Reay Creek) in Victoria, BC*”, dated 13 December 2021 (Golder 2021b). Further sampling to support the detailed ecological and human health risk assessment (HHERA) was recommended and are described in this appendix.

Note that the HHERA included all available surface water, soil and sediment data collected from the study area (e.g., SLR 2018, Golder 2021b and this current appendix).

2.0 SCOPE OF WORK

The overall objective of the additional SSI was to support the detailed HHERA. Data collection included:

Aquatic Sampling

- KEŁSET sediment sampling: Collection of sediment samples from 15 locations in KEŁSET, which were analyzed for metals, grain size, and total organic carbon, and submitted for 10-day chironomid toxicity testing.
- Background sediment sampling: Collection of sediment samples from three locations in an urbanized background creek (TENTEN), which were analyzed for metals, grain size, and total organic carbon. Based on the chemistry results, the worst-case sediment sample from TENTEN was submitted for 10-day chironomid toxicity testing.
- Elutriate toxicity testing: Based on the chemistry results, the worst-case sediment sample from KEŁSET was used to create an elutriate for a 7-day fathead minnow survival and growth test.
- Passive samplers: Deployment of passive samplers (“peepers”) in seven locations in KEŁSET, representing a range of previously observed metals concentrations. Each location had a peeper pushed into the sediment to measure metals concentrations in porewater. At three locations (upper, middle, and lower KEŁSET), a second peeper was placed in the water column and a surface water sample was collected and analyzed for total metals, dissolved metals, pH, hardness, and dissolved organic carbon (DOC). Three additional peepers were analyzed as trip blanks.

Riparian Sampling

- Soil sampling: Collection of soil samples from 20 locations along the length of KÉLSET, which were analyzed for metals, total organic carbon, and grain size. Soil samples were located along the length of KÉLSET, focussed on areas with low gradients where spring freshets could have deposited material.
- Vegetation sampling: Soil sampling locations were co-located with plant forage species including alder leaves, dogwood leaves, and blackberries. Samples were frozen and archived for potential future analysis.
- Earthworm sampling: Select soil sampling locations were also co-located with earthworm samples, which were frozen and archived for potential future analysis.

2.1 Deviation from Proposed Scope of Work

The following deviations from the proposed scope of work are noted:

- Collection of additional tissue types were planned but could not be collected. An opportunistic search of aquatic invertebrates occurred, but insufficient quantities were collected for analysis, and malaise traps were not deployed due to scheduling constraints.
- Due to high rainfall and flooding, three passive samplers (peepers) became detached from their sampling locations (information provided in Section 3.4).
- The elutriate testing included chemical analysis of the dilutions (as discussed in Section 3.2). However, dissolved metals were not analyzed in several of the dilutions due to filtration issues resulting from high particulate in the higher concentration dilutions.
- For soil samples, the laboratory reported chromatographic interference, which prevented measurement of speciated chromium.

3.0 SAMPLE COLLECTION METHODS

The field program was carried out over several mobilizations by WSP staff and a cultural monitor from the Tseycum First Nation as summarized in Table 1. The following sections describe the methods carried out for the SSI.

Table 1: Summary of Field Investigations

Dates of Field Program	Description of Field Activities Completed
16 September 2021	Blackberry sampling
20 - 21 October 2021	Sediment sampling in KÉLSET
22 October 2021	Sediment sampling in TENTEN (background creek)
25 - 26 October 2021	Deployment of peepers
26 - 29 October 2021	Co-located soil, vegetation, and earthworm sampling
8 November 2021	Collection of surface water for generation of elutriate
24 November 2021	Retrieval of peepers and opportunistic macroinvertebrate sampling (unsuccessful)

3.1 Health, Safety, and Environment Plan

Prior to undertaking the field investigation program, the project-specific health, safety, and environment plan (HaSEP) was updated to reflect current site conditions and planned activities. The HaSEP described potential risks associated with the field tasks and included measures to mitigate the identified risks. The HaSEP included safe work procedures, accident reporting procedures, Site location and route to the hospital plans, an emergency response plan, emergency contact and telephone numbers, and check-in procedures.

At the beginning of the first day of the field program, the HaSEP was communicated to WSP staff and subcontractors. Daily tailgate safety meetings and hazard assessments were held onsite to review the day’s field tasks and associated potential risks, and to assess if Site conditions changed and/or if modifications to the HaSEP were required.

3.2 Sediment Sampling

Sediment sampling was undertaken in KÉLSET from 20 to 21 October 2021, and in TENTEN on 22 October 2021. The sediment sampling program and laboratory analysis is summarized in Table 2 and illustrated on Figures 2 and 5 in the main report.

Table 2: Summary of Sediment Sampling

Location	Number of samples	Analysis	Laboratory	Notes
KÉLSET	15 plus two duplicates	Metals, speciated chromium, TOC, and grain size	AGAT	
	15	Toxicity (10-day chironomid)	Nautilus	
	1	Elutriate toxicity (7-day fathead minnow survival and growth test)	Nautilus	Worst-case metals concentrations in KÉLSET were used to select one sample to generate an elutriate for toxicity testing
TENTEN	3 plus one duplicate	Metals, speciated chromium, TOC, and grain size	AGAT	Extra sample volume was collected at each location for potential toxicity testing
	1	Toxicity (10-day chironomid)	Nautilus	Worst-case metals concentrations in TENTEN were used to select one sample for toxicity testing

Surface sediment grab samples were collected at depths up to 0.1 m below ground surface (mbgs) from each sampling location using a shovel. If multiple grab samples were required to fill the laboratory-supplied containers, repeated shovel grabs were taken as close together as possible, with care to obtain representative, undisturbed samples. Observations with respect to texture, colour, particle size, sheen, depth of sediment horizon sampled, and presence of non-sediment materials (e.g., shells, debris, biota) were recorded. Field sheets are included in Attachment 1. Once sufficient sediment volume was collected to fill the laboratory-supplied containers, any remaining sediment was placed back in the creek near where it was collected. Each sample container was labeled with the client, project number, sample date and time, and sample identifier code.

Equipment in contact with the sample was decontaminated before being reused. The shovel was washed with laboratory-grade detergent (e.g., Liquinox®), before being rinsed with deionized water.

For chemistry analysis, sediment samples were stored in airtight, pre-cleaned, wide-mouth glass jars with Teflon-lined lids with no headspace. For toxicity testing, sediment samples were stored in 4L plastic pails. Lids were placed on containers securely to prevent leakage. Samples were packed securely in ice-filled coolers kept cool prior to delivery to their respective laboratory: AGAT Laboratories (AGAT) for chemistry analysis or Nautilus Environmental (Nautilus) for toxicity testing.

The elutriate was generated from the worst-case sediment sample from KÉLSET by Nautilus at WSP’s instruction. As part of elutriate generation, WSP staff collected 100L of surface water from KÉLSET on 8 November 2021 and shipped it to Nautilus. During elutriate generation, subsamples were collected by Nautilus from each dilution, which were submitted to AGAT for analysis of pH, DOC, and total and/or dissolved metals as described in Table 3.

Table 3: Elutriate Sample Summary

Sample Name	Laboratory Analysis	Notes
Elutriate Lab Control	pH, DOC, total metals, dissolved metals	Generated using clean laboratory provided water
Elutriate Site Control	pH, DOC, total metals, dissolved metals	Generated using surface water from KÉLSET
Elutriate 1.6%	pH, DOC, total metals, dissolved metals	Created using sediment from worst-case chemistry sample from KÉLSET. Dilutions made with surface water collected from KÉLSET.
Elutriate 3.2%	pH, DOC, total metals, dissolved metals	
Elutriate 6.5%	pH, DOC, total metals	
Elutriate 12%	pH, DOC, total metals	
Elutriate 25%	pH, DOC, total metals	
Elutriate 50%	pH, DOC, total metals	
Elutriate 100%	pH, DOC, total metals, dissolved metals	

Completed Chain-of-Custody forms were submitted with each shipment. Laboratory Certificates of Analysis (COA) reports and corresponding chain-of-custody forms are included in Attachment 2.

3.3 Peeper Deployment

Passive samplers (“peepers” with a plastic housing and membrane cap that contained deionized water) were deployed at seven locations in KÉLSET. During deployment, the peeper equilibrated with the porewater to permit measurement of in-situ bioavailable metal concentrations without the alteration and oxidation that occurs when a sediment sample is collected for ex-situ porewater exaction. The sampling locations are shown on Figure 3 in the main report.

The peepers, which are known by their proprietary name SPeeper™, were provided by SiREM, a division of Geosyntec Consultants International Inc. At each location, a metal frame was provided by SiREM which held four

individual SPeeper™ vials. SiREM also provided a deployment push pole and detailed instructions for the deployment and retrieval of the peepers. At each location, the peeper frame was pushed into the sediment using the deployment pole until the wings at the top of the frame were resting on the bottom of the creek. The frame was weighed down by placing Ziploc bags filled with clean sand on top of each metal wing. The frame was also secured with a nylon rope to a tree on the bank of the creek.

The seven locations were selected based on the available sediment chemistry to capture a range of metals concentrations. At three locations (upper, middle, and lower KÉLSET), three additional frames were installed on the surface of the sediment in the water column to measure concentrations at the sediment-water interface. These peepers were held in place with weighted bags of sand, were secured to a wooden stake, and secured with a nylon rope to a tree at the bank of the creek.

At the three locations with peepers installed at the sediment-water interface, surface water samples were also collected. During sampling, measurements of pH, temperature, dissolved oxygen, oxidation-reduction potential (redox), and conductivity were recorded on a multi-meter placed in KÉLSET. Water samples were collected in laboratory-prepared and -supplied containers with appropriate preservatives. Samples were labelled, registered on chain-of-custody forms, stored on ice in coolers and shipped by WSP personnel to AGAT. Samples were analyzed for DOC, dissolved metals, total metals, pH, and hardness. One field duplicate was collected and analyzed for quality control purposes.

During water sampling, nitrile gloves were worn when handling sampling equipment and samples, and the gloves were changed between sample locations.

3.4 Peeper Retrieval and Processing

The peepers, which required a minimum of 28 days of deployment to equilibrate with the surrounding environment, were retrieved on 24 November 2021 and brought back to the WSP warehouse. One peeper was lost during a flooding event (PW21-07), while two peepers were pulled out of the sediment due to high rainfall (PS21-02 and PS21-03). One peeper (PS21-03) was found floating in KÉLSET, while still anchored to the shoreline, while the other peeper (PS21-02) was sitting on the bank adjacent to KÉLSET.

The peepers were processed at the WSP warehouse according to the instructions provided by SiREM. Samples were collected from the peeper vials and placed in laboratory-prepared and -supplied containers with appropriate preservatives. Samples were labelled, registered on chain-of-custody forms, stored on ice in coolers, and shipped by WSP personnel to the appropriate laboratories as detailed below.

For the analysis of dissolved metals, pH, hardness, and bromide tracer, samples were shipped to Eurofins Environment Testing America (Eurofins) in Pittsburgh, PA. For the analysis for hexavalent chromium, samples were shipped to AGAT in Burnaby due to the relatively short hold time for hexavalent chromium and amount of time required to ship the samples to Eurofins. The sample results were then forwarded by each laboratory to SiREM, who completed the calculations for freely-dissolved concentrations of dissolved metals in the sediment porewater and sediment-water interface.

3.5 Co-located Soil, Vegetation, and Earthworm Sampling

Co-located soil, vegetation, and earthworm sampling was undertaken at KÉLSET from 26 to 29 October 2021, with the exception of blackberry sampling, which was conducted on 16 September 2021 due to seasonal availability. The sampling locations are shown on Figure 4 in the main report.

Twenty sampling locations were selected along the length of KÉLSET, where a 3m by 3m sample plot was identified that would allow for the collection of co-located soil and tissue. A sample sketch was prepared for each location to indicate the location of the co-located soil and tissue samples. Table 4 summarizes the number of soil and tissue samples collected.

Table 4: Summary of Co-located Soil, Vegetation, and Earthworm Samples

Sample Type	Number of Samples
Soil	20 plus two duplicates
Blackberry	6 (co-located with soil)
Blackberry leaves	5 (co-located with soil)
Alder leaves	7 (co-located with soil)
Dogwood leaves	11 (co-located with soil)
Earthworms	5 (co-located with soil and vegetation)

3.5.1 Soil Sampling

Surface soil samples were collected at depths up to 0.1 mbgs from each sampling location using a shovel. If multiple grab samples were required to fill the laboratory-supplied containers, repeated shovel grabs were taken as close together as possible. Observations with respect to texture, colour, particle size, sheen, and depth of soil horizon sampled were recorded. Field sheets are included in Attachment 1. Once sufficient soil volume was collected to fill the laboratory-supplied containers, any remaining soil was placed back in the ground where it was collected. Each sample container was labeled with the client, project number, sample date and time, and sample identifier code.

Equipment in contact with the sample was decontaminated before being reused. The shovel was washed with laboratory-grade detergent (e.g., Liquinox®), before being rinsed with deionized water.

Soil samples were stored in airtight, pre-cleaned, wide-mouth glass jars with Teflon-lined lids with no headspace. Lids were placed on containers securely to prevent leakage. Samples were packed securely in ice-filled coolers kept cool prior to delivery to AGAT for analysis. Completed WSP Chain-of-Custody forms were submitted with each shipment. Laboratory COA reports and corresponding chain-of-custody forms are included in Attachment 2.

3.5.2 Blackberry Sampling

Blackberry samples were collected on 16 September 2021, while blackberries were still in season and available for sampling. Blackberries were picked from blackberry bushes located within 10 metres of the creek, targeting at least 20 grams of berries from each bush. The samples were gently rinsed with deionized water, placed in a clean Ziploc bag, and frozen. Each Ziploc bag was labeled with the client, project number, sample date and time, and

sample identifier code. The samples were kept frozen at the WSP warehouse for potential future analysis if required. Each blackberry bush was flagged and identified with GPS coordinates, to facilitate future co-located soil sampling during the October 2021 field program.

3.5.3 Earthworm Sampling

Five earthworm samples were collected, co-located with soil samples. Earthworms were sampled by using a shovel to loosen the top 10 – 15 cm of an area of soil. A trowel and hands (wearing nitrile gloves) were used to sift through the soil and collect earthworms, targeting at least 20 grams of earthworms per sample. The earthworms were then placed in laboratory jars with a moistened Kimwipe and holes drilled in the lid for ventilation.

The earthworms were left to dehydrate for 24 hours in their jars in a cool and dry location at the WSP warehouse. Once dehydrated, the worms were gently rinsed in deionized water, placed in a clean Ziploc bag, and frozen. Each Ziploc bag was labeled with the client, project number, sample date and time, and sample identifier code. The samples were kept frozen at the WSP warehouse for potential future analysis if required.

3.5.4 Vegetation Sampling

Vegetation samples were collected, co-located with soil samples. A total of 23 leaf samples were collected across the 20 soil sampling locations, targeting 20 grams of one species per sample. Vegetation species were selected based on the likelihood that they would be consumed by insects and animals near KÉLSET. Three types of leaves were selected for sampling, based on proximity to KÉLSET and availability: Red alder (*Alnus rubra*) leaves, Red osier dogwood (*Cornus sericea*) leaves, and Himalayan blackberry (*Rubus armeniacus*) leaves.

Healthy leaves were selected and cut with scissors and placed in a labelled Ziploc bag. At the WSP warehouse, leaves were gently rinsed with deionized water, patted dry, and placed in a clean Ziploc bag. Each Ziploc bag was labeled with the client, project number, sample date and time, and sample identifier code. The samples were kept frozen at the WSP warehouse for potential future analysis if required.

3.6 Opportunistic Aquatic Invertebrate Sampling

During peeper retrieval on 24 November 2021, opportunistic aquatic invertebrate sampling was attempted. At each location where peepers were retrieved, a WSP biologist spent 15 minutes wading the creek and searching for aquatic invertebrates that could be sampled. If observed, the aquatic invertebrates were collected by hand (with nitrile gloves) and placed in a Ziploc bag. Each Ziploc bag was labeled with the client, project number, sample date and time, and sample identifier code.

During opportunistic sampling, only two fly larvae were observed. Due to the small tissue volume (insufficient for laboratory analysis), the samples were not frozen and were discarded.

3.7 Quality Assurance and Quality Control

A WSP quality assurance/quality control (QA/QC) program was followed to produce interpretable, meaningful, and reproducible sampling and analytical data. Standard industry field procedures were used during the field investigation to help achieve reproducibility. This involved using QA/QC measures in both the collection and analysis of samples.

Quality Assurance—Field Investigation

The QA measures used in the collection, preservation, and shipment of samples included the following management controls:

- Sampling methods were consistent with established WSP protocols, industry standards, and provincial and/or federal requirements.
- Samples were collected and processed by qualified personnel and were collected in such a way to minimize the introduction of foreign material into the sample and minimize loss of material.
- Field notes were recorded during the investigation. Detailed field records documenting the methods and circumstances of collection for field samples were prepared at the time of sample collection. Samples were assigned a unique sample identification number recorded in the field notes, along with the date and time of sample collection, the sample matrix, and the requested analyses. The geographic locations of samples collected were recorded to allow for revisiting of the sample location if needed.
- Dedicated sampling equipment and clean disposable Nitrile™ gloves were used at sampling locations to avoid cross-contamination. Non-dedicated sampling equipment (e.g., shovel) was decontaminated between sampling locations using a laboratory-grade detergent (e.g., phosphate-free Liquinox) and thoroughly rinsing with deionized water.
- Chain-of-Custody procedures were used for the shipment of samples to the laboratories; samples included in a shipment were identified on a WSP chain-of-custody form, with one copy retained by WSP personnel after sign-off.
- Samples were stored in coolers and chilled with ice during transport and prior to submission to the analytical laboratory(ies).

Quality Control—Field Investigation

The QC measures established for the field program included the following technical aspects:

- Submission of field duplicate samples (i.e., paired sample analyses). A field duplicate sample is a second sample from the same location that is submitted to the analytical laboratory under a separate label. For sediment and soil samples, duplicates were collected by placing sediment/soil from the same sample location directly into the sample jars; thus, the sample and duplicate were not mixed together. For surface water, water was poured from the collection bottle into sample bottles, alternating between the bottle sets for the sample and the duplicate. The duplicate target is 10% duplicates for samples analyzed.
- Sufficient sample volumes were collected so that target detection limits could be met, and quality control samples could be analyzed.

- Samples were packaged and shipped to the laboratory by appropriate means, so that holding times and storage conditions for the analyses were met.

Quality Control—Data Interpretation

The QC measures established for interpretation of the chemistry results included the following technical aspects:

- Standard WSP data quality checks were completed to verify that electronic and manual data transfers (e.g., compilation of data into tables) were complete and that the potential for errors was minimized.
- The relative percent difference (RPD) between paired sample results was used to assess duplicate sample data. The RPD is a measure of the variability between two outcomes from the same procedure or process and is calculated by:

$$RPD(\%) = \left| \frac{(x_1 - x_2)}{\text{average}(x_1, x_2)} \right| \times 100$$

where x_1 is the original sample result and x_2 is the paired analysis result.

Where the concentration of a given parameter is less than five times the laboratory reporting limit (LRL), the laboratory results are considered to be less precise and the RPD is not calculated. For parameters with concentrations less than five times the LRL, the difference factor (DF) between paired analyses results is calculated by:

$$DF = \frac{(x_1 - x_2)}{LDL}$$

where x_1 is the original sample result and x_2 is the paired analysis result.

In 2020, the BC Ministry of Environment updated the British Columbia Laboratory Manual (BC ENV 2020) which contains recommended Data Quality Objectives (DQOs) for laboratories duplicate RPDs. It is recognized that these DQOs are intended for laboratory duplicates and do not include provisions for additional variability in field duplicates. However, these DQOs are considered a conservative screen for assessing the quality of field duplicates. In sediment and soil, the DQOs applied to this investigation are an RPD of less than 40% for high-variability metals (Ag, Al, Ba, Hg, K, Mo, Na, Pb, Sn, Sr, Ti), an RPD of less than 30% for other metals and inorganics, and a difference factor less than two. In water, the DQOs applied to this investigation are an RPD of less than 20% for inorganics and metals, and a difference factor less than two. Where the DQO was exceeded, further examination was conducted.

Quality Assurance—Laboratory Program

AGAT was contracted by PSPC to analyze the sediment, soil, and surface water samples collected as part of the investigation. SiREM was contracted by WSP to report the results from the Peepers, but the chemical analysis was subcontracted to Eurofins TestAmerica (Eurofins) by SiREM. Toxicity testing was completed by Nautilus Environmental (Nautilus), contracted by WSP. Both AGAT and Nautilus are accredited by CALA for the analyses they conducted. Eurofins is not accredited by CALA, as they are located in Pittsburgh, outside of the Canadian jurisdiction.

The analytical laboratories incorporated and reported the results of internal checks to WSP. These consisted of analysis of laboratory replicates, method blanks, and reference samples (a certified reference standard, matrix spike or control standard), as applicable. These were used to assess the reliability, accuracy, and reproducibility of the data. Reports from the laboratory were reviewed internally prior to submission to WSP. If internal QA/QC problems were encountered, the field samples and internal QA/QC samples were re-analyzed. Data quality issues identified by the laboratory were communicated to WSP at the time of data delivery.

Laboratory data were reviewed upon receipt to verify that specified data quality objectives were met. Potential inconsistencies were noted and addressed with the laboratory facilities to confirm results.

Copies of the analytical reports and the corresponding Chain-of-Custody forms are presented in Attachment 2 for AGAT and SiREM, and in Attachment 3 for Nautilus.

4.0 CHEMICAL ANALYSIS

4.1 Chemical Results

Tabulated results for the samples collected by WSP are provided in Appendix B of the main report as follows:

- Table B-1: Sediment Chemistry
- Table B-2: Surface Water Chemistry
- Table B-3: Porewater Chemistry
- Table B-4: Elutriate Chemistry
- Table B-5: Soil Chemistry

The laboratory COA, along with the chain-of-custody forms, are provided in Attachment 2. The data collected by WSP were integrated with the applicable data used to conduct the HHERA (described in the main report) and presented in the tables in Appendix B. The results of the screening against applicable criteria and the implications for risk management for KÉLSET Creek are discussed in the main body of the report.

4.2 QA/QC Results

Standard WSP field procedures were used throughout the investigation. Chain-of-custody procedures were followed during sampling events. Samples were submitted to the laboratory under chain-of-custody protocols using forms that did not identify the expected concentrations. The samples were stored in coolers prior to submission to the analytical laboratory, and appropriately completed chain-of-custody forms accompanied the submissions. Samples were received at the laboratory at acceptable temperatures and analyzed within the recommended holding times.

4.2.1 Laboratory

Analytical laboratory reports from AGAT and SiREM are provided in Attachment 2.

AGAT Laboratories

AGAT considered their data to be reliable. The following quality control notes were made in their analytical reports:

- Sediment Samples: AGAT was unable to perform hexavalent chromium analysis due to color interference on two samples.
- Soil: AGAT was unable to perform hexavalent chromium analysis due to color interference on all samples.
- Surface water: Some concentrations of total metals (arsenic, barium, boron, potassium, sodium, strontium, and sulphur) were less than the corresponding dissolved metals concentrations. AGAT noted that results were within the precision of each method. In addition, the analysis of pH was conducted outside the holding time. The field-measured pH was used instead.
- Elutriate: The method blank spike for total aluminum was low (70%, outside the target range of 80% - 120%). AGAT noted that “with multi element scans it is acceptable for a maximum of 10% of each QC criteria to fail to an absolute maximum of 10%”. Since only one method blank spike fell outside the QC criteria range by 10%, these results are considered acceptable.

In general, laboratory quality control measures were within acceptance criteria including surrogate recoveries, method blank concentrations, laboratory duplicate RPDs, matrix spike recoveries and blank spike recoveries. Analyses complied with the analysis holding time requirements (with the exception of pH noted above) and were received in acceptable condition.

SiREM

SiREM considered their data to be reliable. The following quality control notes were made in their analytical report:

- Samples arrived at the laboratory slightly outside the acceptable temperature range. However, it was noted in the laboratory analytical report that metals analysis does not require thermal preservation.
- pH had exceeded its hold time when analyzed.
- Tin was elevated in the laboratory method blank.
- Several samples were diluted due to the conductivity of the sample matrix.
- There were no published values for the diffusion coefficient for tin, so concentrations were not calculated by SiREM.

In general, laboratory quality control measures were within acceptance criteria, with the exceptions noted above. Analyses complied with the analysis holding time requirements (with the exception of pH noted above).

4.2.2 Field

The results of the sediment, soil, and surface water duplicate pair analyses are presented in Tables B-6, B-7, and B-8 in Appendix B of the main report. Duplicate samples were analyzed for the same parameters as the parent samples. The target duplicate frequency of 10% was met for this investigation. RPD exceedances of the DQOs for the duplicate pairs were:

- Sediment:
 - SED21-31: Total Carbon (RPD = 39%), antimony (RPD = 182%), arsenic (RPD = 89%), lead (RPD = 96%), manganese (RPD = 50%), phosphorus (RPD = 37%), and zinc (RPD = 55%)
 - SED21-BG-01: Arsenic (RPD = 111%) and Lead (RPD = 48%)
- Soil:
 - CS21-16: pH (RPD = 40%)
- Surface Water:
 - SW21-03: Dissolved antimony (DF = 2.5) and total arsenic (DF = 3)

WSP concludes that these RPDs are not indicative of an overall quality control issue. For all of the duplicate pairs in soil and surface water, results were below the applicable standard/guideline, and so this heterogeneity will not affect the interpretation of the results. In sediment, there was one duplicate pair (SED21-31) where one sample in the pair was above the applicable standard while the other was not (for arsenic). In this case, WSP conservatively assumed that the location was represented by the higher concentration. In general, sediment samples are more heterogenous than soil, and therefore, minor difference in the fine-grained fraction between two samples can lead to differences in the contaminant concentrations that are bound to that fraction.

The laboratory QA/QC programs were also reviewed. The samples met the lab's data quality objectives for laboratory control samples, method blanks, duplicate pairs, and recommended hold times, with any exceptions noted in Section 4.2.1 above. The results of the internal laboratory QA testing are provided in the laboratory reports included in Attachment 2. WSP reviewed the laboratory quality control duplicates and found that the results of the analyses met the objectives of the QA/QC program. The review of the laboratory QA/QC analyses suggests the laboratory data is generally accurate and reproducible and can be relied upon for the purposes of this environmental investigation.

Overall, WSP concludes that the chemistry data is representative of site conditions and suitable for use for both site characterization and risk assessment purposes.

5.0 TOXICITY TESTING

The collection of samples for toxicity testing was described in Section 3.0. The following sections describe the methods and results for the toxicity testing conducted as part of the SSI.

5.1 Methods

Sediment toxicity testing was performed at the Nautilus Environmental Laboratory (Burnaby, BC) using the 10-d *Chironomus dilutus* survival and growth toxicity test according to procedures described by Environment Canada (1997, EPS 1/RM/32) and the 7-d *Pimephales promelas* survival and biomass toxicity test (Environment Canada 2011, EPS 1/RM/22). For more detailed information regarding specific test conditions and methodology, please refer to the laboratory reports provided in Attachment 3. Toxicity testing was conducted as follows:

- The first round of toxicity testing was initiated on November 19, 2021 and involved 10-d *Chironomus dilutus* (*C. dilutus*) survival and growth sediment toxicity tests and 7-d fathead minnow (*Pimephales promelas*) elutriate survival and biomass toxicity tests.
- Due to the large number of samples, the *C. dilutus* tests were conducted on two separate dates, November 19, 2021 and November 26, 2021. Each batch of *C. dilutus* test was conducted with a control sediment and reference site (identified by Nautilus as 06188-04).
- The fathead minnow elutriate test also included a control sample, as well as a site control.

5.1.1 Fathead Minnow Elutriate Preparation

The elutriate sample was prepared at the Nautilus Environmental laboratory in Burnaby, BC using the procedure described by the United States Environmental Protection Agency (1998). Briefly, the sediment sample (06188-01) and water sample (5399-01) were acclimated to room temperature overnight. Both samples were homogenized before use. The sediment sample was hand-stirred for 5 minutes, large, woody debris was removed, and the water sample was shaken. The sediment and water were then combined in a sediment-to-water ratio of 1:4 on a volume basis. This mixture was stirred vigorously for 30 minutes via magnetic stirrer. Every 10 minutes the mixture was also stirred manually to ensure complete mixing. After the 30-minute mixing period, the mixture was left to settle for one hour. The supernatant was then removed using a siphon, yielding the elutriate sample. The elutriate was centrifuged at approximately 2,000 rpm for 30 minutes to remove any remaining particulates. The centrifugation was repeated once more to further clarify the elutriate. Prepared elutriate was stored in the dark at 4 ± 2°C until required for testing.

5.2 Results

Results of the 10-d *C. dilutus* and 7-d *Pimephales promelas* toxicity tests are provided in Tables 5 through 7. Pair-wise statistical comparisons ($p < 0.05$) were made by the analytical laboratory and the results of those statistical comparisons to the negative control and background reference sediments (collected from TENTEN) are shown on the tables. The detailed HHERA relied on additional decision criteria (i.e., an adverse effect in the risk assessment is defined by greater than a 20% reduction, not just a statistical difference) which are discussed in the main report.

Overall, the samples did not demonstrate a statistically significant (or greater than 20%) reduction relative to the negative controls or background samples. The implications of these results are discussed in greater detail in the main report.

Table 5: *Chironomus dilutus* Survival and Growth Toxicity Test Results (19 November 2021)

Sample ID	Mean ± SD	
	Survival (%)	Dry Weight (mg/organism)
Control Sediment	100 ± 0.0	1.88 ± 0.09
06188-04 (Reference Sediment)	84.0 ± 11.4 ^a	2.76 ± 0.37
06186-01	96.0 ± 5.5	2.66 ± 0.46
06186-02	94.0 ± 8.9	2.80 ± 0.57
06186-03	92.0 ± 13.0	2.69 ± 0.61
06186-04	94.0 ± 5.5	2.45 ± 0.64
06186-05	98.0 ± 4.5	2.28 ± 0.12
06186-06	100.0 ± 0.0	2.52 ± 0.29
06186-07	92.0 ± 8.4	2.71 ± 0.23
06186-08	98.0 ± 4.5	2.52 ± 0.25

Notes:

SD = Standard Deviation; mg = milligrams.

^a Indicates a statistically significant effect relative to the control sediment.

Table 6: *Chironomus dilutus* Survival and Growth Toxicity Test Results (26 November 2021)

Sample ID	Mean ± SD	
	Survival (%)	Dry Weight (mg/organism)
Control Sediment	98.0 ± 4.5	1.94 ± 0.22
06188-04 (Reference Sediment)	94.0 ± 8.9	2.08 ± 0.37
06186-09	94.0 ± 5.5	1.98 ± 0.21
06186-10	94.0 ± 8.9	2.34 ± 0.36
06186-11	88.0 ± 4.5	2.21 ± 0.57
06186-12	100.0 ± 0.0	2.43 ± 0.20
06188-01	96.0 ± 8.9	2.51 ± 0.33
06188-02	94.0 ± 8.9	2.51 ± 0.29
06188-03	100.0 ± 0.0	2.61 ± 0.44

Notes:

SD = Standard Deviation; mg = milligrams.

Table 7: Fathead Minnow Survival and Biomass Toxicity Test Results (19 November 2021)

Concentration (% v/v)	Mean ± SD	
	Survival (%)	Biomass (mg/organism)
Laboratory Control	100.0 ± 0.0	0.22 ± 0.01
Site Control	100.0 ± 0.0	0.54 ± 0.03
1.56	100.0 ± 0.0	0.50 ± 0.02
3.12	100.0 ± 0.0	0.50 ± 0.05
6.25	90.0 ± 10.0	0.45 ± 0.05
12.5	100.0 ± 0.0	0.50 ± 0.08
25	100.0 ± 0.0	0.56 ± 0.11
50	96.7 ± 5.8	0.47 ± 0.04
100	96.7 ± 5.8	0.48 ± 0.02
Test Endpoint (% v/v)		
LC50	>100	--
IC50	--	>100

Notes:

IC = Inhibition Concentration; LC = Lethal Concentration; SD = Standard Deviation; mg = milligrams.

5.3 Quality Assurance/Quality Control

The health history of the test organisms used in the exposures was acceptable and met the requirements of the Environment Canada protocols (Environment Canada 1997, 2011). The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the tests. There were no deviations from the test methodology, with the exception of not feeding the fathead minnow test organisms on day zero of testing. Uncertainty associated with this test is best described by the standard deviations around the mean. Results of the reference toxicant tests conducted during the testing program are summarized in Table 8. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in the tests was appropriate.

Table 8: Results of the Reference Toxicant Tests Performed During the 2021 Toxicity Testing Program

Species	Endpoint (Survival)	Endpoint (Biomass)	Historical Mean (2 SD Range)	CV (%)	Test Date
<i>Chironomus dilutus</i>	6.6 g/L KCl	-	5.4 (3.8 – 7.6) g/L KCl	17	November 19, 2021
<i>Chironomus dilutus</i>	6.2 g/L KCl	-	5.4 (3.8 – 7.6) g/L KCl	17	November 21, 2021
<i>Pimephales promelas</i>	8.5 g/L NaCl	3.0 g/L NaCl	5.8 (3.8 – 8.9) Survival 3.4 (2.2 – 5.3) Biomass	14.3	November 19, 2021

Notes:

SD = Standard Deviation, CV = Coefficient of Variation

6.0 REFERENCES

- BC ENV. 2020. British Columbia Environmental Laboratory Manual. Analysis, Reporting & Knowledge Services, Knowledge Management Branch, Ministry of Environment and Climate Change Strategy; [accessed 15 December 2021]. <https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-environmental-laboratory-manual>
- Environment Canada. 1997. Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (*Chironomus tentans* and *Chironomus riparius*). Environmental Protection Series EPS 1/RM/32. December 1997. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 131 pp.
- Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. EPS 1/RM/22, Second Edition, March 2011.
- Golder 2021a. Data Review and Gap Analysis, and High Level Sampling Analysis Plan for KÉLSET (Reay) Creek, Sidney, BC. Dated 25 March 2021. Internal Reference No. 21455123-001-L-Rev0.
- Golder 2021b. Supplemental Sediment Sampling in Support of Risk Management at KÉLSET (Reay Creek) in Victoria, BC. Dated 13 December 2021. Internal Reference No. 21455123-055-L-Rev0.
- SLR Consulting (Canada) Ltd. (SLR). 2018. Reay Creek Downstream Sediment and Surface Water Assessment. Reay Creek, Sidney and North Saanich, BC. Report prepared for Public Services and Procurement Canada. January 2018. SLR Project No: 205.03892.00000.
- US EPA/US ACE. 1998. Evaluation of dredged material proposed for discharge in waters of the U.S.- testing manual. Standard elutriate preparation. EPA-823-B-98-004, February 1998.

ATTACHMENT 1

Field Sampling Sheets

Project Name KELSET Creek
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Date / Time	Location Description	Analyses	SCN	Depth (m bgs)	Coordinates	FDA/FD	Description
TENTEN Creek Background Locations							
22/10/21 11:00	TENTEN-A upstream of West Saanich Road SED21-86-02	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06189-02 06188-05	Target 0 - 0.1m			3 samples -- 1 DUPLICATE for chemistry only (not toxicity) (ML) SILT, trace sand and gravel.
22/10/21 12:00	TENTEN-B middle of the reach SED21-86-03	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06189-04 06188-06	Target 0 - 0.1m			(ML) CLAYEY SILT, trace gravel. grey.
22/10/21 09:00	TENTEN-C downstream of Willingdon Road SED21-86-01	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06189-01/02 06188-04	Target 0 - 0.1m		FBI FDA	(sh) gravelly SAND, F.C, grey.

Submit TENTEN chemistry samples (2 jars 2 bags) to Agat lab for analysis on 72-hour rush. Submit toxicity samples to Nautilus Environmental

KELSET Creek Sediment Locations - TOP 10 PRIORITY LOCATIONS							10 samples -- 1 DUPLICATE for chemistry only (not toxicity)
20/10/21 09:45	SED21-28	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-01 06186-01	Target 0 - 0.1m			COMP: collected within 1m x 1m mixture of FM gravel / some silt
25/10/21	SED21-A SW21-01 (near former SED21-27)	Surface water sample	06183-01				Note YSI water quality parameters in field notebook
25/10/21	PW21-01 PS21-01	Peeper install: one in sediment and one in water column					
20/10/21 10:50	SED21-B (near former SED21-22)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-03 06185-03	Target 0 - 0.1m			(GP/SP) GRAVEL and SAND trace silt, grey.
25/10/21	PS21-02	Peeper install: one in sediment					
20/10/21 11:45	SED21-C (near former RC17-12)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-04/05 06186-04	Target 0 - 0.1m		FDA FD (x2)	SAME AS 21-30. X NO GRAIN SIZE DURE. & Silty
20/10/21 11:50	SED21-D (near former RC17-11)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-06 06186-05	Target 0 - 0.1m			(GP-SP) GRAVEL (F-C) and SAND. F-C, wood organics
25/10/21	SW21-03	Surface water sample	06183-02/03			FDA FD.	Note YSI water quality parameters in field notebook
25/10/21	PW21-03 PS21-03	Peeper install: one in sediment and one in water column					
20/10/21 13:00	SED21-E (near former RC17-10)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-07 06186-06	Target 0 - 0.1m			* GRAVEL AND SILT, trace sand, silt upstream/downstream. lot's of H2O in samples.
25/10/21	PS21-04	Peeper install: one in sediment					
20/10/21 14:30	SED21-F (near former SED21-16)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06186-08/09 06186-07	Target 0 - 0.1m		FDA FD (x4)	(SP) gravelly SAND, some silt light grey Coronation lighter (F-C)

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Date / Time	Location Description	Analyses	SCN	Depth (m bgs)	Coordinates	FDA/FD	Description
25/10/21	PS21-05						
20/10/21 15:15	SED21-G SED21-35 Somewhere in reach between RC17-07 and SED21-12	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-10 06186-08	Target 0 - 0.1m			(SM) SILTY SAND, grey.
21/10/21 11:20	SED21-H (near former SED21-12)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06187-03 06186-12	Target 0 - 0.1m			(SP) SAND, fine, some silt. Vegetation debris, light brown
26/10/21	SED21-39 PS21-06 →						
21/10/21 14:00	SED21-I SED21-42 (near former RC17-02)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06187-06 06188-03	Target 0 - 0.1m			(ML) SILT with vegetation organics/wood debris
21/10/21 12:10	SED21-J SED21-40	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06187-04 06188-01	Target 0 - 0.1m			(ML) SILT w/ vegetation organics wood debris
26/10/21	SED21-J (near former SED21-05) SW21-07 →	Surface water sample	06183-04				Note YSI water quality parameters in field notebook
26/10/21	PW21-07 → PS21-07 →	Peeper install: one in sediment and one in water column					
KELSET Creek Sediment Locations - Next 5 lower priority locations							5 samples -- 1 DUPLICATE for chemistry only (not toxicity)
20/10/21 10:15	SED21-K SED21-29 (near former SED21-24)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-02 06186-02	Target 0 - 0.1m			(BW) Sandy GRAVEL, F-c sand, F-c gravel, trace silt.
21/10/21 09:00	SED21-L SED21-37 (near former RC17-13)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06187-01 06186-10	Target 0 - 0.1m			(BW) Sandy GRAVEL, F-c Sand, F-c gravel, trace silt, grey.
21/10/21 10:15	SED21-M SED21-38 (near former RC17-09)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06187-02 06186-11	Target 0 - 0.1m			(BW) Sandy GRAVEL, F-c gravel, m-c sand, trace silt, grey. Underlying CLAY unit 10cm upwards
20/10/21 16:00	SED21-N SED21-36 (near former RC17-07)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06185-11 06186-09	Target 0 - 0.1m			(SM) SILTY SAND, trace gravel, light grey.
21/10/21 12:30	SED21-O SED21-41 Somewhere in reach between RC17-07 and SED21-12	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC 4L pail: Toxicity Analysis	06187-05 06188-02	Target 0 - 0.1m			(SM) SILTY SAND, lots of woody debris and organics. (Air bubbles while digging).

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Date / Time	Location Description	Analyses	SCN	Depth (m bgs)	Coordinates	FDA/FD	Description
KELSET Creek Co-Located Soil/Tissue Locations							
26/10/21 13:00	CS21-01 - (At flagged blackberry bush)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-01	Target 0 - 0.1m	West or east bank? West		20 samples -- 2 DUPLICATES for soil, ideally also for tissue REFER TO FIELD NOTES
26/10/21 13:00	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Earthworm sample: 20 grams of earthworms in glass jars with moistened Kimwipe and holes in lid	-		West or east bank? WEST		Please include sketch relative to creek and soil sample ↓
26/10/21 13:00	LE21-01 (Blackberry)	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? WEST		Please include sketch relative to creek and soil sample
26/10/21 14:30	CS21-02 (near SED21-24)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-02	Target 0 - 0.1m	West or east bank? EAST		
26/10/21 14:30	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? EAST		Please include sketch relative to creek and soil sample
26/10/21 15:00	CS21-03 (near RC17-15)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-03	Target 0 - 0.1m	West or east bank? EAST		
26/10/21 15:00	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? EAST		Please include sketch relative to creek and soil sample
26/10/21 15:40	CS21-04 (near RC17-14)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-04	Target 0 - 0.1m	West or east bank? WEST		
26/10/21 15:40	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? WEST		Please include sketch relative to creek and soil sample
27/10/21 09:15	CS21-05 (near RC17-13)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-05/06	Target 0 - 0.1m	West or east bank? WEST	FDA/ FD	
27/10/21 09:15	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? WEST		Please include sketch relative to creek and soil sample
27/10/21 09:50	CS21-06 (near RC17-12)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-07	Target 0 - 0.1m	West or east bank? WEST		
27/10/21 09:50	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? WEST		Please include sketch relative to creek and soil sample

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Date / Time	Location Description	Analyses	SCN	Depth (m bgs)	Coordinates	FDA/FD	Description
29/10/21 09:30	CS21-07 New location - halfway between RC17-12 and RC17-11	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-06	Target 0 - 0.1m	WEST		
29/10/21 09:30	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves LE21-XX (Alder)	Vegetation sample: 20 grams of one species in a ziploc bag	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 11:30	CS21-08 (At flagged blackberry sample)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-09	Target 0 - 0.1m	WEST		
27/10/21 11:30	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves SI21-08	SI21-XX Earthworm sample: 20 grams of earthworms in glass jars with moistened Kimwipe and holes in lid	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 11:30	LE21-08 (Blackberry)	Vegetation sample: 20 grams of one species in a ziploc bag	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 10:20	CS21-09 (near RC17-10)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-08	Target 0 - 0.1m	WEST		
27/10/21 10:20	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves LE21-09 (Dogwood)	Vegetation sample: 20 grams of one species in a ziploc bag	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 13:00	CS21-10 (At flagged blackberry sample)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-10	Target 0 - 0.1m	WEST		
27/10/21 13:00	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves SI21-10	SI21-XX Earthworm sample: 20 grams of earthworms in glass jars with moistened Kimwipe and holes in lid	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 13:00	LE21-10 (Blackberry)	Vegetation sample: 20 grams of one species in a ziploc bag	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 14:00	CS21-11	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-11	Target 0 - 0.1m	WEST		
27/10/21 14:00	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves NO WORMS	SI21-XX Earthworm sample: 20 grams of earthworms in glass jars with moistened Kimwipe and holes in lid	-		WEST		Please include sketch relative to creek and soil sample
27/10/21 14:00	LE21-11 (Blackberry)	Vegetation sample: 20 grams of one species in a ziploc bag	-		WEST		Please include sketch relative to creek and soil sample

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Date / Time	Location Description	Analyses	SCN	Depth (m bgs)	Coordinates	FDA/FD	Description
27/10/21	CS21-12	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06190-12	Target 0 - 0.1m	West or east bank? EAST		
27/10/21	CS21-12 (At flagged blackberry sample) SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	SI21-XX Earthworm sample: 20 grams of earthworms in glass jars with moistened Kimwipe and holes in lid	-		West or east bank? EAST		Please include sketch relative to creek and soil sample
27/10/21	LE21-12 (Dogwood)	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? EAST.		Please include sketch relative to creek and soil sample
27/10/21	CS21-13 Somewhere in reach between RC17-07 and RC17-03	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-05	Target 0 - 0.1m	West or east bank? WEST		
27/10/21	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag A - Alder B - Dogwood	-		West or east bank? WEST.		Please include sketch relative to creek and soil sample
28/10/21	CS21-14 Somewhere in reach between RC17-07 and RC17-03	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-04	Target 0 - 0.1m	West or east bank? EAST		
28/10/21	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag (X2) A - Alder B - Dogwood	-		West or east bank? EAST		Please include sketch relative to creek and soil sample
28/10/21	CS21-15 Somewhere in reach between RC17-07 and RC17-03	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-03	Target 0 - 0.1m	West or east bank? EAST.		
28/10/21	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? EAST.		Please include sketch relative to creek and soil sample
29/10/21	CS21-16 In area with skunk cabbage west of RC17-03	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-07/08	Target 0 - 0.1m	West or east bank? WEST	FDA FD	
29/10/21	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag	-		West or east bank? WEST		Please include sketch relative to creek and soil sample
29/10/21	CS21-17 Same area as CS21-16 but outside the swampy/skunk cabbage area	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-09	Target 0 - 0.1m	West or east bank? WEST		
29/10/21	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves	Vegetation sample: 20 grams of one species in a ziploc bag A - Alder B - Dogwood	-		West or east bank? WEST.		Please include sketch relative to creek and soil sample

Project Name KELSET Creek
 Project # 21455123
 Collected By Sean Sutherland / Gordon Phillippe
 Verified By _____

GPS _____
 UTM Zone _____
 Page _____ of _____

Date / Time	Location Description	Analyses	SCN	Depth (m bgs)	Coordinates	FDA/FD	Description
29/10/21 11:20	CS21-18 (Near RC17-02)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-10	Target 0 - 0.1m	WEST		
29/10/21 11:20	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves LE21-18 (Dogwood)	Vegetation sample: 20 grams of one species in a ziploc bag	-		WEST		Please include sketch relative to creek and soil sample
28/10/21 10:00	CS21-19 (At flagged blackberry sample)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-01	Target 0 - 0.1m	NORTH EAST		
28/10/21 10:00	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves SI21-19	SI21-XX Earthworm sample: 20 grams of earthworms in glass jars with moistened Kimwipe and holes in lid	-		NORTH EAST		Please include sketch relative to creek and soil sample
28/10/21 10:00	LE21-19 (Blackberry)	Vegetation sample: 20 grams of one species in a ziploc bag	-		NORTH EAST		Please include sketch relative to creek and soil sample
28/10/21 10:45	CS21-20 (Near culvert and RC17-01)	2 bags and 2 jars: Metals, speciated chromium, Grain size and hydrometer, TOC	06191-02	Target 0 - 0.1m	NORTH EAST		
28/10/21 10:45	SI21-XX for earthworms GR21-XX for grass LE21-XX for leaves LE21-20 (Alder)	Vegetation sample: 20 grams of one species in a ziploc bag	-		NORTH EAST		Please include sketch relative to creek and soil sample
KELSET Creek Flying Invertebrate Locations							3 samples -- 1 Duplicate
	FI21-01	Malaise traps - place insects from each day into a small ziploc bag, label with date and Sample ID			West or east bank?		Please include sketch relative to creek
	FI21-02	Malaise traps - place insects from each day into a small ziploc bag, label with date and Sample ID			West or east bank?		Please include sketch relative to creek
	FI21-03	Malaise traps - place insects from each day into a small ziploc bag, label with date and Sample ID			West or east bank?		Please include sketch relative to creek

ATTACHMENT 2

Laboratory Certificates of Analysis



CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)
219-800 BURRARD ST
VANCOUVER, BC V6Z 0B9
604-671-1831

ATTENTION TO: Robyn Chatwin-Davies

PROJECT: 21455123

AGAT WORK ORDER: 21V822374

SOIL ANALYSIS REVIEWED BY: Clarissa Muljono, Report Writer

DATE REPORTED: Nov 10, 2021

PAGES (INCLUDING COVER): 22

VERSION*: 4

Should you require any information regarding this analysis please contact your client services representative at (778) 452-4000

***Notes**

VERSION 4:Version 1 issued on October 29, 2021 to report Metals and TOC on samples 3141211, -214, -215, -216. Complete results to follow.
Version 2 issued on November 1, 2021 to report Metals and TOC on all samples. Version 2 is an amendment of version 1.
Version 3 issued on November 9, 2021 to report complete results. Version 3 is an amendment of version 2.
Version 4 issued on November 10, 2021 to report Trivalent Chromium as part of Speciated Chromium. Version 4 is an amendment of version 3.

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

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<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Parameter	Unit	SAMPLE DESCRIPTION:									
		G / S	RDL	06185-01	06185-02	06185-03	06185-04	06185-05	06185-06	06185-07	06185-08
				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30
				3141189	3141195	3141196	3141197	3141198	3141199	3141200	3141201
Aluminum	µg/g		10	21400	14700	17400	13000	11100	10800	8990	18200
Antimony	µg/g		0.1	0.2	0.2	0.2	0.2	4.2	0.2	0.3	0.3
Arsenic	µg/g		1	4	3	2	5	13	3	3	6
Barium	µg/g		0.5	81.1	49.9	73.4	54.8	36.5	42.6	47.3	71.8
Beryllium	µg/g		0.1	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.4
Bismuth	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	µg/g		0.01	0.29	1.04	1.19	1.11	0.93	0.84	3.19	1.64
Calcium	µg/g		10	8780	7620	6230	6960	6060	5390	4060	6360
Chromium	µg/g		1	39	33	26	21	19	24	24	40
Cobalt	µg/g		0.1	12.5	12.8	12.5	11.3	8.9	9.1	8.5	14.5
Copper	µg/g		0.2	32.3	31.4	20.5	19.5	22.2	16.6	18.6	30.1
Iron	µg/g		10	26900	29400	31000	24500	21800	20300	13100	29600
Lead	µg/g		0.1	5.1	5.7	6.5	4.4	12.5	5.6	10.4	6.9
Magnesium	µg/g		10	8160	7420	7820	6000	5050	4700	3270	7650
Manganese	µg/g		1	544	413	573	935	563	380	276	481
Mercury	µg/g		0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Molybdenum	µg/g		0.2	0.5	0.4	0.5	0.6	1.0	0.4	0.5	0.3
Nickel	µg/g		0.5	28.0	25.0	22.6	17.6	14.9	14.2	13.7	29.3
Phosphorus	µg/g		5	603	658	631	763	527	529	369	676
Potassium	µg/g		5	608	458	658	374	296	430	420	952
Selenium	µg/g		0.1	0.4	0.3	0.3	0.3	0.2	<0.1	<0.1	0.3
Lithium	µg/g		0.5	13.8	8.5	11.5	6.3	5.6	6.3	6.1	13.2
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium	µg/g		5	360	292	318	219	224	239	199	433
Strontium	µg/g		1	40	26	30	34	29	26	22	29
Thallium	µg/g		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/g		0.2	0.5	3.6	0.5	1.6	1.3	0.4	0.5	0.6
Titanium	µg/g		1	1120	1370	1380	1050	1030	1070	734	1320
Uranium	µg/g		0.2	0.6	0.6	0.4	0.3	0.2	0.4	0.4	0.3

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
CANADA V5J 0B6
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FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Parameter	Unit	SAMPLE DESCRIPTION:										
		G / S	RDL	06185-01	06185-02	06185-03	06185-04	06185-05	06185-06	06185-07	06185-08	
				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:	2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30
				3141189	3141195	3141196	3141197	3141198	3141199	3141200	3141201	
Vanadium	µg/g	1	75	66	57	55	47	46	36	73		
Zinc	µg/g	1	71	171	147	144	253	142	162	148		
Zirconium	µg/g	0.1	2.6	6.0	4.2	3.7	3.9	3.1	1.3	6.4		
pH 1:2	pH units	0.10	6.52	7.50	7.46	7.54	7.61	7.00	6.03	5.98		

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Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Parameter	Unit	SAMPLE DESCRIPTION:									
		G / S	RDL	06185-09	06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05
				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				2021-10-21 14:30	2021-10-21 15:15	2021-10-21 16:00	2021-10-21 09:00	2021-10-21 10:15	2021-10-21 11:20	2021-10-21 12:10	2021-10-21 12:30
				3141202	3141203	3141204	3141205	3141206	3141207	3141208	3141209
Aluminum	µg/g		10	22000	13000	11700	12000	12600	7830	22600	9270
Antimony	µg/g		0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.7	0.5
Arsenic	µg/g		1	6	2	4	<1	5	2	7	4
Barium	µg/g		0.5	79.6	59.6	48.4	56.6	49.3	42.9	113	55.1
Beryllium	µg/g		0.1	0.3	0.2	0.3	0.3	0.3	0.2	0.5	0.2
Bismuth	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	µg/g		0.01	1.47	1.30	1.53	0.68	1.13	1.00	13.8	6.18
Calcium	µg/g		10	6490	4580	4510	5220	5910	3820	8060	7340
Chromium	µg/g		1	45	25	27	15	28	14	74	30
Cobalt	µg/g		0.1	16.8	8.8	9.7	7.5	10.5	6.5	16.6	9.1
Copper	µg/g		0.2	33.9	17.7	19.1	13.8	21.9	10.5	54.9	30.8
Iron	µg/g		10	34600	17100	20400	21600	22400	15900	31100	15900
Lead	µg/g		0.1	8.1	7.1	5.9	5.8	5.9	6.6	43.1	11.3
Magnesium	µg/g		10	9260	4120	4790	4900	5740	2620	7290	3320
Manganese	µg/g		1	565	236	440	566	472	531	806	594
Mercury	µg/g		0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.10	0.04
Molybdenum	µg/g		0.2	0.3	0.4	0.2	0.3	0.3	0.4	1.0	1.0
Nickel	µg/g		0.5	36.0	17.2	18.7	12.4	19.2	9.3	33.1	15.1
Phosphorus	µg/g		5	670	442	527	609	489	594	1330	529
Potassium	µg/g		5	1210	526	583	506	612	363	1110	443
Selenium	µg/g		0.1	0.3	0.1	0.3	0.4	0.1	0.3	0.7	0.5
Lithium	µg/g		0.5	14.2	8.6	8.8	8.2	8.4	4.8	17.1	5.8
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium	µg/g		5	496	226	297	218	250	145	947	233
Strontium	µg/g		1	31	26	25	25	22	20	57	38
Thallium	µg/g		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/g		0.2	0.6	0.5	0.4	0.3	0.3	0.2	1.3	0.6
Titanium	µg/g		1	1450	807	897	974	1070	666	1100	684
Uranium	µg/g		0.2	0.4	0.5	0.3	0.3	0.3	0.2	1.1	0.9

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

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FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION:	06185-09	06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05
				SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2021-10-21	2021-10-21	2021-10-21	2021-10-21	2021-10-21	2021-10-21	2021-10-21	2021-10-21	2021-10-21
				14:30	15:15	16:00	09:00	10:15	11:20	12:10	12:10	12:30
				3141202	3141203	3141204	3141205	3141206	3141207	3141208	3141208	3141209
Vanadium	µg/g		1	84	43	49	40	52	30	71	38	
Zinc	µg/g		1	164	132	143	90	128	109	419	277	
Zirconium	µg/g		0.1	6.4	1.9	3.5	4.2	3.6	1.1	3.4	1.3	
pH 1:2	pH units		0.10	5.98	6.23	7.38	7.19	6.39	7.16	5.81	6.26	

Certified By:



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ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Parameter	Unit	SAMPLE DESCRIPTION:		06187-06	06189-01	06189-02	06189-03	06189-04
		G / S	RDL	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21	2021-10-22	2021-10-22	2021-10-22	2021-10-22
				14:00	09:00	09:00	11:00	12:00
				3141210	3141211	3141214	3141215	3141216
Aluminum	µg/g		10	19300	15200	16000	26700	25500
Antimony	µg/g		0.1	0.5	0.5	0.4	0.3	0.3
Arsenic	µg/g		1	7	2	7	4	6
Barium	µg/g		0.5	109	57.4	59.2	106	133
Beryllium	µg/g		0.1	0.4	0.3	0.3	0.4	0.4
Bismuth	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	µg/g		0.01	12.6	0.17	0.17	0.23	0.21
Calcium	µg/g		10	6920	6700	6470	6870	7920
Chromium	µg/g		1	86	21	26	40	45
Cobalt	µg/g		0.1	13.0	8.0	9.9	13.1	15.8
Copper	µg/g		0.2	46.1	29.0	31.0	39.1	42.4
Iron	µg/g		10	25700	22200	22500	33300	39400
Lead	µg/g		0.1	44.0	14.4	8.8	8.1	6.7
Magnesium	µg/g		10	6130	5430	5640	8090	9750
Manganese	µg/g		1	629	572	637	528	1500
Mercury	µg/g		0.01	0.07	0.03	0.03	0.04	0.03
Molybdenum	µg/g		0.2	0.9	0.6	0.5	0.5	1.9
Nickel	µg/g		0.5	27.6	18.1	21.1	31.3	44.7
Phosphorus	µg/g		5	1320	619	596	491	777
Potassium	µg/g		5	921	700	740	1190	1770
Selenium	µg/g		0.1	0.5	0.1	0.3	0.3	0.4
Lithium	µg/g		0.5	14.5	9.4	9.6	17.0	22.2
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium	µg/g		5	474	309	307	404	649
Strontium	µg/g		1	49	33	32	45	64
Thallium	µg/g		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/g		0.2	1.0	0.5	0.7	0.6	0.5
Titanium	µg/g		1	952	1050	1170	1470	1220
Uranium	µg/g		0.2	0.9	0.3	0.3	0.6	0.8

Certified By:



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SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Parameter	Unit	SAMPLE DESCRIPTION:		06187-06	06189-01	06189-02	06189-03	06189-04
		G / S	RDL	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:		2021-10-21	2021-10-22	2021-10-22	2021-10-22	2021-10-22	2021-10-22	2021-10-22
		14:00	09:00	09:00	11:00	12:00		
		3141210	3141211	3141214	3141215	3141216		
Vanadium	µg/g	1	60	51	63	85	87	
Zinc	µg/g	1	322	110	124	66	107	
Zirconium	µg/g	0.1	2.2	3.1	3.3	4.8	4.1	
pH 1:2	pH units	0.10	5.92	7.87	7.67	6.85	7.42	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141189-3141216 Results are based on the dry weight of the sample

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
CANADA V5J 0B6
TEL (778)452-4000
FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Particle Size by SIEVE - 19mm, 4.75mm & 75um

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

		SAMPLE DESCRIPTION:		06185-01	06185-02	06185-03	06185-04	06185-06	06185-07	06185-08	06185-09
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30	2021-10-21 14:30
Parameter	Unit	G / S	RDL	3141189	3141195	3141196	3141197	3141199	3141200	3141201	3141202
Sieve Analysis - 19 mm	%		1	14	6	26	33	9	25	<1	<1
Sieve Analysis - 4.75 mm	%		1	60	23	30	39	72	41	20	11
Sieve Analysis - 75 microns	%		1	4	42	21	20	14	26	22	28
Sieve Texture				Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
		SAMPLE DESCRIPTION:		06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05	06187-06
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 15:15	2021-10-21 16:00	2021-10-21 09:00	2021-10-21 10:15	2021-10-21 11:20	2021-10-21 12:10	2021-10-21 12:30	2021-10-21 14:00
Parameter	Unit	G / S	RDL	3141203	3141204	3141205	3141206	3141207	3141208	3141209	3141210
Sieve Analysis - 19 mm	%		1	<1	<1	7	6	<1	<1	<1	<1
Sieve Analysis - 4.75 mm	%		1	<1	7	44	48	<1	1	<1	<1
Sieve Analysis - 75 microns	%		1	46	55	39	19	88	33	84	16
Sieve Texture				Fine	Coarse	Fine	Fine	Coarse	Fine	Coarse	Fine
		SAMPLE DESCRIPTION:		06189-01	06189-02	06189-03	06189-04				
		SAMPLE TYPE:		Soil	Soil	Soil	Soil				
		DATE SAMPLED:		2021-10-22 09:00	2021-10-22 09:00	2021-10-22 11:00	2021-10-22 12:00				
Parameter	Unit	G / S	RDL	3141211	3141214	3141215	3141216				
Sieve Analysis - 19 mm	%		1	<1	<1	<1	31				
Sieve Analysis - 4.75 mm	%		1	11	29	8	25				
Sieve Analysis - 75 microns	%		1	52	47	23	9				
Sieve Texture				Coarse	Fine	Fine	Fine				

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141189-3141216 Value reported is amount of sample retained on sieve after wash with water and represents proportion by weight particles larger than indicated sieve size. Sieve Texture is a calculated parameter. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Chromium (VI)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

		SAMPLE DESCRIPTION:		06185-01	06185-02	06185-03	06185-04	06185-05	06185-06	06185-07	06185-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30
Parameter	Unit	G / S	RDL	3141189	3141195	3141196	3141197	3141198	3141199	3141200	3141201
Chromium, Hexavalent	mg/L		0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	N/A	<0.3
		SAMPLE DESCRIPTION:		06185-09	06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 14:30	2021-10-21 15:15	2021-10-21 16:00	2021-10-21 09:00	2021-10-21 10:15	2021-10-21 11:20	2021-10-21 12:10	2021-10-21 12:30
Parameter	Unit	G / S	RDL	3141202	3141203	3141204	3141205	3141206	3141207	3141208	3141209
Chromium, Hexavalent	mg/L		0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	N/A	N/A
		SAMPLE DESCRIPTION:		06187-06	06189-01	06189-02	06189-03	06189-04			
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil			
		DATE SAMPLED:		2021-10-21 14:00	2021-10-22 09:00	2021-10-22 09:00	2021-10-22 11:00	2021-10-22 12:00			
Parameter	Unit	G / S	RDL	3141210	3141211	3141214	3141215	3141216			
Chromium, Hexavalent	mg/L		0.3	N/A	<0.3	<0.3	<0.3	<0.3			

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141189-3141199 Result is based on the dry weight of the sample.

3141200 N/A - Unable to perform Chromium Hexavalent analysis due to color interference.
Result is based on the dry weight of the sample.

3141201-3141216 Result is based on the dry weight of the sample.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Texture (Gravel, Sand, Silt, Clay) (100 %)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

		SAMPLE DESCRIPTION:		06185-01	06185-02	06185-03	06185-04	06185-06	06185-07	06185-08	06185-09
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30	2021-10-21 14:30
Parameter	Unit	G / S	RDL	3141189	3141195	3141196	3141197	3141199	3141200	3141201	3141202
Clay	%		1	12	6	10	2	5	4	25	32
Gravel	%		1	15	23	13	8	2	1	9	12
Sand	%		1	48	62	63	86	84	81	46	34
Silt	%		1	26	9	15	4	9	14	20	22
Soil Texture				Sandy Loam	Loamy Sand	Sandy Loam	Sand	Loamy Sand	Loamy Sand	Sandy Clay Loam	Clay Loam
		SAMPLE DESCRIPTION:		06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05	06187-06
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 15:15	2021-10-21 16:00	2021-10-21 09:00	2021-10-21 10:15	2021-10-21 11:20	2021-10-21 12:10	2021-10-21 12:30	2021-10-21 14:00
Parameter	Unit	G / S	RDL	3141203	3141204	3141205	3141206	3141207	3141208	3141209	3141210
Clay	%		1	11	13	6	17	4	16	4	12
Gravel	%		1	1	10	5	14	2	3	5	<1
Sand	%		1	61	64	85	50	87	42	84	45
Silt	%		1	27	13	4	18	6	39	7	42
Soil Texture				Sandy Loam	Sandy Loam	Sand	Sandy Clay Loam	Sand	Loam	Sand	Loam
		SAMPLE DESCRIPTION:		06189-01	06189-02	06189-03	06189-04				
		SAMPLE TYPE:		Soil	Soil	Soil	Soil				
		DATE SAMPLED:		2021-10-22 09:00	2021-10-22 09:00	2021-10-22 11:00	2021-10-22 12:00				
Parameter	Unit	G / S	RDL	3141211	3141214	3141215	3141216				
Clay	%		1	9	5	29	31				
Gravel	%		1	6	9	6	7				
Sand	%		1	72	77	33	34				
Silt	%		1	11	7	32	28				
Soil Texture				Sandy Loam	Loamy Sand	Clay Loam	Clay Loam				

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Texture (Gravel, Sand, Silt, Clay) (100 %)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141189-3141216 Soil Texture is a calculated parameter. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Speciated Chromium in Soil

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

		SAMPLE DESCRIPTION:		06185-01	06185-02	06185-03	06185-04	06185-05	06185-06	06185-07	06185-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30
Parameter	Unit	G / S	RDL	3141189	3141195	3141196	3141197	3141198	3141199	3141200	3141201
Chromium, Trivalent	µg/g		0.4	39.0	33.0	26.0	21.0	19.0	24.0	NA	40.0
		SAMPLE DESCRIPTION:		06185-09	06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 14:30	2021-10-21 15:15	2021-10-21 16:00	2021-10-21 09:00	2021-10-21 10:15	2021-10-21 11:20	2021-10-21 12:10	2021-10-21 12:30
Parameter	Unit	G / S	RDL	3141202	3141203	3141204	3141205	3141206	3141207	3141208	3141209
Chromium, Trivalent	µg/g		0.4	45.0	25.0	27.0	15.0	28.0	14.0	NA	NA
		SAMPLE DESCRIPTION:		06187-06	06189-01	06189-02	06189-03	06189-04			
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil			
		DATE SAMPLED:		2021-10-21 14:00	2021-10-22 09:00	2021-10-22 09:00	2021-10-22 11:00	2021-10-22 12:00			
Parameter	Unit	G / S	RDL	3141210	3141211	3141214	3141215	3141216			
Chromium, Trivalent	µg/g		0.4	NA	21.0	26.0	40.0	45.0			

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141189-3141199 Results are based on the dry weight of the sample
Trivalent Chromium result is a calculation based on Chromium performed at AGAT Vancouver and Hexavalent Chromium performed at AGAT Calgary.

3141200 Results are based on the dry weight of the sample
Trivalent Chromium result is a calculation based on Chromium performed at AGAT Vancouver and Hexavalent Chromium performed at AGAT Calgary.
N/A - Unable to perform Chromium Hexavalent analysis due to color interference.

3141201-3141207 Results are based on the dry weight of the sample
Trivalent Chromium result is a calculation based on Chromium performed at AGAT Vancouver and Hexavalent Chromium performed at AGAT Calgary.

3141208-3141210 Results are based on the dry weight of the sample
Trivalent Chromium result is a calculation based on Chromium performed at AGAT Vancouver and Hexavalent Chromium performed at AGAT Calgary.
N/A - Unable to perform Chromium Hexavalent analysis due to color interference.

3141211-3141216 Results are based on the dry weight of the sample
Trivalent Chromium result is a calculation based on Chromium performed at AGAT Vancouver and Hexavalent Chromium performed at AGAT Calgary.

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822374

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Total Organic Carbon in Soil (LECO) (Calc) (%)

DATE RECEIVED: 2021-10-26

DATE REPORTED: 2021-11-10

		SAMPLE DESCRIPTION:		06185-01	06185-02	06185-03	06185-04	06185-05	06185-06	06185-07	06185-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 09:45	2021-10-21 10:15	2021-10-21 10:50	2021-10-21 11:45	2021-10-21 11:45	2021-10-21 12:20	2021-10-21 13:00	2021-10-21 14:30
Parameter	Unit	G / S	RDL	3141189	3141195	3141196	3141197	3141198	3141199	3141200	3141201
Carbon - Total	%		0.02	2.13	0.95	1.62	0.46	0.31	1.54	1.92	0.57
Inorganic Carbon - Total	%		0.02	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Organic Carbon-Total (Calc)	%		0.02	2.08	0.95	1.62	0.46	0.31	1.54	1.92	0.57
		SAMPLE DESCRIPTION:		06185-09	06185-10	06185-11	06187-01	06187-02	06187-03	06187-04	06187-05
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-21 14:30	2021-10-21 15:15	2021-10-21 16:00	2021-10-21 09:00	2021-10-21 10:15	2021-10-21 11:20	2021-10-21 12:10	2021-10-21 12:30
Parameter	Unit	G / S	RDL	3141202	3141203	3141204	3141205	3141206	3141207	3141208	3141209
Carbon - Total	%		0.02	0.54	2.39	0.51	0.55	1.06	0.75	9.17	2.25
Inorganic Carbon - Total	%		0.02	<0.02	<0.02	<0.02	<0.02	0.08	<0.02	0.10	<0.02
Organic Carbon-Total (Calc)	%		0.02	0.54	2.39	0.51	0.55	0.98	0.75	9.07	2.25
		SAMPLE DESCRIPTION:		06187-06	06189-01	06189-02	06189-03	06189-04			
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil			
		DATE SAMPLED:		2021-10-21 14:00	2021-10-22 09:00	2021-10-22 09:00	2021-10-22 11:00	2021-10-22 12:00			
Parameter	Unit	G / S	RDL	3141210	3141211	3141214	3141215	3141216			
Carbon - Total	%		0.02	4.90	0.89	0.89	1.09	0.85			
Inorganic Carbon - Total	%		0.02	<0.02	<0.02	<0.02	<0.02	0.02			
Organic Carbon-Total (Calc)	%		0.02	4.90	0.89	0.89	1.09	0.83			

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822374
PROJECT: 21455123
ATTENTION TO: Robyn Chatwin-Davies
SAMPLING SITE:
SAMPLED BY:

Soil Analysis															
RPT Date: Nov 10, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Metals in Soil - Public Works (µg/g)

Aluminum	3141195		14700	15300	3.9%	< 10	100%	70%	130%	109%	85%	115%
Antimony	3143330		0.2	0.1	NA	< 0.1	108%	70%	130%	99%	85%	115%
Arsenic	3143330		3	3	NA	< 1	95%	70%	130%	106%	85%	115%
Barium	3143330		79.1	66.2	17.7%	< 0.5	114%	70%	130%	95%	85%	115%
Beryllium	3143330		0.3	0.3	NA	< 0.1	103%	70%	130%	105%	85%	115%
Bismuth	3143330		<0.5	<0.5	NA	< 0.5				101%	85%	115%
Cadmium	3143330		0.19	0.19	1.0%	< 0.01	97%	70%	130%	103%	85%	115%
Calcium	3141195		7620	7730	1.4%	< 10	102%	70%	130%	103%	85%	115%
Chromium	3143330		28	33	17.3%	< 1	109%	70%	130%	114%	85%	115%
Cobalt	3143330		10.9	11.3	3.3%	< 0.1	103%	70%	130%	105%	85%	115%
Copper	3143330		41.1	42.1	2.4%	< 0.2	107%	70%	130%	114%	85%	115%
Iron	3141195		29400	25900	12.6%	< 10	100%	70%	130%	107%	85%	115%
Lead	3143330		5.1	4.4	14.4%	< 0.1	103%	70%	130%	102%	85%	115%
Magnesium	3141195		7420	7500	1.0%	< 10	103%	70%	130%	101%	85%	115%
Manganese	3143330		648	640	1.2%	< 1	109%	70%	130%	100%	85%	115%
Mercury	3143330		0.03	0.02	NA	< 0.01	111%	70%	130%	106%	85%	115%
Molybdenum	3143330		0.3	0.2	NA	< 0.2	98%	70%	130%	98%	85%	115%
Nickel	3143330		24.3	25.8	6.1%	< 0.5	108%	70%	130%	115%	85%	115%
Phosphorus	3141195		658	562	15.8%	< 5	106%	70%	130%	97%	85%	115%
Potassium	3141195		458	476	3.9%	< 5	95%	70%	130%	103%	85%	115%
Selenium	3143330		0.3	0.4	NA	< 0.1				105%	85%	115%
Lithium	3143330		9.4	9.1	2.7%	< 0.5				103%	85%	115%
Silver	3143330		<0.5	<0.5	NA	< 0.5	109%	70%	130%	102%	85%	115%
Sodium	3141195		292	345	16.5%	< 5	90%	70%	130%	103%	85%	115%
Strontium	3143330		23	21	6.9%	< 1	103%	70%	130%	100%	85%	115%
Thallium	3143330		<0.1	<0.1	NA	< 0.1	103%	70%	130%	100%	85%	115%
Tin	3143330		0.4	0.3	NA	< 0.2	106%	70%	130%	90%	85%	115%
Titanium	3141195		1370	1450	5.9%	< 1	111%	70%	130%	104%	85%	115%
Uranium	3143330		0.3	0.2	NA	< 0.2	118%	70%	130%	102%	85%	110%
Vanadium	3143330		79	75	4.9%	< 1	109%	70%	130%	106%	85%	115%
Zinc	3143330		50	52	3.0%	< 1	101%	70%	130%	111%	85%	115%
Zirconium	3143330		4.8	5.3	10.9%	< 0.1				97%	85%	115%
pH 1:2	3141195		7.50	7.49	0.1%		101%	90%	110%	100%	95%	105%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Metals in Soil - Public Works (µg/g)

Aluminum	3146181		21700	21000	3.3%	< 10	97%	70%	130%	102%	85%	115%
Antimony	3146181		0.5	0.4	NA	< 0.1	101%	70%	130%	102%	85%	115%
Arsenic	3146181		7	6	15.4%	< 1	89%	70%	130%	101%	85%	115%

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822374
PROJECT: 21455123
ATTENTION TO: Robyn Chatwin-Davies
SAMPLING SITE:
SAMPLED BY:

Soil Analysis (Continued)															
RPT Date: Nov 10, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Barium	3146181		130	133	2.2%	< 0.5	103%	70%	130%	100%	85%	115%			
Beryllium	3146181		0.4	0.4	NA	< 0.1	104%	70%	130%	99%	85%	115%			
Bismuth	3146181		0.6	0.6	NA	< 0.5				100%	85%	115%			
Cadmium	3146181		0.15	0.14	4.1%	< 0.01	86%	70%	130%	100%	85%	115%			
Calcium	3146181		5100	5090	0.2%	< 10	104%	70%	130%	106%	85%	115%			
Chromium	3146181		27	26	1.2%	< 1	102%	70%	130%	103%	85%	115%			
Cobalt	3146181		12.9	12.0	7.2%	< 0.1	96%	70%	130%	99%	85%	115%			
Copper	3146181		30.4	28.2	7.4%	< 0.2	94%	70%	130%	98%	85%	115%			
Iron	3146181		29200	27800	5.0%	< 10	105%	70%	130%	104%	85%	115%			
Lead	3146181		10.7	10.3	4.0%	< 0.1	104%	70%	130%	106%	85%	115%			
Magnesium	3146181		7230	6800	6.1%	< 10	109%	70%	130%	105%	85%	115%			
Manganese	3146181		731	721	1.4%	< 1	106%	70%	130%	105%	85%	115%			
Mercury	3146181		0.05	0.03	NA	< 0.01	109%	70%	130%	105%	85%	115%			
Molybdenum	3146181		0.6	0.7	NA	< 0.2	91%	70%	130%	94%	85%	115%			
Nickel	3146181		29.3	28.7	2.0%	< 0.5	92%	70%	130%	95%	85%	115%			
Phosphorus	3146181		420	452	7.4%	< 5	111%	70%	130%	98%	85%	115%			
Potassium	3146181		868	833	4.1%	< 5	96%	70%	130%	96%	85%	115%			
Selenium	3146181		0.2	0.5	NA	< 0.1				99%	85%	115%			
Lithium	3146181		26.5	24.7	7.0%	< 0.5				100%	85%	115%			
Silver	3146181		<0.5	<0.5	NA	< 0.5	100%	70%	130%	102%	85%	115%			
Sodium	3146181		313	318	1.3%	< 5	80%	70%	130%	102%	85%	115%			
Strontium	3146181		37	34	8.5%	< 1	98%	70%	130%	104%	85%	115%			
Thallium	3146181		<0.1	<0.1	NA	< 0.1	100%	70%	130%	100%	85%	115%			
Tin	3146181		0.4	0.4	NA	< 0.2	95%	70%	130%	89%	85%	115%			
Titanium	3146181		733	717	2.2%	< 1	110%	70%	130%	102%	85%	115%			
Uranium	3146181		0.4	0.4	NA	< 0.2	104%	70%	130%	103%	85%	110%			
Vanadium	3146181		63	61	4.4%	< 1	99%	70%	130%	103%	85%	115%			
Zinc	3146181		83	85	3.1%	< 1	88%	70%	130%	99%	85%	115%			
Zirconium	3146181		2.1	1.7	21.1%	< 0.1				102%	85%	115%			
pH 1:2	3146181		6.83	6.79	0.6%		103%	90%	110%	99%	95%	105%			

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Total Organic Carbon in Soil (LECO) (Calc) (%)

Carbon - Total	3141189	2.13	2.16	1.4%	< 0.02	95%	90%	110%
Inorganic Carbon - Total	3141189	0.05	0.03	NA	< 0.02	84%	80%	120%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Total Organic Carbon in Soil (LECO) (Calc) (%)

Inorganic Carbon - Total	3141189	0.05	0.03	NA	< 0.02	95%	80%	120%
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Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) **AGAT WORK ORDER:** 21V822374

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)															
RPT Date: Nov 10, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Total Organic Carbon in Soil (LECO) (Calc) (%)

Carbon - Total	3141211	3141211	0.89	0.88	1.1%	< 0.02	96%	90%	110%
Inorganic Carbon - Total	3141211	3141211	<0.02	<0.02	NA	< 0.02	85%	80%	120%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Soil Analysis - Chromium (VI)

Chromium, Hexavalent	3141189	3141189	<0.3	<0.3	NA	< 0.3	97%	70%	130%	100%	80%	120%	97%	70%	130%
----------------------	---------	---------	------	------	----	-------	-----	-----	------	------	-----	------	-----	-----	------

Comments: Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.
 Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

Particle Size by SIEVE - 19mm, 4.75mm & 75um

Sieve Analysis - 19 mm	3141204	<1	<1	NA	< 1						NA		NA
Sieve Analysis - 4.75 mm	3141204	7	6	15.4%	< 1						NA		NA
Sieve Analysis - 75 microns	3141204	55	62	12.0%	< 1	100%	80%	120%	NA				NA

Comments: Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

Certified By: _____



Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822374
PROJECT: 21455123
ATTENTION TO: Robyn Chatwin-Davies
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Aluminum	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Antimony	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Arsenic	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Barium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Beryllium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Bismuth	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Cadmium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Calcium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Chromium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Cobalt	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Copper	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Iron	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Lead	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Magnesium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Manganese	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP-MS
Mercury	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Molybdenum	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Nickel	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Phosphorus	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Potassium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Selenium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Lithium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Silver	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Sodium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Strontium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP-MS
Thallium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Tin	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS



Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822374

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Titanium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Uranium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Vanadium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Zinc	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Zirconium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
pH 1:2	INOR-181-6031	BC MOE Lab Manual B (pH, Electrometric, Soil)	PH METER
Sieve Analysis - 19 mm	SOIL 0540; SOIL 0110	KROETSCH 2007; SHEPPARD 2007	SIEVE
Sieve Analysis - 4.75 mm	SOIL 0540; SOIL 0110	KROETSCH 2007; SHEPPARD 2007	SIEVE
Sieve Analysis - 75 microns	SOIL 0540; SOIL 0110	KROETSCH 2007; SHEPPARD 2007	SIEVE
Chromium, Hexavalent	SOIL 0600	BARTLETT, R.J., JAMES, B.R. (1996) S	SPECTROPHOTOMETER
Chromium, Trivalent	LAB-181-4016, INOR-181-6005	BC MOE Lab Manual Section C	CALCULATION
Carbon - Total	INOR-181-6027	ASTM E1915-11	LECO
Inorganic Carbon - Total	INOR-181-6027	Modified from ASTM E1915-11	COMBUSTION



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

(4th)

No. 06185 page 1 of 3

200 - 2920 Virtual Way
 Vancouver, British Columbia, Canada V5M 0C4
 Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123		Laboratory Name: A6AT 214822374	
Short Title: KELSEY Creek	Golder Contact: Robin Chantwin-Davies	Address: 8600 Glenlyon Parkway RR4	
Golder E-mail Address 1: schantwin@golder.com	Golder E-mail Address 2: rfast	Telephone/Fax: 604 603 8081	Contact: Jennifer Yoon

Office Name: Victoria	EQUS Facility Code: 279666564	Analyses Required: 26 OCT 9:15 AM
Turnaround Time: <input type="checkbox"/> 24 hr <input type="checkbox"/> 48 hr <input type="checkbox"/> 72 hr <input checked="" type="checkbox"/> Regular (5 Days)	EQUS upload: <input checked="" type="checkbox"/>	
Criteria: <input type="checkbox"/> CSR <input type="checkbox"/> CCME <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other		

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D / M / Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	Analyses Required				RUSH (Select TAT above)	Remarks (over)
											CSR Metals	TOC	Speciated Ammonium	Grain Size* Sieve & Hydrometer		
06185 - 01	SED21-28		0-0.1	SE	20/10/21	09:45	COMP			4	X	X	X	X		* % Clay, % Silt
06185 - 02	SED21-29				20/10/21	10:15				4	X	X	X	X		% Sand, % gravel
06185 - 03	SED21-30				20/10/21	10:50				4	X	X	X	X		19mm (0.75")
06185 - 04	SED21-31				20/10/21	11:45		FDA 06185-05		4	X	X	X	X		4.75 mm
06185 - 05	SED21-31				20/10/21	11:45		FD 06185-04		2	X	X	X			(Sieve Number 4)
06185 - 06	SED21-32				20/10/21	12:20				4	X	X	X	X		75um
06185 - 07	SED21-33				20/10/21	13:00				4	X	X	X	X		(Sieve Number 75)
06185 - 08	SED21-34				20/10/21	14:30		FDA 06185-09		4	X	X	X	X		
06185 - 09	SED21-34				20/10/21	14:30		FD 06185-08		4	X	X	X	X		
06185 - 10	SED21-35				20/10/21	15:15				4	X	X	X	X		
06185 - 11	SED21-36				20/10/21	16:00				4	X	X	X	X		
- 12																

Sampler's Signature:	Relinquished by: Signature	Company: Golder	Date: 25/10/21	Time: 09:00	Received by: Signature	Company:
Comments: ON ICE packs.	Method of Shipment: courier	Waybill No.:	Received for Lab by:	Date:	Time:	
	Shipped by: ACE	Shipment Condition: Seal Intact:	Temp (°C): 4	Cooler opened by:	Date:	Time:

WHITE: Golder Copy YELLOW: Lab Copy

me



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 06187 page 2 of 3

200 - 2920 Virtual Way
 Vancouver, British Columbia, Canada V5M 0C4
 Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123		Laboratory Name: ABAT	
Short Title: KELSEY CREEK	Golder Contact: Robyn Clouston-Davies	Address: 8600 Glenlyon Parkway RSU	
Golder E-mail Address 1: rchouston@valdavis@golder.com	Golder E-mail Address 2: AFast@golder.com	Telephone/Fax: 604 603 8081	Contact: Jennifer Yoon

Office Name: Victoria	EQUS Facility Code: 229666564
EQUS upload: <input checked="" type="checkbox"/>	

Turnaround Time: <input type="checkbox"/> 24 hr <input type="checkbox"/> 48 hr <input type="checkbox"/> 72 hr <input type="checkbox"/> Regular (5 Days)	Analyses Required
Criteria: <input type="checkbox"/> CSR <input type="checkbox"/> CCME <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other	

Note: Final Reports to be issued by e-mail

Quote No.: Bill to PSPC
TA: 700589472

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D / M / Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	CSR Metals	TOC	Speciated Carbon	Grain Size * Sieve: Hydrometers	RUSH (Select TAT above)	Remarks (over)
06187 - 01	SED21-37		0-0.1	SE	21/10/21	09:00	COMP			4	X	X	X	X		* % clay, % silt,
06187 - 02	SED21-38					10:15				4	X	X	X	X		% sand, % gravel
06187 - 03	SED21-39					11:20				4	X	X	X	X		10mm (0.75")
06187 - 04	SED21-40					12:10				4	X	X	X	X		4.75 mm
06187 - 05	SED21-41					12:30				4	X	X	X	X		(Sieve no 4)
06187 - 06	SED21-42					14:00				4	X	X	X	X		75 um
- 07																(Sieve no 200)
- 08																
- 09																
- 10																
- 11																
- 12																

Sampler's Signature:	Relinquished by: Signature:	Company: Golder	Date: 25/10/21	Time: 0900	Received by: Signature:	Company:
Comments: DNICE	Method of Shipment: COURIER	Waybill No.:	Received for Lab by:	Date:	Time:	
	Shipped by: ACE	Shipment Condition: Seal Intact:	Temp (°C): 4°C	Cooler opened by:	Date:	Time:

WHITE: Golder Copy YELLOW: Lab Copy



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 06189 page 3 of 3

200 - 2920 Virtual Way
 Vancouver, British Columbia, Canada V5M 0C4
 Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123		Laboratory Name: A6AT	
Short Title: KELSEY Creek		Golder Contact: Robyn Chaturvedi-Davies	
Golder E-mail Address 1: rchaturvedi@golder.com		Golder E-mail Address 2: A6AT@golder.com	
Address: 8600 Glenlyon Avenue, STE 100		Telephone/Fax: 604 603 8081	
Contact: Jennifer Yoon			

Office Name: Victoria

EQiS Facility Code: 729666564
 EQiS upload: SA Suther (suther@golder.com)

Turnaround Time: 24 hr 48 hr 72 hr Regular (5 Days)
 Criteria: CSR CCME BC Water Quality RUSH Other

Note: Final Reports to be issued by e-mail

Quote No.: Bill to RSPC
 TA: 700589477

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D/M/Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	Analyses Required				RUSH (Select TAT above)	Remarks (over)
											Core Metals	TOC	Speciated Chromium	0.5µm Size * (sieve + hydrophobic)		
06189 - 01	SED21-26-01	0-0.1	SE	22/10/21	09:00	Comp	FDA	06189-02	4	X	X	X	X			* No clay 90ft
06189 - 02	SED21-26-01		SE		09:00	Comp	FD	06189-01	4	X	X	X	X			Refer to 90ft
06189 - 03	SED21-26-02		SE			11:00	Comp		4	X	X	X	X			15mm (0.75")
06189 - 04	SED21-26-03		SE			12:00	Comp		4	X	X	X	X			0.75mm
- 05																(Sieve no 4)
- 06																75um
- 07																(Sieve no 75)
- 08																
- 09																
- 10																
- 11																
- 12																

Sampler's Signature:	Relinquished by: Signature	Company: Golder	Date: 25/10/21	Time:	Received by: Signature	Company:
Comments: ON ICE 72 HR RUSH	Method of Shipment: Courier	Waybill No.:	Received for Lab by:		Date:	Time:
	Shipped by: ACE	Shipment Condition: Seal Intact:	Temp (°C): 4°C	Cooler opened by:	Date:	Time:

WHITE: Golder Copy YELLOW: Lab Copy



AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM - BURNABY

Work Order # _____

RECEIVING BASICS:

Received From: ARU comm

Waybill #: C569662 / C6617610

SAMPLE QUANTITIES:

Coolers: 6 Containers: _____

TIME SENSITIVE ISSUES:

Earliest Date Sampled: _____ ALREADY EXCEEDED? Yes No

NON-CONFORMANCES:

3 temperatures of samples* and average of each cooler: (record differing temperatures on the CoC next to sample ID's) *use jars when available

(1) 9 + 9 + 7 = 9 °C (2) 1 + 1 + 2 = 1 °C (3) 9 + 10 + 9 = 9 °C (4) 8 + 8 + 9 = 8 °C

Was ice or ice pack present:

Yes No

(5) 8 + 8 + 8 = 8

4 °C

Integrity Issues:

(6) 3 + 1 + 2 = 2

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date and Time: _____

ADDITIONAL NOTES:



CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)
219-800 BURNARD ST
VANCOUVER, BC V6Z 0B9
604-671-1831

ATTENTION TO: Robyn Chatwin-Davies

PROJECT: 21455123

AGAT WORK ORDER: 21V825326

SOIL ANALYSIS REVIEWED BY: Dana Solari, Lab Reporter

DATE REPORTED: Nov 17, 2021

PAGES (INCLUDING COVER): 20

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (778) 452-4000

***Notes**

VERSION 2: Version 1 issued on November 10, 2021 to report TOC and Metals. Particle Size by Sieve, Texture, and Speciated Chromium results to follow.

Version 2 issued on November 17, 2021 to report Particle Size by Sieve and Texture. Speciated Chromium results to follow.

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
CANADA V5J 0B6
TEL (778)452-4000
FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

Parameter	Unit	SAMPLE DESCRIPTION:									
		G / S	RDL	06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08
				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				2021-10-26 13:00	2021-10-26 14:30	2021-10-26 15:00	2021-10-26 15:40	2021-10-27 09:15	2021-10-27 09:15	2021-10-27 09:50	2021-10-27 10:20
				3165240	3165241	3165242	3165243	3165244	3165245	3165246	3165247
Aluminum	µg/g		10	21500	22700	20400	18800	17800	18700	18500	20500
Antimony	µg/g		0.1	0.5	0.3	0.4	0.5	0.4	0.4	0.3	0.4
Arsenic	µg/g		1	4	5	5	5	5	5	4	5
Barium	µg/g		0.5	129	109	99.7	103	103	110	87.5	108
Beryllium	µg/g		0.1	0.4	0.5	0.4	0.4	0.4	0.4	0.3	0.4
Bismuth	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	µg/g		0.01	1.08	1.18	9.63	9.89	2.83	3.20	0.31	9.59
Calcium	µg/g		10	6370	8670	8190	7420	7060	7240	6660	7560
Chromium	µg/g		1	39	44	78	78	45	52	30	67
Cobalt	µg/g		0.1	12.8	13.9	12.5	13.4	11.5	12.9	10.2	13.1
Copper	µg/g		0.2	21.7	35.9	36.8	36.9	30.2	33.8	17.0	36.3
Iron	µg/g		10	27400	31500	27400	27000	23800	25000	24400	27200
Lead	µg/g		0.1	14.3	10.6	26.2	32.2	25.1	26.7	10.9	28.7
Magnesium	µg/g		10	6220	7580	6990	6230	5450	5690	6280	6540
Manganese	µg/g		1	909	630	574	825	588	627	688	866
Mercury	µg/g		0.01	0.02	0.04	0.03	0.04	0.05	0.05	0.03	0.04
Molybdenum	µg/g		0.2	1.2	0.4	0.7	0.8	0.6	0.7	0.4	0.6
Nickel	µg/g		0.5	25.2	32.7	24.7	27.0	22.9	26.7	22.8	27.4
Phosphorus	µg/g		5	650	733	1290	1080	814	879	681	1020
Potassium	µg/g		5	771	1350	834	747	715	729	636	920
Selenium	µg/g		0.1	0.1	0.4	0.4	0.5	0.5	0.5	0.4	0.6
Lithium	µg/g		0.5	14.9	17.2	13.6	14.1	12.8	14.0	13.1	14.6
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium	µg/g		5	214	241	222	267	233	244	163	307
Strontium	µg/g		1	37	53	47	45	46	47	44	46
Thallium	µg/g		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/g		0.2	0.6	0.5	1.0	1.5	1.0	1.4	0.4	1.3
Titanium	µg/g		1	1060	1050	838	776	707	751	1060	919
Uranium	µg/g		0.2	0.5	0.5	0.9	0.8	0.7	0.7	0.3	0.9

Certified By:

D. Solami



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

		SAMPLE DESCRIPTION:		06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-26 13:00	2021-10-26 14:30	2021-10-26 15:00	2021-10-26 15:40	2021-10-27 09:15	2021-10-27 09:15	2021-10-27 09:50	2021-10-27 10:20
Parameter	Unit	G / S	RDL	3165240	3165241	3165242	3165243	3165244	3165245	3165246	3165247
Vanadium	µg/g		1	70	87	68	66	64	74	69	67
Zinc	µg/g		1	107	99	132	179	103	118	81	179
Zirconium	µg/g		0.1	0.7	1.1	0.4	0.4	0.4	0.5	0.8	0.7
pH 1:2	pH units		0.10	5.40	5.99	5.47	5.70	5.18	5.16	5.47	5.85

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

Parameter	Unit	SAMPLE DESCRIPTION:									
		G / S	RDL	06190-09	06190-10	06190-11	06190-12	06191-01	06191-02	06191-03	06191-04
				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				2021-10-27 11:30	2021-10-27 13:00	2021-10-27 14:30	2021-10-27 15:15	2021-10-28 10:00	2021-10-28 10:45	2021-10-28 11:30	2021-10-28 12:00
				3165248	3165249	3165250	3165251	3165252	3165253	3165254	3165255
Aluminum	µg/g		10	22800	20200	21900	23600	22000	23600	28700	25100
Antimony	µg/g		0.1	0.5	0.3	0.3	0.5	0.4	0.7	0.9	0.4
Arsenic	µg/g		1	5	3	4	6	5	4	6	4
Barium	µg/g		0.5	122	102	98.8	125	105	103	148	139
Beryllium	µg/g		0.1	0.5	0.4	0.4	0.5	0.4	0.4	0.6	0.5
Bismuth	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	µg/g		0.01	4.15	0.23	1.08	6.34	0.41	0.98	10.6	3.13
Calcium	µg/g		10	7700	5670	6470	8890	8230	8010	8910	9000
Chromium	µg/g		1	53	34	36	64	37	46	92	52
Cobalt	µg/g		0.1	14.6	11.8	11.3	14.3	15.1	12.7	17.8	12.5
Copper	µg/g		0.2	40.6	29.3	26.4	43.9	26.1	42.4	63.8	31.1
Iron	µg/g		10	29200	26500	28100	31400	29400	29400	34400	29000
Lead	µg/g		0.1	25.9	11.9	16.0	32.8	47.5	84.8	55.0	31.6
Magnesium	µg/g		10	6560	6180	6490	7230	7470	8780	8600	7870
Manganese	µg/g		1	1160	633	638	1140	775	446	1240	676
Mercury	µg/g		0.01	0.07	<0.01	0.01	0.05	0.04	0.04	0.08	0.06
Molybdenum	µg/g		0.2	1.0	0.4	0.5	1.0	0.4	0.7	1.3	0.6
Nickel	µg/g		0.5	29.8	27.6	24.2	31.2	27.7	30.5	39.1	29.1
Phosphorus	µg/g		5	987	660	577	940	428	544	1260	696
Potassium	µg/g		5	909	894	1000	832	832	786	1220	949
Selenium	µg/g		0.1	0.6	0.2	0.4	0.7	0.4	0.5	0.7	0.4
Lithium	µg/g		0.5	16.9	14.1	14.3	16.7	15.7	16.5	21.0	16.2
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5
Sodium	µg/g		5	298	211	186	311	319	618	408	336
Strontium	µg/g		1	52	34	37	56	52	45	55	59
Thallium	µg/g		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/g		0.2	1.1	0.7	0.8	1.1	0.6	1.2	1.8	1.0
Titanium	µg/g		1	858	884	913	833	1170	1050	989	1030
Uranium	µg/g		0.2	1.0	0.5	0.6	0.9	0.4	0.5	1.4	0.7

Certified By:

D. Solari



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

		SAMPLE DESCRIPTION:		06190-09	06190-10	06190-11	06190-12	06191-01	06191-02	06191-03	06191-04
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-27 11:30	2021-10-27 13:00	2021-10-27 14:30	2021-10-27 15:15	2021-10-28 10:00	2021-10-28 10:45	2021-10-28 11:30	2021-10-28 12:00
Parameter	Unit	G / S	RDL	3165248	3165249	3165250	3165251	3165252	3165253	3165254	3165255
Vanadium	µg/g		1	75	72	69	74	80	77	87	70
Zinc	µg/g		1	179	85	96	228	76	167	365	115
Zirconium	µg/g		0.1	0.4	0.5	0.6	0.5	1.3	1.7	0.6	0.7
pH 1:2	pH units		0.10	5.64	5.57	5.68	5.76	5.52	4.57	5.79	5.41

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: 06191-05		06191-06		06191-07		06191-08		06191-09		06191-10	
				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
DATE SAMPLED:				2021-10-28	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-29
				13:25	09:30	10:30	10:30	11:00	11:00	11:00	11:00	11:00	11:00	11:20	11:20
				3165256	3165257	3165258	3165259	3165260	3165261	3165262	3165263	3165264	3165265	3165266	3165267
Aluminum	µg/g		10	25100	20400	26100	27500	21700	23100						
Antimony	µg/g		0.1	0.8	0.5	0.9	0.8	0.5	0.3						
Arsenic	µg/g		1	6	6	8	7	4	3						
Barium	µg/g		0.5	134	122	166	158	118	116						
Beryllium	µg/g		0.1	0.5	0.4	0.6	0.5	0.4	0.6						
Bismuth	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5						
Cadmium	µg/g		0.01	13.2	9.23	14.8	13.9	1.01	0.43						
Calcium	µg/g		10	7710	7330	9900	11100	7950	4210						
Chromium	µg/g		1	80	80	100	91	37	48						
Cobalt	µg/g		0.1	14.5	13.9	19.9	17.9	14.5	17.8						
Copper	µg/g		0.2	49.2	41.6	65.4	59.7	28.4	20.1						
Iron	µg/g		10	31800	26900	34900	38500	27700	27900						
Lead	µg/g		0.1	42.9	37.4	62.7	58.1	38.0	28.1						
Magnesium	µg/g		10	7570	6430	7880	8490	6440	6810						
Manganese	µg/g		1	1080	1010	1930	1870	961	665						
Mercury	µg/g		0.01	0.07	0.06	0.10	0.07	0.06	0.02						
Molybdenum	µg/g		0.2	1.1	0.8	1.3	1.3	0.7	0.5						
Nickel	µg/g		0.5	31.6	29.0	41.4	36.9	25.0	32.6						
Phosphorus	µg/g		5	1320	960	1540	1740	655	358						
Potassium	µg/g		5	822	826	1100	1170	708	576						
Selenium	µg/g		0.1	0.8	0.5	0.7	0.7	0.5	0.4						
Lithium	µg/g		0.5	17.9	16.0	22.1	20.3	14.3	21.7						
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5						
Sodium	µg/g		5	323	341	389	417	456	231						
Strontium	µg/g		1	49	55	76	73	59	46						
Thallium	µg/g		0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1						
Tin	µg/g		0.2	1.6	1.6	1.7	1.6	0.8	0.8						
Titanium	µg/g		1	912	832	1070	1150	773	1080						
Uranium	µg/g		0.2	1.0	0.9	1.4	1.3	0.6	0.4						

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Metals in Soil - Public Works (µg/g)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION:					
				06191-05	06191-06	06191-07	06191-08	06191-09	06191-10
				SAMPLE TYPE: Soil					
				DATE SAMPLED:					
				2021-10-28 13:25	2021-10-29 09:30	2021-10-29 10:30	2021-10-29 10:30	2021-10-29 11:00	2021-10-29 11:20
				3165256	3165257	3165258	3165259	3165260	3165261
Vanadium	µg/g	1	77	77	73	90	85	68	100
Zinc	µg/g	1	255	255	200	464	418	181	100
Zirconium	µg/g	0.1	0.5	0.5	0.8	1.8	1.5	0.9	1.1
pH 1:2	pH units		0.10	4.73	5.70	6.19	9.27	5.45	4.95

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
 3165240-3165261 Results are based on the dry weight of the sample
 Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Particle Size by SIEVE

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

		SAMPLE DESCRIPTION:		06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-26 13:00	2021-10-26 14:30	2021-10-26 15:00	2021-10-26 15:40	2021-10-27 09:15	2021-10-27 09:15	2021-10-27 09:50	2021-10-27 10:20
Parameter	Unit	G / S	RDL	3165240	3165241	3165242	3165243	3165244	3165245	3165246	3165247
Sieve Analysis - 19 mm	%		1	<1	<1	10	<1	<1	<1	<1	<1
Sieve Analysis - 4.75 mm	%		1	8	4	34	<1	<1	<1	4	<1
Sieve Analysis - 75 microns	%		1	25	23	19	35	32	37	32	32
Sieve Texture				Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
		SAMPLE DESCRIPTION:		06190-09	06190-10	06190-11	06190-12	06191-01	06191-02	06191-03	06191-04
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-27 11:30	2021-10-27 13:00	2021-10-27 14:30	2021-10-27 15:15	2021-10-28 10:00	2021-10-28 10:45	2021-10-28 11:30	2021-10-28 12:00
Parameter	Unit	G / S	RDL	3165248	3165249	3165250	3165251	3165252	3165253	3165254	3165255
Sieve Analysis - 19 mm	%		1	<1	7	5	<1	<1	<1	<1	<1
Sieve Analysis - 4.75 mm	%		1	<1	12	15	<1	<1	<1	<1	1
Sieve Analysis - 75 microns	%		1	20	32	26	10	10	16	1	9
Sieve Texture				Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
		SAMPLE DESCRIPTION:		06191-05	06191-06	06191-07	06191-08	06191-09	06191-10		
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil		
		DATE SAMPLED:		2021-10-28 13:25	2021-10-29 09:30	2021-10-29 10:30	2021-10-29 10:30	2021-10-29 11:00	2021-10-29 11:20		
Parameter	Unit	G / S	RDL	3165256	3165257	3165258	3165259	3165260	3165261		
Sieve Analysis - 19 mm	%		1	<1	<1	<1	<1	11	<1		
Sieve Analysis - 4.75 mm	%		1	<1	<1	<1	<1	3	<1		
Sieve Analysis - 75 microns	%		1	8	23	3	1	8	23		
Sieve Texture				Fine	Fine	Fine	Fine	Fine	Fine		

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3165240-3165261 Value reported is amount of sample retained on sieve after wash with water and represents proportion by weight particles larger than indicated sieve size.

Sieve Texture is a calculated parameter. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Hexavalent Chromium

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

Parameter	Unit	G / S	RDL	06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08		
				SAMPLE DESCRIPTION:		06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08
				SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:		2021-10-26 13:00	2021-10-26 14:30	2021-10-26 15:00	2021-10-26 15:40	2021-10-27 09:15	2021-10-27 09:15	2021-10-27 09:50	2021-10-27 10:20
Chromium, Hexavalent	mg/L		0.3	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK
				SAMPLE DESCRIPTION:		06190-09	06190-10	06190-11	06190-12	06191-01	06191-02	06191-03	06191-04
				SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:		2021-10-27 11:30	2021-10-27 13:00	2021-10-27 14:30	2021-10-27 15:15	2021-10-28 10:00	2021-10-28 10:45	2021-10-28 11:30	2021-10-28 12:00
Chromium, Hexavalent	mg/L		0.3	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK
				SAMPLE DESCRIPTION:		06191-05	06191-06	06191-07	06191-08	06191-09	06191-10		
				SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil		
				DATE SAMPLED:		2021-10-28 13:25	2021-10-29 09:30	2021-10-29 10:30	2021-10-29 10:30	2021-10-29 11:00	2021-10-29 11:20		
Chromium, Hexavalent	mg/L		0.3	DARK	DARK	DARK	DARK	DARK	DARK	DARK	DARK		

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
3165240-3165261 Result is based on the dry weight of the sample.
Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Texture (Gravel, Sand, Silt, Clay) (100 %)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

		SAMPLE DESCRIPTION:		06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-26 13:00	2021-10-26 14:30	2021-10-26 15:00	2021-10-26 15:40	2021-10-27 09:15	2021-10-27 09:15	2021-10-27 09:50	2021-10-27 10:20
Parameter	Unit	G / S	RDL	3165240	3165241	3165242	3165243	3165244	3165245	3165246	3165247
Clay	%		1	20	22	13	21	19	16	17	17
Gravel	%		1	3	3	14	<1	2	<1	<1	<1
Sand	%		1	36	36	52	41	42	42	47	41
Silt	%		1	41	39	21	38	37	42	36	42
Soil Texture				Loam	Loam	Sandy Loam	Loam	Loam	Loam	Loam	Loam
		SAMPLE DESCRIPTION:		06190-09	06190-10	06190-11	06190-12	06191-01	06191-02	06191-03	06191-04
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-27 11:30	2021-10-27 13:00	2021-10-27 14:30	2021-10-27 15:15	2021-10-28 10:00	2021-10-28 10:45	2021-10-28 11:30	2021-10-28 12:00
Parameter	Unit	G / S	RDL	3165248	3165249	3165250	3165251	3165252	3165253	3165254	3165255
Clay	%		1	25	22	24	21	24	11	27	15
Gravel	%		1	<1	4	5	<1	<1	<1	<1	<1
Sand	%		1	29	41	37	27	26	39	17	31
Silt	%		1	46	33	34	52	50	50	56	54
Soil Texture				Loam	Loam	Loam	Silt Loam	Loam	Loam	Silt Clay Loam	Silt Loam
		SAMPLE DESCRIPTION:		06191-05	06191-06	06191-07	06191-08	06191-09	06191-10		
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil		
		DATE SAMPLED:		2021-10-28 13:25	2021-10-29 09:30	2021-10-29 10:30	2021-10-29 10:30	2021-10-29 11:00	2021-10-29 11:20		
Parameter	Unit	G / S	RDL	3165256	3165257	3165258	3165259	3165260	3165261		
Clay	%		1	19	15	19	20	27	15		
Gravel	%		1	<1	<1	<1	<1	1	<1		
Sand	%		1	25	37	28	25	25	42		
Silt	%		1	56	48	53	55	48	44		
Soil Texture				Silt Loam	Loam	Silt Loam	Silt Loam	Clay Loam	Loam		

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
CANADA V5J 0B6
TEL (778)452-4000
FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Texture (Gravel, Sand, Silt, Clay) (100 %)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3165240-3165261 Soil Texture is a calculated parameter. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V825326

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Total Organic Carbon in Soil (LECO) (Calc) (%)

DATE RECEIVED: 2021-11-02

DATE REPORTED: 2021-11-17

		SAMPLE DESCRIPTION:		06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06190-08
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-26 13:00	2021-10-26 14:30	2021-10-26 15:00	2021-10-26 15:40	2021-10-27 09:15	2021-10-27 09:15	2021-10-27 09:50	2021-10-27 10:20
Parameter	Unit	G / S	RDL	3165240	3165241	3165242	3165243	3165244	3165245	3165246	3165247
Carbon - Total	%		0.02	4.78	5.26	4.89	4.29	7.28	6.16	6.34	4.05
Inorganic Carbon - Total	%		0.02	0.06	0.06	0.06	0.05	0.08	0.10	0.04	0.05
Organic Carbon-Total (Calc)	%		0.02	4.72	5.20	4.83	4.24	7.20	6.06	6.30	4.00
		SAMPLE DESCRIPTION:		06190-09	06190-10	06190-11	06190-12	06191-01	06191-02	06191-03	06191-04
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2021-10-27 11:30	2021-10-27 13:00	2021-10-27 14:30	2021-10-27 15:15	2021-10-28 10:00	2021-10-28 10:45	2021-10-28 11:30	2021-10-28 12:00
Parameter	Unit	G / S	RDL	3165248	3165249	3165250	3165251	3165252	3165253	3165254	3165255
Carbon - Total	%		0.02	5.71	3.55	3.38	5.99	7.89	9.90	6.15	9.15
Inorganic Carbon - Total	%		0.02	0.04	<0.02	<0.02	0.06	0.05	0.19	0.04	0.06
Organic Carbon-Total (Calc)	%		0.02	5.67	3.55	3.38	5.93	7.84	9.71	6.11	9.09
		SAMPLE DESCRIPTION:		06191-05	06191-06	06191-07	06191-08	06191-09	06191-10		
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil		
		DATE SAMPLED:		2021-10-28 13:25	2021-10-29 09:30	2021-10-29 10:30	2021-10-29 10:30	2021-10-29 11:00	2021-10-29 11:20		
Parameter	Unit	G / S	RDL	3165256	3165257	3165258	3165259	3165260	3165261		
Carbon - Total	%		0.02	6.96	4.98	7.40	7.54	11.2	3.62		
Inorganic Carbon - Total	%		0.02	0.07	0.04	0.09	0.08	0.10	<0.02		
Organic Carbon-Total (Calc)	%		0.02	6.89	4.94	7.31	7.46	11.1	3.62		

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V825326

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Soil Analysis														
RPT Date: Nov 17, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE	
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits
							Lower	Upper	Lower		Upper	Lower		Upper

Total Organic Carbon in Soil (LECO) (Calc) (%)

Carbon - Total	3165240	4.78	4.73	1.1%	< 0.02	96%	90%	110%
Inorganic Carbon - Total	3165240	0.06	0.06	NA	< 0.02	82%	80%	120%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Metals in Soil - Public Works (µg/g)

Aluminum	3175260	17500	18100	3.6%	< 10	103%	70%	130%	103%	85%	115%
Antimony	3171397	0.2	0.2	NA	< 0.1	106%	70%	130%	106%	85%	115%
Arsenic	3171397	5	5	0.0%	< 1	93%	70%	130%	98%	85%	115%
Barium	3171397	81.7	80.5	1.5%	< 0.5	103%	70%	130%	113%	85%	115%
Beryllium	3171397	0.4	0.4	NA	< 0.1	108%	70%	130%	109%	85%	115%
Bismuth	3171397	<0.5	<0.5	NA	< 0.5				100%	85%	115%
Cadmium	3171397	0.14	0.13	5.5%	< 0.01	105%	70%	130%	109%	85%	115%
Calcium	3175260	5460	5670	3.8%	< 10	108%	70%	130%	101%	85%	115%
Chromium	3171397	48	44	6.8%	< 1	108%	70%	130%	108%	85%	115%
Cobalt	3171397	13.3	12.6	5.2%	< 0.1	105%	70%	130%	115%	85%	115%
Copper	3171397	33.9	32.8	3.1%	< 0.2	101%	70%	130%	111%	85%	115%
Iron	3175260	23900	24700	3.4%	< 10	112%	70%	130%	103%	85%	115%
Lead	3171397	4.5	4.2	5.1%	< 0.1	103%	70%	130%	110%	85%	115%
Magnesium	3175260	5390	5510	2.2%	< 10	116%	70%	130%	100%	85%	115%
Manganese	3171397	353	345	2.2%	< 1	104%	70%	130%	112%	85%	115%
Mercury	3171397	0.02	0.01	NA	< 0.01	116%	70%	130%	105%	85%	115%
Molybdenum	3171397	0.4	0.4	NA	< 0.2	94%	70%	130%	104%	85%	115%
Nickel	3171397	31.3	29.8	4.7%	< 0.5	99%	70%	130%	105%	85%	115%
Phosphorus	3175260	436	452	3.5%	< 5	118%	70%	130%	92%	85%	115%
Potassium	3175260	682	740	8.1%	< 5	96%	70%	130%	93%	85%	115%
Selenium	3171397	0.3	0.6	NA	< 0.1				110%	85%	115%
Lithium	3171397	18.2	18.3	0.6%	< 0.5				104%	85%	115%
Silver	3171397	<0.5	<0.5	NA	< 0.5	106%	70%	130%	107%	85%	115%
Sodium	3175260	304	311	2.3%	< 5	80%	70%	130%	98%	85%	115%
Strontium	3171397	35	34	2.2%	< 1	98%	70%	130%	101%	85%	115%
Thallium	3171397	<0.1	<0.1	NA	< 0.1	102%	70%	130%	108%	85%	115%
Tin	3171397	0.5	0.5	NA	< 0.2	103%	70%	130%	97%	85%	115%
Titanium	3175260	736	824	11.3%	< 1	112%	70%	130%	99%	85%	115%
Uranium	3171397	0.5	0.5	NA	< 0.2	112%	70%	130%	108%	85%	110%
Vanadium	3171397	110	104	6.4%	< 1	104%	70%	130%	109%	85%	115%
Zinc	3171397	47	41	13.7%	< 1	97%	70%	130%	102%	85%	115%
Zirconium	3171397	4.1	3.7	9.6%	< 0.1				99%	85%	115%
pH 1:2	3175260	7.60	7.63	0.4%		103%	90%	110%	99%	95%	105%

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V825326
 PROJECT: 21455123 ATTENTION TO: Robyn Chatwin-Davies
 SAMPLING SITE: SAMPLED BY:

Soil Analysis (Continued)															
RPT Date: Nov 17, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Metals in Soil - Public Works (µg/g)

Aluminum	3175501	29600	25800	13.7%	< 10	105%	70%	130%	102%	85%	115%
Antimony	3175501	0.3	0.3	NA	< 0.1	101%	70%	130%	109%	85%	115%
Arsenic	3175501	7	7	0.0%	< 1	94%	70%	130%	106%	85%	115%
Barium	3175501	86.4	84.3	2.5%	< 0.5	108%	70%	130%	114%	85%	115%
Beryllium	3175501	0.5	0.5	1.7%	< 0.1	114%	70%	130%	112%	85%	115%
Bismuth	3175501	<0.5	<0.5	NA	< 0.5				100%	85%	115%
Cadmium	3175501	0.24	0.22	5.9%	< 0.01	106%	70%	130%	110%	85%	115%
Calcium	3175501	12900	11600	10.6%	< 10	112%	70%	130%	100%	85%	115%
Chromium	3175501	53	53	0.6%	< 1	108%	70%	130%	114%	85%	115%
Cobalt	3175501	19.0	18.8	0.9%	< 0.1	105%	70%	130%	113%	85%	115%
Copper	3175501	62.3	61.1	1.9%	< 0.2	98%	70%	130%	110%	85%	115%
Iron	3175501	43100	38000	12.7%	< 10	111%	70%	130%	104%	85%	115%
Lead	3175501	5.7	5.6	2.7%	< 0.1	113%	70%	130%	108%	85%	115%
Magnesium	3175501	15000	13200	12.9%	< 10	111%	70%	130%	99%	85%	115%
Manganese	3175501	660	647	2.0%	< 1	106%	70%	130%	111%	85%	115%
Mercury	3175501	0.03	0.03	NA	< 0.01	113%	70%	130%	99%	85%	115%
Molybdenum	3175501	0.4	0.3	NA	< 0.2	101%	70%	130%	105%	85%	115%
Nickel	3175501	47.6	47.1	1.1%	< 0.5	96%	70%	130%	113%	85%	115%
Phosphorus	3175501	637	478	28.4%	< 5	123%	70%	130%	94%	85%	115%
Potassium	3175501	1970	1600	20.9%	< 5	105%	70%	130%	92%	85%	115%
Selenium	3175501	0.3	0.5	NA	< 0.1				115%	85%	115%
Lithium	3175501	27.4	27.3	0.2%	< 0.5				103%	85%	115%
Silver	3175501	<0.5	<0.5	NA	< 0.5	106%	70%	130%	110%	85%	115%
Sodium	3175501	1010	753	29.6%	< 5	105%	70%	130%	96%	85%	115%
Strontium	3175501	62	60	2.2%	< 1	107%	70%	130%	101%	85%	115%
Thallium	3175501	<0.1	<0.1	NA	< 0.1	103%	70%	130%	106%	85%	115%
Tin	3175501	0.5	0.5	NA	< 0.2	116%	70%	130%	100%	85%	115%
Titanium	3175501	1760	1480	17.2%	< 1	117%	70%	130%	99%	85%	115%
Uranium	3175501	0.5	0.5	NA	< 0.2	115%	70%	130%	103%	85%	110%
Vanadium	3175501	109	109	0.1%	< 1	106%	70%	130%	112%	85%	115%
Zinc	3175501	83	78	5.9%	< 1	90%	70%	130%	113%	85%	115%
Zirconium	3175501	7.0	6.7	4.7%	< 0.1				101%	85%	115%
pH 1:2	3175501	8.44	8.45	0.1%		103%	90%	110%	100%	95%	105%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Particle Size by SIEVE

Sieve Analysis - 19 mm	3165241	<1	<1	NA	< 1
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Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V825326
 PROJECT: 21455123 ATTENTION TO: Robyn Chatwin-Davies
 SAMPLING SITE: SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Nov 17, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

Sieve Analysis - 4.75 mm	3165241		4	5	NA	< 1								
Sieve Analysis - 75 microns	3165241		23	24	4.3%	< 1	80%	120%						

Comments: Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

Particle Size by SIEVE

Sieve Analysis - 19 mm	3165257		<1	<1	NA	< 1								
Sieve Analysis - 4.75 mm	3165257		<1	<1	NA	< 1								
Sieve Analysis - 75 microns	3165257		23	22	4.4%	< 1	80%	120%						

Comments: Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

Certified By: 

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V825326

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Aluminum	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Antimony	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Arsenic	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Barium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Beryllium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Bismuth	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Cadmium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Calcium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Chromium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Cobalt	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Copper	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Iron	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Lead	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Magnesium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Manganese	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP-MS
Mercury	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Molybdenum	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Nickel	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Phosphorus	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Potassium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Selenium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Lithium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Silver	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Sodium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Strontium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP-MS
Thallium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Tin	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS



Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V825326

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Titanium	MET-181-6106, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6010C	ICP/OES
Uranium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Vanadium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Zinc	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
Zirconium	MET-181-6102, LAB-181-4008	BC MOE Lab Manual C (SALM) and EPA 6020A	ICP-MS
pH 1:2	INOR-181-6031	BC MOE Lab Manual B (pH, Electrometric, Soil)	PH METER
Sieve Analysis - 19 mm	SOIL 0540; SOIL 0110	KROETSCH 2007; SHEPPARD 2007	SIEVE
Sieve Analysis - 4.75 mm	SOIL 0540; SOIL 0110	KROETSCH 2007; SHEPPARD 2007	SIEVE
Sieve Analysis - 75 microns	SOIL 0540; SOIL 0110	KROETSCH 2007; SHEPPARD 2007	SIEVE
Chromium, Hexavalent	SOIL 0600	BARTLETT, R.J., JAMES, B.R. (1996) S	SPECTROPHOTOMETER
Carbon - Total	INOR-181-6027	ASTM E1915-11	LECO
Inorganic Carbon - Total	INOR-181-6027	Modified from ASTM E1915-11	COMBUSTION



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

21V825326

No. 06190 page 1 of 2

200 - 2920 Virtual Way
 Vancouver, British Columbia, Canada V5M 0C4
 Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123		Laboratory Name: AGAT	
Short Title: KELSEY Creek	Golder Contact: R. Christina Davies	Address: 8600 Glenlyon Drive BSV	
Golder E-mail Address 1: R.Christina-Davies@golder.com	Golder E-mail Address 2: AFast@golder.com	Telephone/Fax: 604 603 8081	Contact: Jennifer Yoon

Office Name: Victoria	EQUIS Facility Code: 229666564	Analyses Required: 2 NOV 9:07 AM
Turnaround Time: <input type="checkbox"/> 24 hr <input type="checkbox"/> 48 hr <input type="checkbox"/> 72 hr <input checked="" type="checkbox"/> Regular (5 Days)	EQUIS upload: <input checked="" type="checkbox"/>	
Criteria: <input type="checkbox"/> CSR <input type="checkbox"/> CCME <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other		

Note: Final Reports to be issued by e-mail

Quote No.: TA: 700589422

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D/M/Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	CSR Metals	TOC	Speciated Chromium*	Grain Size sieve (Hydromete)	RUSH (Select TAT above)	Remarks (over)
06190 - 01	CS21-01		0-0.1	SO	26/10/21	13:00	6RAS			4	X	X	X	X		40C TK
06190 - 02	CS21-02					14:30				3	X	X	X	X		%Clay, %Silt
06190 - 03	CS21-03					15:00				3	X	X	X	X		%Sand, %Gravel
06190 - 04	CS21-04					15:40				3	X	X	X	X		19mm (0.75")
06190 - 05	CS21-05				27/10/21	09:15		FDA 06190-06		3	X	X	X	X		4.75mm
06190 - 06	CS21-05					09:15		FD 06190-05		3	X	X	X	X		(Sieve no 4)
06190 - 07	CS21-06					09:50				3	X	X	X	X		75mm
06190 - 08	CS21-09					10:20				3	X	X	X	X		(Sieve No 200)
06190 - 09	CS21-08					11:30				3	X	X	X	X		
06190 - 10	CS21-10					13:00				3	X	X	X	X		
06190 - 11	CS21-11					14:30				3	X	X	X	X		
06190 - 12	CS21-12					15:15				3	X	X	X	X		

Sampler's Signature:	Relinquished by: Signature	Company: Golder	Date: 01/11/21	Time: 13:15	Received by: Signature	Company:
Comments: ON ICE Bill to PSPC	Method of Shipment:	Waybill No.:	Received for Lab by: TESFAY		Date:	Time:
	Shipped by:	Shipment Condition: Seal Intact:	Temp (°C):	Cooler opened by:	Date:	Time:

WHITE: Golder Copy YELLOW: Lab Copy

Page 18 of 20



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 06191 page 2 of 2

200 - 2920 Virtual Way
 Vancouver, British Columbia, Canada V5M 0C4
 Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123		Laboratory Name: AGAT	
Short Title: KELSEY Creek	Golder Contact: Robyn Chastain-Davies	Address: 8600 Glenlyon Pkwy TRV	
Golder E-mail Address 1: RChastain-Davies@golder.com	Golder E-mail Address 2: AFast@golder.com	Telephone/Fax: 604 603 8081	Contact: Jennifer Yoon

Office Name: Victoria		EQuIS Facility Code: 229666564		EQuIS upload: <input type="checkbox"/>		Date/Time: 2 NOV 9:10 7AM	
Turnaround Time: <input type="checkbox"/> 24 hr <input type="checkbox"/> 48 hr <input type="checkbox"/> 72 hr <input checked="" type="checkbox"/> Regular (5 Days)		Criteria: <input type="checkbox"/> CSR <input type="checkbox"/> CCME <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other		Analyses Required			

Note: Final Reports to be issued by e-mail
 Quote No.: TA: 700589472

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D / M / Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	CSR Metals	Toc	Speciated Chromium	Grain Size	RUSH (Select TAT above)	Remarks (over)
06191 - 01	CS21-19		0-0.1	SO	28/10/21	10:00	67A5			3	X	X	X	X		* 4°C
06191 - 02	CS21-20					10:45				3	X	X	X	X		% Clay, % silt
06191 - 03	CS21-15					11:30				3	X	X	X	X		% sand, % gravel
06191 - 04	CS21-14					12:00				3	X	X	X	X		19 mm (0.75")
06191 - 05	CS21-13					13:25				3	X	X	X	X		4.75 mm
06191 - 06	CS21-07				29/10/21	09:30				3	X	X	X	X		(sieve 104)
06191 - 07	CS21-16					10:30		EPA	06191-08	3	X	X	X	X		75 um
06191 - 08	CS21-16					10:30		FD	06191-07	3	X	X	X	X		(sieve 1020)
06191 - 09	CS21-17					11:00				3	X	X	X	X		
06191 - 10	CS21-18					11:20				3	X	X	X	X		
- 11																
- 12																

Sampler's Signature: [Signature]	Relinquished by: Signature: [Signature]	Company: Golder	Date: 01/11/21	Time: 13:15	Received by: Signature	Company
Comments: ON ICE - Bin to PSPC.	Method of Shipment: Courier	Waybill No.:	Received for Lab by: TESPAY		Date	Time
	Shipped by: ACE	Shipment Condition: Seal Intact:	Temp (°C)	Cooler opened by:	Date	Time

WHITE: Golder Copy YELLOW: Lab Copy



AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM - BURNABY

Work Order # _____

RECEIVING BASICS:

Received From: COLLIER - TESFAY

Waybill #: 06190 - 06191

SAMPLE QUANTITIES:

Coolers: _____ Containers: _____

TIME SENSITIVE ISSUES:

Earliest Date Sampled: _____

ALREADY EXCEEDED? Yes No

NON-CONFORMANCES:

3 temperatures of samples* and average of each cooler: (record differing temperatures on the CoC next to sample ID's) *use jars when available

(1) 0 + 0 + 1 = 1 °C (2) 5 + 5 + 5 = 5 °C (3) 6 + 6 + 6 = 6 °C (4) 6 + 6 + 6 = 6 °C

Was ice or ice pack present: Yes No

Integrity Issues:

4°C (5) 3 - 3 - 2 = 3

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date and Time: _____

ADDITIONAL NOTES:



CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)
219-800 BURNARD ST
VANCOUVER, BC V6Z 0B9
604-671-1831

ATTENTION TO: Robyn Chatwin-Davies

PROJECT: 21455123

AGAT WORK ORDER: 21V822430

WATER ANALYSIS REVIEWED BY: Clarissa Muljono, Report Writer

DATE REPORTED: Nov 04, 2021

PAGES (INCLUDING COVER): 17

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (778) 452-4000

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
CANADA V5J 0B6
TEL (778)452-4000
FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

BC Schedule 6 Dissolved Mercury

DATE RECEIVED: 2021-10-27

DATE REPORTED: 2021-11-04

Parameter	Unit	SAMPLE DESCRIPTION:			
		G / S	RDL	3141728	3141731
		06183-01	06183-02	06183-03	06183-04
		Water	Water	Water	Water
		DATE SAMPLED:	2021-10-25	2021-10-25	2021-10-25
			2021-10-25	2021-10-26	2021-10-26
			3141728	3141731	3141732
			3141733	3141733	3141733
Dissolved Mercury	ug/L	0.005	<0.005	<0.005	<0.005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141728-3141733 < - Values refer to Method Detection Limit.

Analysis performed at AGAT Edmonton (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

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<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

BC Schedule 6 Total Mercury

DATE RECEIVED: 2021-10-27

DATE REPORTED: 2021-11-04

Parameter	Unit	SAMPLE DESCRIPTION:		06183-01	06183-02	06183-03	06183-04
		G / S	RDL				
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2021-10-25	2021-10-25	2021-10-25	2021-10-26
				3141728	3141731	3141732	3141733
Total Mercury	ug/L			0.005	<0.005	<0.005	<0.005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141728-3141733 < - Values refer to Report Detection Limits.

Analysis performed at AGAT Edmonton (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

DOC in Water (mg/L)						
DATE RECEIVED: 2021-10-27				DATE REPORTED: 2021-11-04		
		SAMPLE DESCRIPTION:		06183-01	06183-02	06183-04
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2021-10-25	2021-10-25	2021-10-26
Parameter	Unit	G / S	RDL	3141728	3141731	3141733
Carbon Dissolved Organic	mg/L		0.5	5.1	5.2	5.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Dissolved Metals - Public Works (µg/L)

DATE RECEIVED: 2021-10-27

DATE REPORTED: 2021-11-04

Parameter	Unit	SAMPLE DESCRIPTION:		06183-01	06183-02	06183-03	06183-04
		G / S	RDL	3141728	3141731	3141732	3141733
Aluminum Dissolved	µg/L	2	12	7	6	10	
Antimony Dissolved	µg/L	0.2	2.2	1.0	0.5	0.5	
Arsenic Dissolved	µg/L	0.1	0.9	0.6	0.5	0.4	
Barium Dissolved	µg/L	0.2	8.8	7.8	8.4	5.6	
Beryllium Dissolved	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	
Bismuth Dissolved	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	
Boron Dissolved	µg/L	2	23	26	28	19	
Cadmium Dissolved	µg/L	0.01	<0.01	<0.01	0.01	0.03	
Calcium Dissolved	µg/L	50	27000	27800	27600	15400	
Chromium Dissolved	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	
Cobalt Dissolved	µg/L	0.05	0.08	0.07	0.07	0.06	
Copper Dissolved	µg/L	0.2	2.5	3.1	2.9	3.7	
Iron Dissolved	µg/L	10	13	40	36	55	
Lead Dissolved	µg/L	0.05	<0.05	<0.05	<0.05	0.07	
Lithium Dissolved	µg/L	0.5	0.8	0.9	1.0	0.6	
Magnesium Dissolved	µg/L	50	9490	9520	9460	5070	
Manganese Dissolved	µg/L	1	16	12	12	12	
Molybdenum Dissolved	µg/L	0.05	2.36	1.98	1.94	1.73	
Nickel Dissolved	µg/L	0.2	0.5	0.8	0.5	0.6	
Potassium Dissolved	µg/L	50	1470	1510	1480	1710	
Selenium Dissolved	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	
Silicon Dissolved	µg/L	50	5060	4640	4630	2650	
Silver Dissolved	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	
Sodium Dissolved	µg/L	50	21800	23400	23800	14000	
Strontium Dissolved	µg/L	0.1	117	108	110	70.8	
Sulphur Dissolved	µg/L	500	8220	7570	7570	4750	
Thallium Dissolved	µg/L	0.01	0.01	<0.01	<0.01	<0.01	
Tin Dissolved	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	
Titanium Dissolved	µg/L	0.5	2.7	3.2	3.0	2.3	
Uranium Dissolved	µg/L	0.01	0.22	0.17	0.19	0.08	

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Dissolved Metals - Public Works (µg/L)

DATE RECEIVED: 2021-10-27

DATE REPORTED: 2021-11-04

Parameter	Unit	SAMPLE DESCRIPTION:		06183-01	06183-02	06183-03	06183-04
		G / S	RDL	3141728	3141731	3141732	3141733
Vanadium Dissolved	µg/L		0.5	0.5	0.7	0.5	0.5
Zinc Dissolved	µg/L		2	9	5	6	7
Zirconium Dissolved	µg/L		0.1	<0.1	<0.1	<0.1	<0.1
Hardness (calc)	ug CaCO3/L		100	107000	109000	108000	59300

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Total Metals - Public Works (µg/L)

DATE RECEIVED: 2021-10-27

DATE REPORTED: 2021-11-04

Parameter	Unit	SAMPLE DESCRIPTION:		06183-01	06183-02	06183-03	06183-04
		G / S	RDL	3141728	3141731	3141732	3141733
Aluminum Total	µg/L	5	82	83	94	214	
Antimony Total	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	
Arsenic Total	µg/L	0.1	0.2	0.4	<0.1	0.5	
Barium Total	µg/L	0.2	8.0	9.6	9.8	7.1	
Beryllium Total	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	
Bismuth Total	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	
Boron Total	µg/L	5	25	33	30	18	
Cadmium Total	µg/L	0.01	0.02	0.02	0.03	0.06	
Calcium Total	µg/L	50	29100	27900	27600	15800	
Chromium Total	µg/L	0.5	0.5	0.5	<0.5	0.7	
Cobalt Total	µg/L	0.05	0.09	0.12	0.12	0.18	
Copper Total	µg/L	0.5	4.6	5.2	4.5	5.6	
Iron Total	µg/L	10	122	175	169	348	
Lead Total	µg/L	0.05	0.08	0.19	0.12	0.42	
Lithium Total	µg/L	0.5	1.0	1.3	1.3	1.0	
Magnesium Total	µg/L	50	9830	10100	9610	5350	
Manganese Total	µg/L	1	25	16	15	21	
Molybdenum Total	µg/L	0.1	2.9	2.2	2.2	2.2	
Nickel Total	µg/L	0.5	0.8	0.8	0.7	1.0	
Potassium Total	µg/L	100	1460	1580	1510	1730	
Selenium Total	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	
Silicon Total	µg/L	50	5190	4950	4710	3170	
Silver Total	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	
Sodium Total	µg/L	100	21700	24200	22900	14300	
Strontium Total	µg/L	0.1	132	143	137	68.7	
Sulphur Total	µg/L	500	8100	7730	7410	4760	
Thallium Total	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	
Tin Total	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	
Titanium Total	µg/L	0.5	6.2	7.2	6.8	11.8	
Uranium Total	µg/L	0.01	0.23	0.22	0.20	0.09	

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
 Burnaby, British Columbia
 CANADA V5J 0B6
 TEL (778)452-4000
 FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Total Metals - Public Works (µg/L)							
DATE RECEIVED: 2021-10-27				DATE REPORTED: 2021-11-04			
SAMPLE DESCRIPTION:		06183-01	06183-02	06183-03	06183-04		
SAMPLE TYPE:		Water	Water	Water	Water		
DATE SAMPLED:		2021-10-25	2021-10-25	2021-10-25	2021-10-26		
Parameter	Unit	G / S	RDL	3141728	3141731	3141732	3141733
Vanadium Total	µg/L		1	1	1	1	2
Zinc Total	µg/L		5	11	9	9	11
Zirconium Total	µg/L		0.5	<0.5	<0.5	<0.5	<0.5
Total Hardness (calc)	ug CaCO3/L		100	113000	111000	108000	61500

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3141728-3141733 Some total metal results are less than the dissolved metal results; results are within the precision of the method.

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21V822430

PROJECT: 21455123

Unit 120, 8600 Glenlyon Parkway
Burnaby, British Columbia
CANADA V5J 0B6
TEL (778)452-4000
FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

pH in Water

DATE RECEIVED: 2021-10-27

DATE REPORTED: 2021-11-04

Parameter	Unit	SAMPLE DESCRIPTION:			
		G / S	RDL	3141728	3141731
		06183-01	06183-02	06183-03	06183-04
		Water	Water	Water	Water
		DATE SAMPLED:	2021-10-25	2021-10-25	2021-10-25
			2021-10-25	2021-10-25	2021-10-26
			3141728	3141731	3141732
pH	pH units	0.01	7.52	7.58	7.57
			7.52	7.58	7.57
			7.52	7.58	7.57
			7.52	7.58	7.57

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
3141728-3141733 Literature holding time exceeded for pH analysis.
Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822430
 PROJECT: 21455123 ATTENTION TO: Robyn Chatwin-Davies
 SAMPLING SITE: SAMPLED BY:

Water Analysis															
RPT Date: Nov 04, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Dissolved Metals - Public Works (µg/L)												
Aluminum Dissolved	3142220		35	40	13.3%	< 2	98%	70%	130%	86%	85%	115%
Antimony Dissolved	3142220		787	738	6.4%	< 0.2	72%	70%	130%	99%	85%	115%
Arsenic Dissolved	3142220		257	249	3.0%	< 0.1	96%	70%	130%	92%	85%	115%
Barium Dissolved	3142220		53.2	55.3	3.8%	< 0.2	83%	70%	130%	102%	85%	115%
Beryllium Dissolved	3142220		<0.01	<0.01	NA	< 0.01	89%	70%	130%	100%	85%	115%
Bismuth Dissolved	3142220		<0.05	<0.05	NA	< 0.05				100%	85%	115%
Boron Dissolved	3142220		5	5	NA	< 2	79%	70%	130%	104%	85%	115%
Cadmium Dissolved	3142220		<0.01	<0.01	NA	< 0.01	88%	70%	130%	100%	85%	115%
Calcium Dissolved	3142220		8790	8710	0.9%	< 50	101%	70%	130%	101%	85%	115%
Chromium Dissolved	3142220		<0.5	<0.5	NA	< 0.5	89%	70%	130%	94%	85%	115%
Cobalt Dissolved	3142220		1.48	1.40	5.6%	< 0.05	106%	70%	130%	100%	85%	115%
Copper Dissolved	3142220		0.3	<0.2	NA	< 0.2	98%	70%	130%	96%	85%	115%
Iron Dissolved	3142220		44	41	NA	< 10	104%	70%	130%	98%	85%	115%
Lead Dissolved	3142220		0.07	0.06	NA	< 0.05	97%	70%	130%	106%	85%	115%
Lithium Dissolved	3142220		0.5	0.6	NA	< 0.5				104%	85%	115%
Magnesium Dissolved	3142220		1020	1010	1.1%	< 50	106%	70%	130%	103%	85%	115%
Manganese Dissolved	3142220		<1	<1	NA	< 1	102%	70%	130%	96%	85%	115%
Molybdenum Dissolved	3142220		9.03	9.74	7.6%	< 0.05	88%	70%	130%	106%	85%	115%
Nickel Dissolved	3142220		<0.2	<0.2	NA	< 0.2	102%	70%	130%	100%	85%	115%
Potassium Dissolved	3142220		1060	1030	3.6%	0.06	102%	70%	130%	99%	85%	115%
Selenium Dissolved	3142220		4.4	4.1	8.2%	< 0.5	105%	70%	130%	100%	85%	115%
Silicon Dissolved	3142220		1330	1290	3.4%	< 50				106%	85%	115%
Silver Dissolved	3142220		<0.02	<0.02	NA	< 0.02				95%	85%	115%
Sodium Dissolved	3142220		8020	8100	0.9%	< 50	99%	70%	130%	106%	85%	115%
Strontium Dissolved	3142220		47.7	47.8	0.1%	< 0.1	86%	70%	130%	105%	85%	115%
Sulphur Dissolved	3142220		5930	5810	2.0%	< 500				101%	85%	115%
Thallium Dissolved	3142220		0.03	0.03	NA	< 0.01	85%	70%	130%	101%	85%	115%
Tin Dissolved	3142220		<0.05	<0.05	NA	< 0.05				102%	85%	115%
Titanium Dissolved	3142220		1.2	1.2	NA	< 0.5				100%	85%	115%
Uranium Dissolved	3142220		0.58	0.55	4.3%	< 0.01	91%	70%	130%	103%	85%	115%
Vanadium Dissolved	3142220		0.6	0.7	NA	< 0.5	89%	70%	130%	97%	85%	115%
Zinc Dissolved	3142220		<2	<2	NA	< 2	83%	70%	130%	94%	85%	115%
Zirconium Dissolved	3142220		0.1	0.1	NA	< 0.1				107%	85%	115%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Total Metals - Public Works (µg/L)												
Aluminum Total	3148795		89	103	14.6%	< 5	84%	70%	130%	96%	85%	115%
Antimony Total	3148795		<0.5	<0.5	NA	< 0.5	104%	70%	130%	101%	85%	115%
Arsenic Total	3148795		<0.1	<0.1	NA	< 0.1	105%	70%	130%	98%	85%	115%

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822430

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Nov 04, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Barium Total	3148795		0.5	1.0	NA	< 0.2	87%	70%	130%	101%	85%	115%			
Beryllium Total	3148795		<0.05	<0.05	NA	< 0.05	103%	70%	130%	103%	85%	115%			
Bismuth Total	3148795		<0.05	<0.05	NA	< 0.05				98%	85%	115%			
Boron Total	3148795		<5	<5	NA	< 5	116%	70%	130%	100%	85%	115%			
Cadmium Total	3148795		<0.01	0.01	NA	< 0.01	107%	70%	130%	100%	85%	115%			
Calcium Total	3148795		199	196	NA	< 50	103%	70%	130%	105%	85%	115%			
Chromium Total	3148795		<0.5	<0.5	NA	< 0.5	104%	70%	130%	101%	85%	115%			
Cobalt Total	3148795		0.16	0.18	NA	< 0.05	98%	70%	130%	101%	85%	115%			
Copper Total	3148795		1.4	3.4	NA	< 0.5	107%	70%	130%	105%	85%	115%			
Iron Total	3148795		79	77	2.1%	< 10	106%	70%	130%	101%	85%	115%			
Lead Total	3148795		0.13	0.17	NA	< 0.05	106%	70%	130%	105%	85%	115%			
Lithium Total	3148795		<0.5	<0.5	NA	< 0.5				102%	85%	115%			
Magnesium Total	3148795		178	179	NA	< 50	112%	70%	130%	109%	85%	115%			
Manganese Total	3148795		15	16	3.3%	< 1	103%	70%	130%	98%	85%	115%			
Molybdenum Total	3148795		<0.1	<0.1	NA	< 0.1	103%	70%	130%	102%	85%	115%			
Nickel Total	3148795		<0.5	1.6	NA	< 0.5	107%	70%	130%	103%	85%	115%			
Potassium Total	3148795		369	384	NA	< 100	100%	70%	130%	99%	85%	115%			
Selenium Total	3148795		<0.5	<0.5	NA	< 0.5	128%	70%	130%	100%	85%	115%			
Silicon Total	3148795		200	202	NA	< 50				108%	85%	115%			
Silver Total	3148795		<0.02	<0.02	NA	< 0.02				102%	85%	115%			
Sodium Total	3148795		577	593	2.7%	< 100	102%	70%	130%	108%	85%	115%			
Strontium Total	3148795		1.3	1.3	0.4%	< 0.1	103%	70%	130%	103%	85%	115%			
Sulphur Total	3148795		<500	<500	NA	< 500				99%	85%	115%			
Thallium Total	3148795		<0.02	<0.02	NA	< 0.02	122%	70%	130%	99%	85%	115%			
Tin Total	3148795		<0.05	0.07	NA	< 0.05				103%	85%	115%			
Titanium Total	3148795		5.0	5.9	16.9%	< 0.5				105%	85%	115%			
Uranium Total	3148795		<0.01	<0.01	NA	< 0.01	104%	70%	130%	103%	85%	115%			
Vanadium Total	3148795		1	1	NA	< 1	94%	70%	130%	105%	85%	115%			
Zinc Total	3148795		<5	<5	NA	< 5	94%	70%	130%	98%	85%	115%			
Zirconium Total	3148795		<0.5	<0.5	NA	< 0.5				106%	85%	115%			

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

pH in Water

pH	3141728	7.52	7.52	0.0%	100%	95%	105%
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Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

DOC in Water (mg/L)

Carbon Dissolved Organic	3141728	5.1	5.0	1.6%	< 0.5	102%	85%	115%	105%	90%	110%
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BC Schedule 6 Dissolved Mercury

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822430
 PROJECT: 21455123 ATTENTION TO: Robyn Chatwin-Davies
 SAMPLING SITE: SAMPLED BY:

Water Analysis (Continued)

RPT Date: Nov 04, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
Dissolved Mercury	307	TAP	<0.005	<0.005	NA	< 0.005	84%	70%	130%	85%	80%	120%	82%	70%	130%	

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
 If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

BC Schedule 6 Total Mercury

Total Mercury	307	TAP	<0.005	<0.005	NA	<0.005	81%	70%	130%	88%	80%	120%	82%	70%	130%
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Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
 If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

Certified By: _____





Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822430

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Dissolved Mercury		SM 3112 B	CV/AFS
Total Mercury	INOR-171-6202	SM 3112 B	CV/AFS
Carbon Dissolved Organic	INOR-181-6003	Modified from SM 5310 B	COMBUSTION
Aluminum Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Antimony Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Arsenic Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Barium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Beryllium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Bismuth Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Boron Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Cadmium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Calcium Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Chromium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Cobalt Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Copper Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Iron Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Lead Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Lithium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Magnesium Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Manganese Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Molybdenum Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Nickel Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Potassium Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Selenium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Silicon Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Silver Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Sodium Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES
Strontium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Sulphur Dissolved	MET-181-6101, LAB-181-4015	Modified from SM 3120 B	ICP/OES



Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822430

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Thallium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Tin Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Titanium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Uranium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Vanadium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Zinc Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Zirconium Dissolved	MET-181-6102, LAB-181-4015	Modified from SM 3125 B	ICP-MS
Aluminum Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Antimony Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Arsenic Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Barium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Beryllium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Bismuth Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Boron Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Cadmium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Calcium Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Chromium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Cobalt Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Copper Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Iron Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Lead Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Lithium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Magnesium Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Manganese Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Molybdenum Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Nickel Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Potassium Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Selenium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS

Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V822430

PROJECT: 21455123

ATTENTION TO: Robyn Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Silicon Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Silver Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Sodium Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Strontium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Sulphur Total	MET-181-6101, LAB-181-4009	Modified from SM 3120 B	ICP/OES
Thallium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Tin Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Titanium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Uranium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Vanadium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Zinc Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
Zirconium Total	MET-181-6102, LAB-181-4009	Modified from SM 3125 B	ICP-MS
pH	INOR-181-6000	Modified from SM 4500-H+	PH METER



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

21V 822430
No. 06183 page 1 of 1

200 - 2920 Virtual Way
Vancouver, British Columbia, Canada V5M 0C4
Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123		Laboratory Name: ALBAT 27OCT 8H7AM	
Short Title: KELSET Creek	Golder Contact: Robyn Chatwin-Davies		Address: 8600 Glenlyon Parkway RR4
Golder E-mail Address 1: RChatwin-Davies@golder.com	Golder E-mail Address 2: AFast@golder.com	Telephone/Fax: 604 603 3081	Contact: Jennifer Yoon

Office Name: Victoria	EQUIS Facility Code: 229666564
Turnaround Time: <input type="checkbox"/> 24 hr <input type="checkbox"/> 48 hr <input type="checkbox"/> 72 hr	EQUIS upload: <input checked="" type="checkbox"/> Regular (5 Days)
Criteria: <input type="checkbox"/> CSR <input type="checkbox"/> CCME <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other	

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D / M / Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	Analyses Required					RUSH (Select TAT above)	Remarks (over)
											ESR Dissolved Metals	ESR Total Metals	Hardness	PH	DOC *		
06183-01	SW21-01			SW	25/10/21		GRAB			6	X	X	X	X	X		*DOC
06183-02	SW21-03			SW	↓		↓	FDA 06183-03		6	X	X	X	X	X		Collected in
06183-03	SW21-03			SW	↓		↓	FD 06183-02		5	X	X	X	X			1L generic
06183-04	SW21-07			SW	26/10/21		↓			6	X	X	X	X	X		Bottles.
-05																	Non-Preserved
-06																	UN-Filtered
-07																	Collected
-08																	on Oct 26/2021
-09																	
-10																	
-11																	
-12																	

Sampler's Signature:	Relinquished by: Signature	Company: Golder	Date: 26/10/21	Time: 16:30	Received by: Signature	Company:
Comments: ON ICE Bill to POPE	Method of Shipment:	Waybill No.:	Received for Lab by:		Date:	Time:
	Shipped by:	Shipment Condition: Seal Intact:	Temp (°C): 2	Cooler opened by: MS	Date:	Time:

WHITE: Golder Copy YELLOW: Lab Copy



AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM - BURNABY

Work Order # _____

RECEIVING BASICS:

Received From: Ace courier Waybill #: _____

SAMPLE QUANTITIES:

Coolers: 1 Containers: _____

TIME SENSITIVE ISSUES:

Earliest Date Sampled: _____ ALREADY EXCEEDED? Yes No

NON-CONFORMANCES:

3 temperatures of samples* and average of each cooler: (record differing temperatures on the CoC next to sample ID's) *use jars when available

(1) 2 + 4 + 0 = 2 °C (2) ___ + ___ = ___ °C (3) ___ + ___ = ___ °C (4) ___ + ___ = ___ °C

Was ice or ice pack present: Yes No

Integrity Issues:

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date and Time: _____

ADDITIONAL NOTES:

Certificate of Analysis
Concentrations of Freely Dissolved Analytes
Measured via SPeeper™ Passive Samplers

Customer: Golder

SiREM Reference: Si-5280-082321

Site Deployment Dates:

Report Issued:

October 25, 2021 to November 24, 2021

June 24, 2021

Introduction

This report represents the results from *in-situ* deployment of SPeeper™ passive samplers in surface sediment from the Kelset Creek site in Victoria, BC the Site). The data from twelve (12) passive sampler sets (nine [9] deployed in sediment and three [3] trip blanks) were analyzed to determine the freely-dissolved concentrations (C_{free}) of dissolved metals¹ and hexavalent chromium in sediment porewater. The analysis of bromide (Br), a reverse tracer used to evaluate diffusion equilibrium was also measured in the samplers. A total of 9 SPeeper™ sampler sets were deployed between October 25, 2021 and October 26, 2021 and were retrieved on November 24, 2021. Details of the data analysis procedure are provided in Attachment A.

Sample Summary

Client Sample ID	Sample Type	Sampler Deployment Date	Sampler Retrieval Date	Analysis
06169-01	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-02	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-03	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-04	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-05	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-06	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide

¹ Al, Ni, Cd, SB, Na, Be, Ba, Ca, Fe, V, Ag, Mg, Cu, Zn, Mn, Cr, Co, Mo, Sr, B

Client Sample ID	Sample Type	Sampler Deployment Date	Sampler Retrieval Date	Analysis
06169-07	Sample	10/26/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-08	Sample	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-09	Sample	10/26/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-10	Trip Blank	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-11	Trip Blank	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide
06169-12	Trip Blank	10/25/2021	11/24/2021	Dissolved metals, hexavalent chromium, and bromide

Sampler Design, Deployment, and Chemical Analysis

The SPeeper™ sampler design for this project consisted of pre-cleaned and pre-filled 60 mL peeper vials made of polypropylene [PP] with 0.45 micrometer (µm) polyethersulfone (PES) diffusion membranes in the lids of the vials. The SPeeper™ vials were cleaned by washing with a laboratory grade detergent, performing a double rinse with ultrapure water, then using reagent grade hydrochloric acid to remove any potential metals followed by a final double rinse with ultrapure water to remove any remaining hydrochloric acid.

The vials were filled with ultrapure deoxygenated water (dissolved oxygen [DO] of less than 0.8 milligrams per liter [mg/L]) that was spiked with a potassium bromide (KBr) salt to target a concentration of 100 mg/L as bromide. After filling, the vials were stored and shipped to the Site in Mylar™ bags that have very low gas permittivity and that were filled with the same water that was used to fill the SPeeper™ vials.

For deployment, pre-cleaned polyethylene terephthalate glycol (PETG) frames that could contain four (4) SPeeper™ vials each were also prepared. The 3D-printed custom frames were cleaned in the same way as the SPeeper™ vials and shipped to the Site in Mylar™ bags.

In total, 48 SPeeper™ vials and 9 PETG frames were prepared for deployment. In the field, 36 of the prepared SPeeper™ vials were removed from their Mylar™ bags and immediately inserted into the pre-cleaned frames. Once inserted, the vials were deployed into the sediment at the Site. One (1) frame with 4 vials was deployed for each sampling location (9 field locations). The remaining twelve SPeeper™ vials were designated for use as trip blanks. These samples remained in their sealed Mylar™ bags until sample processing and were stored at 4 °C.

The SPeeper™ vials were deployed over two days between October 25, 2021 and October 26, 2021. The SPeepers™ were retrieved on November 24, 2021. The deployment time for the samplers were between 29 and 30 days, based on the exact deployment and retrieval dates for each Site location.

Upon retrieval, the SPeepers™ for each location were gently, but thoroughly rinsed off to remove excess sediment. Each vial was then sampled by piercing the side wall with a 60 mL high-density polyethylene (HDPE) syringe equipped with a 16-gauge stainless steel needle and filled with non-site-related clean ambient air and leaving the syringe in the side of the vial. A second syringe, prepared similarly, was then used to pierce a hole in the bottom of the cleaned vial, and the syringe withdrawn. The pierced SPeeper™ vial was positioned over the sample collection bottles and using the clean ambient air in the first syringe, the SPeeper™ water was pushed out of the vial through the pierced hole and collected in the sample collection bottle. The same set of syringes were used for all 4 SPeeper™ vials from a single location. Syringes were replaced for each new location.

On November 24, 2021 the trip blanks were removed from their Mylar™ bags and sampled in the same way as described above for the deployed SPeepers™. Four (4) of the trip blank peepers were used to represent each trip blank (3 trip blanks in total, 4 peepers per trip blank).

For each sample set, samples were collected in Eurofins Environment Testing America-provided sample bottles for analysis of dissolved metals and bromide and samples were also collected in Agat Laboratories approved sample bottles for analysis of hexavalent chromium. After collection, dissolved metal and bromide samples were shipped to Eurofins Environment Testing America in Pittsburgh, PA and hexavalent chromium samples were shipped to Agat Laboratories in Burnaby, BC for analysis. The analytical report provided by Eurofins Environment Testing America and Agat Laboratories is attached to this report (Attachment B).

Results

C_{free} values for selected analytes are reported in Table 1. The C_{free} concentrations were calculated as described in Attachment A using a first-order diffusion model. Diffusion coefficients used in the calculations for each analyte were sourced from the literature ^{2,3,4,5}.

For metals where multiple oxidation states may be observed in nature, the following species diffusion coefficients were selected for the purposes of estimating C_{free} concentrations:

- Copper – Cu^{2+}
- Vanadium – V^{6+} as VO_4^{2-}
- Iron – Fe^{3+}
- Antimony – Sb^{5+} as $\text{Sb}(\text{OH})_6^-$
- Manganese – Mn^{2+}
- Chromium – Cr^{3+}
- Hexavalent chromium – Cr^{6+} as CrO_4^{2-}
- Molybdenum – Mo^{6+} as MoO_4^{2-}

Tin was analyzed in the submitted SPeeper™ samplers. However, no known diffusion coefficient for tin in water could be determined from the literature. As a result, estimates for C_{free} of tin were not calculated for any of the samples.

For pH and hardness, an estimate for C_{free} was not calculated, and it is assumed that the pH and hardness reached equilibrium between the sediment porewater and the SPeeper™.

For samples where bromide was not detected in the SPeeper™ after deployment, it was assumed 100% equilibration between the SPeeper™ and the porewater had been achieved and the concentration measured in the SPeeper™ was equal to the concentration in the porewater (Tables A1 and A2).

² Thibodeaux, L.J. 1996. *Environmental chemodynamics: Movement of chemicals in air, water, and soil*. Wiley, New York, NY.

³ Buffle, J., Z. Zhang, and K. Startchev. 2007. Metal flux and dynamic speciation at (bio)interfaces. Part i: Critical evaluation and compilation of physicochemical parameters for complexes with simple ligands and fulvic/humic substances. 2007. *Enviro. Sci. Tech.* 41:7609–7620.

⁴ Henry V. K. (Ed.) CRC handbook of thermophysical and thermochemical data. CRC press Inc. Boca Raton, 1994.

⁵ J.G. Panther, W.W. Bennett, D.T. Welsh, P.R. Teasdale, Simultaneous Measurement of TraceMetal and Oxyanion Concentrations in Water using Diffusive Gradients in Thin Films with a Chelex–Metsorb Mixed Binding Layer, *Analytical Chemistry*, 86 (2013) 427-434.

TABLE 1

Table 1: Freely Dissolved Concentration of Analytes in Sediment Porewater
Kelset Creek, Victoria, BC

Client ID	06169-01			06169-02			06169-03			06169-04			06169-05		
	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)
Aluminum	ND		0.047	ND		0.12	0.025	J	0.013	0.053		0.013	ND		0.018
Nickel	0.0013	J	0.0010	ND		0.0025	0.00085	J	0.00034	0.0010	J	0.00034	0.00094	J	0.00041
Cadmium	ND		0.00063	ND		0.0016	ND		0.00022	ND		0.00022	ND		0.00026
Antimony	ND		0.0010	ND		0.0024	ND		0.00038	ND		0.00038	ND		0.00043
Sodium	11.4		0.64	58.1		1.5	18.0		0.35	18.0		0.35	17.6		0.36
Beryllium	ND		0.00060	ND		0.0015	ND		0.00018	ND		0.00018	ND		0.00023
Barium	0.033		0.0040	0.27		0.010	0.0086	J	0.0016	0.0082	J	0.0016	0.0091	J	0.0018
Calcium	28.7		0.34	98.3		0.86	20.0		0.13	21.0		0.13	23.2		0.15
Iron	1.91		0.066	136.4		0.17	0.049	J	0.020	0.071		0.020	0.030	J	0.026
Vanadium	ND		0.0049	0.031		0.013	0.0010		0.0010	0.0010		0.0010	0.0020		0.0016
Silver	ND		0.00029	ND		0.00062	ND		0.00018	ND		0.00018	ND		0.00018
Magnesium	10.7		0.24	45.0		0.61	7.3		0.083	7.60		0.083	8.9		0.10
Copper	ND		0.0018	ND	J	0.0046	0.0041		0.00063	0.0037		0.00063	0.0025		0.00076
Zinc	ND		0.0093	ND		0.024	0.012		0.0032	0.013		0.0032	ND		0.0039
Manganese	2.21		0.0025	16.1		0.0064	0.0039	J	0.00087	0.0031	J	0.00087	0.026		0.0010
Chromium	ND		0.0050	ND		0.013	ND		0.0015	ND		0.0015	ND		0.0019
Cobalt	0.00084	J	0.00037	0.0031	J	0.00093	ND		0.00013	ND		0.00013	ND		0.00016
Molybdenum	0.0016	J	0.00089	ND		0.0018	0.0019	J	0.00061	0.0020	J	0.00061	0.0018	J	0.00061
Strontium	0.14		0.0025	0.66		0.0062	0.086		0.00093	0.089		0.00093	0.10		0.0011
Boron	ND		0.087	ND		0.21	ND		0.039	ND		0.039	ND		0.043
Tin	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexavalent Chromium	ND		0.15	ND		0.44	ND		0.010	ND		0.010	ND		0.041
pH	7.70	H H3	0.10	7.4	H H3	0.10	7.8	H H3	0.10	7.8	H H3	0.10	8.0	H H3	0.10
Hardness as calcium carbonate	43		0.55	63.0		0.55	80.0		0.55	84.0		0.55	80.0		0.55

Notes

--: Not applicable. A diffusion coefficient for tin was not available in the literature, therefore, a C_{free} calculation was not completed.

H: Sample was prepped or analyzed beyond the specified holding time.

H3: Sample was received and analyzed past holding time.

J: Result is less than the reporting limit but greater than or equal to the MDL and the concentration is an approximate value.

MDL: method detection limit

mg/L: milligrams per liter

ND: Not detected at the MDL shown in the third column for each sample.

Table 1: Freely Dissolved Concentration of Analytes in Sediment Porewater
Kelset Creek, Victoria, BC

Client ID	06169-06			06169-07			06169-08			06169-09		
	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)
Aluminum	0.025	J	0.013	0.17		0.085	0.070	J	0.076	ND		0.083
Nickel	0.00069	J	0.00034	0.0043	J	0.0018	0.0045	J	0.0016	0.011		0.0017
Cadmium	ND		0.00022	ND		0.00111	ND		0.00099	ND		0.0011
Antimony	ND		0.00038	ND		0.0017	ND		0.0015	ND		0.0016
Sodium	17.0		0.35	328		1.04	45.8		0.94	58.2		1.02
Beryllium	ND		0.00018	ND		0.00108	ND		0.00096	ND		0.0010
Barium	0.0076	J	0.0016	0.12		0.0070	0.14		0.0063	0.16		0.0068
Calcium	19.0		0.13	96.9		0.60	86.7		0.54	135		0.59
Iron	0.055		0.020	59.3		0.119	44.4		0.11	47.2		0.12
Vanadium	0.0010		0.0010	0.015		0.0091	0.013		0.0081	ND		0.0089
Silver	ND		0.00018	ND		0.00045	ND		0.00041	ND		0.00044
Magnesium	7.1		0.083	87.6		0.43	33.5		0.38	50.0		0.42
Copper	0.0041		0.00063	ND		0.0032	ND	J	0.0029	ND		0.0031
Zinc	0.011		0.0032	ND		0.0165	ND		0.015	ND		0.016
Manganese	0.0020	J	0.00087	10.2		0.0044	11.4		0.0040	31.8		0.0043
Chromium	ND		0.0015	ND		0.0090	ND		0.0080	ND		0.0088
Cobalt	ND		0.00013	0.0055		0.00065	0.0080		0.00058	0.021		0.00063
Molybdenum	0.0019	J	0.00061	ND		0.00136	0.0019	J	0.0012	0.0046	J	0.0013
Strontium	0.081		0.00093	0.74		0.0043	0.50		0.0039	0.72		0.0042
Boron	0.066	J	0.039	0.53		0.149	ND		0.13	0.14	J	0.14
Tin	--	--	--	--	--	--	--	--	--	--	--	--
Hexavalent Chromium	ND		0.010	ND		0.30	ND		0.26	ND		0.29
pH	8.0	H H3	0.10	7.7	H H3	0.10	7.6	H H3	0.10	7.9	H H3	0.10
Hardness as calcium carbonate	77.0		0.55	120.0		0.55	82.0		0.55	120.0		0.55

Notes

--: Not applicable. A diffusion coefficient for tin was not available in the literature, therefore, a C_{free} calculation was not completed.

H: Sample was prepped or analyzed beyond the specified holding time.

H3: Sample was received and analyzed past holding time.

J: Result is less than the reporting limit but greater than or equal to the MDL and the concentration is an approximate value.

MDL: method detection limit

mg/L: milligrams per liter

ND: Not detected at the MDL shown in the third column for each sample.

ATTACHMENT A:
DATA ANALYSIS METHODS

Attachment A:

Data Analysis Methods Concentrations of Freely Dissolved Analytes Measured via SPeeper™ Passive Samplers

The concentration of analytes in the SPeeper™ water (Table A1) obtained from the information provided in the analytical reports (Attachment B) are used in a multi-step data process to calculate C_{free} analytes as described below and adapted from Thomas and Arthur (2010).

Step 1:

The concentrations of the bromide reverse tracer in the SPeeper™ water [$Peeper_t$] were used to calculate the site-specific diffusion constant values (K_{mBr}) in each deployed sampler using the following equation

$$\text{Reverse Tracer } K_{mBr} = \frac{-1}{t_{final}} \cdot \ln \left(\frac{[Peeper_{t=final}]}{[Peeper_{t=0}]} \right)$$

where:

$Peeper_{t=0}$ = the concentration of the bromide reverse tracer present in the SPeeper™ water at the beginning of the deployment (obtained from the undeployed trip blanks)

$Peeper_{t=final}$ = the concentration of the bromide reverse tracer after the deployment (obtained from each deployed SPeeper™ sampler)

t_{final} = the deployment time (in days)

K_{mBr} = the site-specific diffusion constant (in days⁻¹)

Bromide K_{mBr} values for each sampler are shown in Table A2. The values are also expressed as a percentage of steady state (concentration at equilibrium).

Step 2:

The second step was to estimate K_{mi} values for the primary analytes in each of the deployed samplers. This was accomplished by developing a relationship between the site-specific bromide diffusion constant (K_{mBr}) values (from Table A2) and bromide diffusivity coefficient (D_{iBr}) and the site-specific diffusion constants and diffusivity coefficients for each analyte.

$$\frac{K_{mi}}{K_{mBr}} = \frac{D_i}{D_{Br}}$$

$$K_{mi} = \frac{D_i \cdot K_{mBr}}{D_{Br}}$$

K_{mBr} = the site-specific bromide reverse tracer diffusion constant (in days⁻¹)

K_{mi} = the site-specific primary analyte diffusion constant (in days⁻¹)

D_{Br} = bromide diffusivity constant (in cm²/s)

D_i = primary analyte diffusivity constant (in cm²/s)

Step 3:

Concentrations of some analytes (Table A1) in the SPeepers™ were corrected for trace levels of the analytes present in the control trip blanks (due to trace levels present in the peeper filling solution). Using the sample specific K_{mi} values, the expected amount of these trace analyte present in the sample at the end of deployment (*Trace Analyte*_{*t = final*}) was calculated via the following equation:

$$[Trace\ Analyte]_{t=final} = \frac{[Trace\ Analyte]_{t=0}}{e^{K_{mi} \times t_{final}}}$$

where:

$Trace\ Analyte_{t=final}$ = the concentration of trace PCBs remaining in the sample at the end of the deployment

$Trace\ Analyte_{t=0}$ = the average concentration of the trace PCB in the PE at the beginning of the deployment (obtained from an average measurement of the trace PCBs in the PRC control blanks)

K_{mi} = the elimination rate value predicted by the sampler-specific regression model (in days⁻¹)

t_{final} = the deployment time (in days)

Concentrations of *Trace Analyte* $t = t_{final}$ values were then subtracted from the measured concentrations of the analytes in the deployed SPeepers™ (Table A1).

Step 4:

This step describes the calculation of sampling rate correction factors (*CFs*) for each primary analyte in each sampler.

$$CF = 1 - e^{(-K_{mi} \cdot t_{final})}$$

where:

K_{mi} = the site-specific primary analyte diffusion constant (in days⁻¹)

t_{final} = the deployment time (in days).

Step 5:

The concentration of primary analyte in the SPeeper™ of each sampler (obtained from Table A1) were divided by the *CF* values to calculate the C_{free} concentration of the primary analytes. These are reported in Table 1. C_{free} Method Detection Limits (MDLs) were calculated in the approach described above using the MDL concentration from the analysis as reported from Eurofins Environmental Testing America and shown in Table A1.

References Cited

Thomas, B. and M.A. Arthur. 2010. Correcting porewater concentration measurements from peepers: Application of a reverse tracer. *Limnol. Oceanogr.: Methods*. 8: 403–413.

TABLE A1

Table A1: Concentration of Analytes in SPeeper
Kelset Creek, Victoria, BC

Client ID		06169-01			06169-02			06169-03			06169-04			06169-05			06169-06		
Analyte	Diffusion Tracer	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)
Bromide	X	26.0		0.053	59.0		0.21	ND		0.053	ND		0.053	0.51		0.053	ND		0.053
Aluminum		ND		0.013	0.015	J	0.013	0.025	J	0.013	0.053		0.013	ND		0.013	0.025	J	0.013
Nickel		0.00046	J	0.00034	ND		0.00034	0.00085	J	0.00034	0.0010	J	0.00034	0.00078	J	0.00034	0.00069	J	0.00034
Cadmium		ND		0.00022	ND		0.00022	ND		0.00022	ND		0.00022	ND		0.00022	ND		0.00022
Antimony		ND		0.00038	ND		0.00038	ND		0.00038	ND		0.00038	ND		0.00038	ND		0.00038
Sodium		6.30		0.35	14.0		0.35	18.0		0.35	18.0		0.35	17.0		0.35	17.0		0.35
Beryllium		ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018
Barium		0.013		0.0016	0.044		0.0016	0.0086	J	0.0016	0.0082	J	0.0016	0.0080	J	0.0016	0.0076	J	0.0016
Calcium		11.0		0.13	15.0		0.13	20.0		0.13	21.0		0.13	20.0		0.13	19.0		0.13
Iron		0.58		0.020	16.0		0.020	0.049	J	0.020	0.071		0.020	0.023	J	0.020	0.055		0.020
Vanadium		ND		0.0010	0.0023		0.0010	0.0010		0.0010	0.0010		0.0010	0.0012		0.0010	0.0010		0.0010
Silver		ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018
Magnesium		3.70		0.083	6.1		0.083	7.3		0.083	7.60		0.083	7.40		0.083	7.10		0.083
Copper		0.0020		0.00063	0.0019	J	0.00063	0.0041		0.00063	0.0037		0.00063	0.0032		0.00063	0.0041		0.00063
Zinc		0.0053		0.0032	0.011		0.0032	0.012		0.0032	0.013		0.0032	0.0085		0.0032	0.011		0.0032
Manganese		0.77		0.00087	2.20		0.00087	0.0039	J	0.00087	0.0031	J	0.00087	0.022		0.00087	0.0020	J	0.00087
Chromium		ND		0.0015	ND		0.0015	ND		0.0015	ND		0.0015	ND		0.0015	ND		0.0015
Cobalt		0.00030	J	0.00013	0.00043	J	0.00013	ND		0.00013	ND		0.00013	ND		0.00013	ND		0.00013
Molybdenum		0.0011	J	0.00061	ND		0.00061	0.0019	J	0.00061	0.0020	J	0.00061	0.0018	J	0.00061	0.0019	J	0.00061
Strontium		0.054		0.00093	0.10		0.00093	0.086		0.00093	0.089		0.00093	0.088		0.00093	0.081		0.00093
Boron		ND		0.039	ND		0.039	ND		0.039	ND		0.039	ND		0.039	0.066	J	0.039
Tin		ND		0.0010	ND		0.0010	ND		0.0010	ND		0.0010	ND		0.0010	0.0014	J	0.0010
Hexavalent Chromium		ND		0.010	ND		0.010	ND		0.010	ND		0.010	ND		0.010	ND		0.010
pH		7.70	H H3	0.10	7.40	H H3	0.10	7.80	H H3	0.10	7.80	H H3	0.10	8.00	H H3	0.10	8.00	H H3	0.10
Hardness as calcium carbonate		43.0		0.55	63.0		0.55	80.0		0.55	84.0		0.55	80.0		0.55	77.0		0.55

Notes

H: Sample was prepped or analyzed beyond the specified holding time.

H3: Sample was received and analyzed past holding time.

J: Result is less than the reporting limit but greater than or equal to the MDL and the concentration is an approximate value.

MDL: method detection limit

mg/L: milligrams per liter

ND: Not detected at the MDL shown in the third column for each sample.

Table A1: Concentration of Analytes in SPeeper
Kelset Creek, Victoria, BC

Client ID		06169-07			06169-08			06169-09			06169-10			06169-11			06169-12		
Analyte	Diffusion Tracer	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)	Result (mg/L)	Qualifier	MDL (mg/L)
Bromide	X	48.0		0.27	44.0		0.21	47.0		0.11	90.0		0.21	91.0		0.21	91.0		0.21
Aluminum		0.032		0.013	0.018	J	0.013	ND		0.013	ND		0.013	ND		0.013	0.022	J	0.013
Nickel		0.00083	J	0.00034	0.0010	J	0.00034	0.0022		0.00034	ND		0.00034	ND		0.00034	ND		0.00034
Cadmium		ND		0.00022	ND		0.00022	ND		0.00022	ND		0.00022	ND		0.00022	ND		0.00022
Antimony		ND		0.00038	ND		0.00038	ND		0.00038	ND		0.00038	ND		0.00038	ND		0.00038
Sodium		110		0.35	17.0		0.35	20.0		0.35	ND		0.35	ND		0.35	ND		0.35
Beryllium		ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018
Barium		0.027		0.0016	0.035		0.0016	0.037		0.0016	ND		0.0016	ND		0.0016	ND		0.0016
Calcium		21.0		0.13	21.0		0.13	30.0		0.13	ND		0.13	0.34	J	0.13	0.24	J	0.13
Iron		10.0		0.020	8.40		0.020	8.2		0.020	ND		0.020	ND		0.020	ND		0.020
Vanadium		0.0016		0.0010	0.0016		0.0010	ND		0.0010	ND		0.0010	ND		0.0010	ND		0.0010
Silver		ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018	ND		0.00018
Magnesium		17.0		0.083	7.30		0.083	10.0		0.083	ND		0.083	ND		0.083	ND		0.083
Copper		ND		0.00063	0.00066	J	0.00063	ND		0.00063	0.0087		0.00063	0.0072		0.00063	0.0035		0.00063
Zinc		ND		0.0032	0.0061		0.0032	0.028		0.0032	0.086		0.0032	0.083		0.0032	0.028		0.0032
Manganese		2.00		0.00087	2.50		0.00087	6.4		0.00087	0.0012	J	0.00087	ND		0.00087	ND		0.00087
Chromium		ND		0.0015	ND		0.0015	ND		0.0015	ND		0.0015	ND		0.0015	ND		0.0015
Cobalt		0.0011		0.00013	0.0018		0.00013	0.0043		0.00013	ND		0.00013	ND		0.00013	ND		0.00013
Molybdenum		ND		0.00061	0.00093	J	0.00061	0.0021	J	0.00061	ND		0.00061	ND		0.00061	ND		0.00061
Strontium		0.16		0.00093	0.12		0.00093	0.16		0.00093	ND		0.00093	0.0021	J	0.00093	0.0014	J	0.00093
Boron		0.14		0.039	ND		0.039	0.039	J	0.039	ND		0.039	ND		0.039	ND		0.039
Tin		ND		0.0010	ND		0.0010	ND		0.0010	ND		0.0010	ND		0.0010	ND		0.0010
Hexavalent Chromium		ND		0.010	ND		0.010	ND		0.010	ND		0.010	ND		0.010	ND		0.010
pH		7.70	H H3	0.10	7.60	H H3	0.10	7.90	H H3	0.10	4.30	H H3	0.10	4.40	H H3	0.10	4.30	H H3	0.10
Hardness as calcium carbonate		120		0.55	82.0		0.55	120		0.55	ND		0.55	0.85	J	0.55	0.60	J	0.55

Notes

H: Sample was prepped or analyzed beyond the specified holding time.

H3: Sample was received and analyzed past holding time.

J: Result is less than the reporting limit but greater than or equal to the MDL and the concentration is an approximate value.

MDL: method detection limit

mg/L: milligrams per liter

ND: Not detected at the MDL shown in the third column for each sample.

TABLE A2

Table A2: Location Specific Bromide Diffusion Constants (K_{D-Br}) and Percentage to Steady State Reached by Tracers During Deployment

Kelset Creek, Victoria, BC

Client ID	06169-01		06169-02		06169-03		06169-04		06169-05		06169-06		06169-07		06169-08		06169-09	
Diffusion Tracer	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State	K_{D-Br}	Steady State
	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%	(d^{-1})	%
Bromide	0.0416	71.3	0.0143	34.9	NA	100	NA	100	0.1727	99.4	NA	100	0.0219	47.1	0.0241	51.5	0.0227	48.2

Notes

%: percent

d: day

 K_{D-Br} : location specific bromide diffusion constant

NA: Not Applicable. Bromide was not detected in the peeper sample, therefore a location specific bromide diffusion coefficient was not calculable. It is assumed the peeper and pore water came to 100% equilibrium and the peeper concentration is equal to the porewater concentration.

ATTACHMENT B:
ANALYTICAL REPORTS

ANALYTICAL REPORT

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238
Tel: (412)963-7058

Laboratory Job ID: 180-130726-1
Client Project/Site: Kelset, Golder

For:
Sirem, div of Geosyntec Consultants
130 Stone Rd West
Guelph, Ontario N1G 3Z2

Attn: Dr. Brent Pautler



Authorized for release by:
12/20/2021 2:57:39 PM

Carrie Gamber, Senior Project Manager
(412)963-2428
Carrie.Gamber@Eurofinset.com

LINKS

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www.eurofinsus.com/Env

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

PA Lab ID: 02-00416



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Case Narrative

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Job ID: 180-130726-1

Laboratory: Eurofins TestAmerica, Pittsburgh

Narrative

CASE NARRATIVE

Client: Sirem, div of Geosyntec Consultants

Project: Kelset, Golder

Report Number: 180-130726-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 12/03/2021; the samples arrived in good condition, properly preserved and on ice. The temperature of the cooler at receipt was 7.6 C (acceptable is 6.0 degrees C or less)

The samples were received at the laboratory outside the required temperature criteria. The temperature is noted and the analyses proceeded. Thermal preservation is not required for metals.

IC

Several samples were diluted due to the conductivity of the sample matrix. Elevated reporting limits (RLs) are provided.

METALS

Tin was detected in method blank MB 180-381123/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged.

GENERAL CHEMSITRY

The pH has a holding time of immediate. The pH performed in the laboratory is outside the immediate holding time. The data is flagged and reported.

Definitions/Glossary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
H3	Sample was received and analyzed past holding time.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
▫	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Accreditation/Certification Summary

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Laboratory: Eurofins TestAmerica, Pittsburgh

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Arkansas DEQ	State	19-033-0	06-27-22
California	State	2891	04-30-22
Connecticut	State	PH-0688	09-30-22
Florida	NELAP	E871008	06-30-22
Georgia	State	PA 02-00416	04-30-22
Illinois	NELAP	004375	06-30-22
Kansas	NELAP	E-10350	01-31-22
Kentucky (UST)	State	162013	04-30-22
Kentucky (WW)	State	KY98043	12-31-21
Louisiana	NELAP	04041	06-30-22
Maine	State	PA00164	03-06-22
Minnesota	NELAP	042-999-482	12-31-21
Nevada	State	PA00164	08-31-22
New Hampshire	NELAP	2030	04-05-22
New Jersey	NELAP	PA005	06-30-22
New York	NELAP	11182	04-01-22
North Carolina (WW/SW)	State	434	12-31-21
North Dakota	State	R-227	04-30-22
Oregon	NELAP	PA-2151	02-06-22
Pennsylvania	NELAP	02-00416	04-30-22
Rhode Island	State	LAO00362	12-31-21
South Carolina	State	89014	04-30-22
Texas	NELAP	T104704528	03-31-22
USDA	Federal	P-Soil-01	06-26-22
USDA	US Federal Programs	P330-16-00211	06-26-22
Utah	NELAP	PA001462019-8	05-31-22
Virginia	NELAP	10043	09-15-22
West Virginia DEP	State	142	01-31-22
Wisconsin	State	998027800	12-19-21

Sample Summary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-130726-1	06169-01	Water	11/24/21 13:45	12/03/21 09:30
180-130726-2	06169-02	Water	11/24/21 14:25	12/03/21 09:30
180-130726-3	06169-03	Water	11/24/21 15:00	12/03/21 09:30
180-130726-4	06169-04	Water	11/24/21 15:40	12/03/21 09:30
180-130726-5	06169-05	Water	11/24/21 16:05	12/03/21 09:30
180-130726-6	06169-06	Water	11/24/21 17:00	12/03/21 09:30
180-130726-7	06169-07	Water	11/25/21 09:15	12/03/21 09:30
180-130726-8	06169-08	Water	11/25/21 09:45	12/03/21 09:30
180-130726-9	06169-09	Water	11/25/21 10:30	12/03/21 09:30
180-130726-10	06169-10	Water	11/25/21 10:50	12/03/21 09:30
180-130726-11	06169-11	Water	11/25/21 11:30	12/03/21 09:30
180-130726-12	06169-12	Water	11/25/21 12:00	12/03/21 09:30

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13

Method Summary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Method	Method Description	Protocol	Laboratory
EPA 9056A	Anions, Ion Chromatography	SW846	TAL PIT
EPA 6020B	Metals (ICP/MS)	SW846	TAL PIT
SM 2340B	Total Hardness (as CaCO ₃) by calculation	SM	TAL PIT
EPA 9040C	pH	SW846	TAL PIT
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	TAL PIT

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PIT = Eurofins TestAmerica, Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058



Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-01

Lab Sample ID: 180-130726-1

Date Collected: 11/24/21 13:45

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		1			381392	12/09/21 01:24	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			25 mL	25 mL	381125	12/06/21 14:46	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 11:44	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:15	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-02

Lab Sample ID: 180-130726-2

Date Collected: 11/24/21 14:25

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		4			381484	12/09/21 18:43	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 11:52	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:17	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-03

Lab Sample ID: 180-130726-3

Date Collected: 11/24/21 15:00

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		1			381392	12/09/21 02:51	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 11:55	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:19	MJH	TAL PIT
Instrument ID: NOEQUIP										

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-04

Lab Sample ID: 180-130726-4

Date Collected: 11/24/21 15:40

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		1			381392	12/09/21 03:05	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 11:59	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:20	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-05

Lab Sample ID: 180-130726-5

Date Collected: 11/24/21 16:05

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		1			381392	12/09/21 03:20	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:03	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:22	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-06

Lab Sample ID: 180-130726-6

Date Collected: 11/24/21 17:00

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		1			381392	12/09/21 00:12	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:10	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:24	MJH	TAL PIT
Instrument ID: NOEQUIP										

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-07

Lab Sample ID: 180-130726-7

Date Collected: 11/25/21 09:15

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		5			381392	12/09/21 03:49	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:14	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:25	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-08

Lab Sample ID: 180-130726-8

Date Collected: 11/25/21 09:45

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		4			381482	12/09/21 09:36	JRB	TAL PIT
Instrument ID: CHICS2100B										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:24	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:27	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-09

Lab Sample ID: 180-130726-9

Date Collected: 11/25/21 10:30

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		2			381697	12/10/21 21:30	JRB	TAL PIT
Instrument ID: CHIC2100A										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:28	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:37	MJH	TAL PIT
Instrument ID: NOEQUIP										

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-10

Lab Sample ID: 180-130726-10

Date Collected: 11/25/21 10:50

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		4			381484	12/09/21 18:57	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:32	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:39	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-11

Lab Sample ID: 180-130726-11

Date Collected: 11/25/21 11:30

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		4			381484	12/09/21 19:12	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:35	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:40	MJH	TAL PIT
Instrument ID: NOEQUIP										

Client Sample ID: 06169-12

Lab Sample ID: 180-130726-12

Date Collected: 11/25/21 12:00

Matrix: Water

Date Received: 12/03/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		4			381484	12/09/21 19:26	JRB	TAL PIT
Instrument ID: INTEGRION										
Dissolved	Prep	3005A			50 mL	50 mL	381123	12/06/21 14:44	RGM	TAL PIT
Dissolved	Analysis	EPA 6020B		1			381477	12/08/21 12:39	RSK	TAL PIT
Instrument ID: A										
Total Recoverable	Analysis	SM 2340B		1			382224	12/14/21 15:14	RSR	TAL PIT
Instrument ID: NOEQUIP										
Dissolved	Analysis	EPA 9040C		1			381831	12/11/21 10:42	MJH	TAL PIT
Instrument ID: NOEQUIP										

Laboratory References:

TAL PIT = Eurofins TestAmerica, Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Eurofins TestAmerica, Pittsburgh

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Analyst References:

Lab: TAL PIT

Batch Type: Prep

RGM = Rebecca Manns

Batch Type: Analysis

JRB = James Burzio

MJH = Michael Houde

RSK = Robert Kurtz

RSR = Roseann Ruyechan



Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-01

Lab Sample ID: 180-130726-1

Date Collected: 11/24/21 13:45

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	26		0.10	0.053	mg/L			12/09/21 01:24	1

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	13	ug/L		12/06/21 14:46	12/08/21 11:44	1
Nickel	0.46	J	1.0	0.34	ug/L		12/06/21 14:46	12/08/21 11:44	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:46	12/08/21 11:44	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:46	12/08/21 11:44	1
Sodium	6300		500	350	ug/L		12/06/21 14:46	12/08/21 11:44	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:46	12/08/21 11:44	1
Barium	13		10	1.6	ug/L		12/06/21 14:46	12/08/21 11:44	1
Calcium	11000		500	130	ug/L		12/06/21 14:46	12/08/21 11:44	1
Iron	580		50	20	ug/L		12/06/21 14:46	12/08/21 11:44	1
Vanadium	ND		1.0	0.99	ug/L		12/06/21 14:46	12/08/21 11:44	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:46	12/08/21 11:44	1
Magnesium	3700		500	83	ug/L		12/06/21 14:46	12/08/21 11:44	1
Copper	2.0		2.0	0.63	ug/L		12/06/21 14:46	12/08/21 11:44	1
Zinc	5.3		5.0	3.2	ug/L		12/06/21 14:46	12/08/21 11:44	1
Manganese	770		5.0	0.87	ug/L		12/06/21 14:46	12/08/21 11:44	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:46	12/08/21 11:44	1
Cobalt	0.30	J	0.50	0.13	ug/L		12/06/21 14:46	12/08/21 11:44	1
Molybdenum	1.1	J	5.0	0.61	ug/L		12/06/21 14:46	12/08/21 11:44	1
Strontium	54		5.0	0.93	ug/L		12/06/21 14:46	12/08/21 11:44	1
Boron	ND		80	39	ug/L		12/06/21 14:46	12/08/21 11:44	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:46	12/08/21 11:44	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	43		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.7	H H3	0.1	0.1	SU			12/11/21 10:15	1

Client Sample ID: 06169-02

Lab Sample ID: 180-130726-2

Date Collected: 11/24/21 14:25

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	59		0.40	0.21	mg/L			12/09/21 18:43	4

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	15	J	30	13	ug/L		12/06/21 14:44	12/08/21 11:52	1
Nickel	ND		1.0	0.34	ug/L		12/06/21 14:44	12/08/21 11:52	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 11:52	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 11:52	1
Sodium	14000		500	350	ug/L		12/06/21 14:44	12/08/21 11:52	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 11:52	1
Barium	44		10	1.6	ug/L		12/06/21 14:44	12/08/21 11:52	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-02

Lab Sample ID: 180-130726-2

Date Collected: 11/24/21 14:25

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	15000		500	130	ug/L		12/06/21 14:44	12/08/21 11:52	1
Iron	16000		50	20	ug/L		12/06/21 14:44	12/08/21 11:52	1
Vanadium	2.3		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 11:52	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 11:52	1
Magnesium	6100		500	83	ug/L		12/06/21 14:44	12/08/21 11:52	1
Copper	1.9	J	2.0	0.63	ug/L		12/06/21 14:44	12/08/21 11:52	1
Zinc	11		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 11:52	1
Manganese	2200		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 11:52	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 11:52	1
Cobalt	0.43	J	0.50	0.13	ug/L		12/06/21 14:44	12/08/21 11:52	1
Molybdenum	ND		5.0	0.61	ug/L		12/06/21 14:44	12/08/21 11:52	1
Strontium	100		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 11:52	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 11:52	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 11:52	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	63		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.4	H H3	0.1	0.1	SU			12/11/21 10:17	1

Client Sample ID: 06169-03

Lab Sample ID: 180-130726-3

Date Collected: 11/24/21 15:00

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/09/21 02:51	1

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	25	J	30	13	ug/L		12/06/21 14:44	12/08/21 11:55	1
Nickel	0.85	J	1.0	0.34	ug/L		12/06/21 14:44	12/08/21 11:55	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 11:55	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 11:55	1
Sodium	18000		500	350	ug/L		12/06/21 14:44	12/08/21 11:55	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 11:55	1
Barium	8.6	J	10	1.6	ug/L		12/06/21 14:44	12/08/21 11:55	1
Calcium	20000		500	130	ug/L		12/06/21 14:44	12/08/21 11:55	1
Iron	49	J	50	20	ug/L		12/06/21 14:44	12/08/21 11:55	1
Vanadium	1.0		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 11:55	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 11:55	1
Magnesium	7300		500	83	ug/L		12/06/21 14:44	12/08/21 11:55	1
Copper	4.1		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 11:55	1
Zinc	12		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 11:55	1
Manganese	3.9	J	5.0	0.87	ug/L		12/06/21 14:44	12/08/21 11:55	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 11:55	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 11:55	1
Molybdenum	1.9	J	5.0	0.61	ug/L		12/06/21 14:44	12/08/21 11:55	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-03

Lab Sample ID: 180-130726-3

Date Collected: 11/24/21 15:00

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	86		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 11:55	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 11:55	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 11:55	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	80		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.8	H H3	0.1	0.1	SU			12/11/21 10:19	1

Client Sample ID: 06169-04

Lab Sample ID: 180-130726-4

Date Collected: 11/24/21 15:40

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/09/21 03:05	1

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	53		30	13	ug/L		12/06/21 14:44	12/08/21 11:59	1
Nickel	0.98	J	1.0	0.34	ug/L		12/06/21 14:44	12/08/21 11:59	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 11:59	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 11:59	1
Sodium	18000		500	350	ug/L		12/06/21 14:44	12/08/21 11:59	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 11:59	1
Barium	8.2	J	10	1.6	ug/L		12/06/21 14:44	12/08/21 11:59	1
Calcium	21000		500	130	ug/L		12/06/21 14:44	12/08/21 11:59	1
Iron	71		50	20	ug/L		12/06/21 14:44	12/08/21 11:59	1
Vanadium	1.0		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 11:59	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 11:59	1
Magnesium	7600		500	83	ug/L		12/06/21 14:44	12/08/21 11:59	1
Copper	3.7		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 11:59	1
Zinc	13		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 11:59	1
Manganese	3.1	J	5.0	0.87	ug/L		12/06/21 14:44	12/08/21 11:59	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 11:59	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 11:59	1
Molybdenum	2.0	J	5.0	0.61	ug/L		12/06/21 14:44	12/08/21 11:59	1
Strontium	89		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 11:59	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 11:59	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 11:59	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	84		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.8	H H3	0.1	0.1	SU			12/11/21 10:20	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-05

Lab Sample ID: 180-130726-5

Date Collected: 11/24/21 16:05

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	0.51		0.10	0.053	mg/L			12/09/21 03:20	1

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	13	ug/L		12/06/21 14:44	12/08/21 12:03	1
Nickel	0.78	J	1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:03	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:03	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:03	1
Sodium	17000		500	350	ug/L		12/06/21 14:44	12/08/21 12:03	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:03	1
Barium	8.0	J	10	1.6	ug/L		12/06/21 14:44	12/08/21 12:03	1
Calcium	20000		500	130	ug/L		12/06/21 14:44	12/08/21 12:03	1
Iron	23	J	50	20	ug/L		12/06/21 14:44	12/08/21 12:03	1
Vanadium	1.2		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:03	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:03	1
Magnesium	7400		500	83	ug/L		12/06/21 14:44	12/08/21 12:03	1
Copper	3.2		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:03	1
Zinc	8.5		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:03	1
Manganese	22		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:03	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:03	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:03	1
Molybdenum	1.8	J	5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:03	1
Strontium	88		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:03	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 12:03	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:03	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	80		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.0	H H3	0.1	0.1	SU			12/11/21 10:22	1

Client Sample ID: 06169-06

Lab Sample ID: 180-130726-6

Date Collected: 11/24/21 17:00

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/09/21 00:12	1

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	25	J	30	13	ug/L		12/06/21 14:44	12/08/21 12:10	1
Nickel	0.69	J	1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:10	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:10	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:10	1
Sodium	17000		500	350	ug/L		12/06/21 14:44	12/08/21 12:10	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:10	1
Barium	7.6	J	10	1.6	ug/L		12/06/21 14:44	12/08/21 12:10	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-06

Lab Sample ID: 180-130726-6

Date Collected: 11/24/21 17:00

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	19000		500	130	ug/L		12/06/21 14:44	12/08/21 12:10	1
Iron	55		50	20	ug/L		12/06/21 14:44	12/08/21 12:10	1
Vanadium	1.0		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:10	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:10	1
Magnesium	7100		500	83	ug/L		12/06/21 14:44	12/08/21 12:10	1
Copper	4.1		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:10	1
Zinc	11		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:10	1
Manganese	2.0	J	5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:10	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:10	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:10	1
Molybdenum	1.9	J	5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:10	1
Strontium	81		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:10	1
Boron	66	J	80	39	ug/L		12/06/21 14:44	12/08/21 12:10	1
Tin	1.4	J	5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:10	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	77		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.0	H H3	0.1	0.1	SU			12/11/21 10:24	1

Client Sample ID: 06169-07

Lab Sample ID: 180-130726-7

Date Collected: 11/25/21 09:15

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	48		0.50	0.27	mg/L			12/09/21 03:49	5

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	32		30	13	ug/L		12/06/21 14:44	12/08/21 12:14	1
Nickel	0.83	J	1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:14	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:14	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:14	1
Sodium	110000		500	350	ug/L		12/06/21 14:44	12/08/21 12:14	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:14	1
Barium	27		10	1.6	ug/L		12/06/21 14:44	12/08/21 12:14	1
Calcium	21000		500	130	ug/L		12/06/21 14:44	12/08/21 12:14	1
Iron	10000		50	20	ug/L		12/06/21 14:44	12/08/21 12:14	1
Vanadium	1.6		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:14	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:14	1
Magnesium	17000		500	83	ug/L		12/06/21 14:44	12/08/21 12:14	1
Copper	ND		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:14	1
Zinc	ND		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:14	1
Manganese	2000		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:14	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:14	1
Cobalt	1.1		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:14	1
Molybdenum	ND		5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:14	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-07

Lab Sample ID: 180-130726-7

Date Collected: 11/25/21 09:15

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	160		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:14	1
Boron	140		80	39	ug/L		12/06/21 14:44	12/08/21 12:14	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:14	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	120		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.7	H H3	0.1	0.1	SU			12/11/21 10:25	1

Client Sample ID: 06169-08

Lab Sample ID: 180-130726-8

Date Collected: 11/25/21 09:45

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	44		0.40	0.21	mg/L			12/09/21 09:36	4

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	18	J	30	13	ug/L		12/06/21 14:44	12/08/21 12:24	1
Nickel	0.98	J	1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:24	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:24	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:24	1
Sodium	17000		500	350	ug/L		12/06/21 14:44	12/08/21 12:24	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:24	1
Barium	35		10	1.6	ug/L		12/06/21 14:44	12/08/21 12:24	1
Calcium	21000		500	130	ug/L		12/06/21 14:44	12/08/21 12:24	1
Iron	8400		50	20	ug/L		12/06/21 14:44	12/08/21 12:24	1
Vanadium	1.6		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:24	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:24	1
Magnesium	7300		500	83	ug/L		12/06/21 14:44	12/08/21 12:24	1
Copper	0.66	J	2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:24	1
Zinc	6.1		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:24	1
Manganese	2500		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:24	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:24	1
Cobalt	1.8		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:24	1
Molybdenum	0.93	J	5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:24	1
Strontium	120		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:24	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 12:24	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:24	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	82		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.6	H H3	0.1	0.1	SU			12/11/21 10:27	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-09

Lab Sample ID: 180-130726-9

Date Collected: 11/25/21 10:30

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	47		0.20	0.11	mg/L			12/10/21 21:30	2

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	13	ug/L		12/06/21 14:44	12/08/21 12:28	1
Nickel	2.2		1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:28	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:28	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:28	1
Sodium	20000		500	350	ug/L		12/06/21 14:44	12/08/21 12:28	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:28	1
Barium	37		10	1.6	ug/L		12/06/21 14:44	12/08/21 12:28	1
Calcium	30000		500	130	ug/L		12/06/21 14:44	12/08/21 12:28	1
Iron	8200		50	20	ug/L		12/06/21 14:44	12/08/21 12:28	1
Vanadium	ND		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:28	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:28	1
Magnesium	10000		500	83	ug/L		12/06/21 14:44	12/08/21 12:28	1
Copper	ND		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:28	1
Zinc	28		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:28	1
Manganese	6400		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:28	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:28	1
Cobalt	4.3		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:28	1
Molybdenum	2.1 J		5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:28	1
Strontium	160		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:28	1
Boron	39 J		80	39	ug/L		12/06/21 14:44	12/08/21 12:28	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:28	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	120		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.9	H H3	0.1	0.1	SU			12/11/21 10:37	1

Client Sample ID: 06169-10

Lab Sample ID: 180-130726-10

Date Collected: 11/25/21 10:50

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	90		0.40	0.21	mg/L			12/09/21 18:57	4

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	13	ug/L		12/06/21 14:44	12/08/21 12:32	1
Nickel	ND		1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:32	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:32	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:32	1
Sodium	ND		500	350	ug/L		12/06/21 14:44	12/08/21 12:32	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:32	1
Barium	ND		10	1.6	ug/L		12/06/21 14:44	12/08/21 12:32	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-10

Lab Sample ID: 180-130726-10

Date Collected: 11/25/21 10:50

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	ND		500	130	ug/L		12/06/21 14:44	12/08/21 12:32	1
Iron	ND		50	20	ug/L		12/06/21 14:44	12/08/21 12:32	1
Vanadium	ND		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:32	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:32	1
Magnesium	ND		500	83	ug/L		12/06/21 14:44	12/08/21 12:32	1
Copper	8.7		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:32	1
Zinc	86		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:32	1
Manganese	1.2 J		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:32	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:32	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:32	1
Molybdenum	ND		5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:32	1
Strontium	ND		5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:32	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 12:32	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:32	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	ND		3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.3	H H3	0.1	0.1	SU			12/11/21 10:39	1

Client Sample ID: 06169-11

Lab Sample ID: 180-130726-11

Date Collected: 11/25/21 11:30

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	91		0.40	0.21	mg/L			12/09/21 19:12	4

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	13	ug/L		12/06/21 14:44	12/08/21 12:35	1
Nickel	ND		1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:35	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:35	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:35	1
Sodium	ND		500	350	ug/L		12/06/21 14:44	12/08/21 12:35	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:35	1
Barium	ND		10	1.6	ug/L		12/06/21 14:44	12/08/21 12:35	1
Calcium	340 J		500	130	ug/L		12/06/21 14:44	12/08/21 12:35	1
Iron	ND		50	20	ug/L		12/06/21 14:44	12/08/21 12:35	1
Vanadium	ND		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:35	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:35	1
Magnesium	ND		500	83	ug/L		12/06/21 14:44	12/08/21 12:35	1
Copper	7.2		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:35	1
Zinc	83		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:35	1
Manganese	ND		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:35	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:35	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:35	1
Molybdenum	ND		5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:35	1

Eurofins TestAmerica, Pittsburgh

Client Sample Results

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Client Sample ID: 06169-11

Lab Sample ID: 180-130726-11

Date Collected: 11/25/21 11:30

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	2.1	J	5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:35	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 12:35	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:35	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	0.85	J	3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.4	H H3	0.1	0.1	SU			12/11/21 10:40	1

Client Sample ID: 06169-12

Lab Sample ID: 180-130726-12

Date Collected: 11/25/21 12:00

Matrix: Water

Date Received: 12/03/21 09:30

Method: EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	91		0.40	0.21	mg/L			12/09/21 19:26	4

Method: EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	22	J	30	13	ug/L		12/06/21 14:44	12/08/21 12:39	1
Nickel	ND		1.0	0.34	ug/L		12/06/21 14:44	12/08/21 12:39	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/08/21 12:39	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/08/21 12:39	1
Sodium	ND		500	350	ug/L		12/06/21 14:44	12/08/21 12:39	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:39	1
Barium	ND		10	1.6	ug/L		12/06/21 14:44	12/08/21 12:39	1
Calcium	240	J	500	130	ug/L		12/06/21 14:44	12/08/21 12:39	1
Iron	ND		50	20	ug/L		12/06/21 14:44	12/08/21 12:39	1
Vanadium	ND		1.0	0.99	ug/L		12/06/21 14:44	12/08/21 12:39	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/08/21 12:39	1
Magnesium	ND		500	83	ug/L		12/06/21 14:44	12/08/21 12:39	1
Copper	3.5		2.0	0.63	ug/L		12/06/21 14:44	12/08/21 12:39	1
Zinc	28		5.0	3.2	ug/L		12/06/21 14:44	12/08/21 12:39	1
Manganese	ND		5.0	0.87	ug/L		12/06/21 14:44	12/08/21 12:39	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/08/21 12:39	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/08/21 12:39	1
Molybdenum	ND		5.0	0.61	ug/L		12/06/21 14:44	12/08/21 12:39	1
Strontium	1.4	J	5.0	0.93	ug/L		12/06/21 14:44	12/08/21 12:39	1
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 12:39	1
Tin	ND		5.0	0.96	ug/L		12/06/21 14:44	12/08/21 12:39	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	0.60	J	3.3	0.55	mg/L			12/14/21 15:14	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.3	H H3	0.1	0.1	SU			12/11/21 10:42	1

Eurofins TestAmerica, Pittsburgh

QC Sample Results

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Method: EPA 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 180-381392/33
Matrix: Water
Analysis Batch: 381392

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/08/21 23:57	1

Lab Sample ID: LCS 180-381392/32
Matrix: Water
Analysis Batch: 381392

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Bromide	10.0	10.2		mg/L		102	80 - 120

Lab Sample ID: MB 180-381482/7
Matrix: Water
Analysis Batch: 381482

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/09/21 08:30	1

Lab Sample ID: LCS 180-381482/6
Matrix: Water
Analysis Batch: 381482

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Bromide	10.0	9.35		mg/L		93	80 - 120

Lab Sample ID: MB 180-381484/7
Matrix: Water
Analysis Batch: 381484

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/09/21 14:27	1

Lab Sample ID: LCS 180-381484/6
Matrix: Water
Analysis Batch: 381484

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Bromide	10.0	9.98		mg/L		100	80 - 120

Lab Sample ID: MB 180-381697/30
Matrix: Water
Analysis Batch: 381697

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			12/10/21 16:22	1

Lab Sample ID: LCS 180-381697/29
Matrix: Water
Analysis Batch: 381697

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Bromide	10.0	10.6		mg/L		106	80 - 120

Eurofins TestAmerica, Pittsburgh

QC Sample Results

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Method: EPA 9056A - Anions, Ion Chromatography

Lab Sample ID: 180-130726-6 MS
Matrix: Water
Analysis Batch: 381392

Client Sample ID: 06169-06
Prep Type: Dissolved

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Bromide	ND		10.0	10.3		mg/L		103	80 - 120

Lab Sample ID: 180-130726-6 MSD
Matrix: Water
Analysis Batch: 381392

Client Sample ID: 06169-06
Prep Type: Dissolved

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Bromide	ND		10.0	10.4		mg/L		104	80 - 120	1	15

Method: EPA 6020B - Metals (ICP/MS)

Lab Sample ID: MB 180-381123/1-A
Matrix: Water
Analysis Batch: 381302

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 381123

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	13	ug/L		12/06/21 14:44	12/07/21 19:34	1
Nickel	ND		1.0	0.34	ug/L		12/06/21 14:44	12/07/21 19:34	1
Cadmium	ND		1.0	0.22	ug/L		12/06/21 14:44	12/07/21 19:34	1
Antimony	ND		2.0	0.38	ug/L		12/06/21 14:44	12/07/21 19:34	1
Sodium	ND		500	350	ug/L		12/06/21 14:44	12/07/21 19:34	1
Beryllium	ND		1.0	0.18	ug/L		12/06/21 14:44	12/07/21 19:34	1
Barium	ND		10	1.6	ug/L		12/06/21 14:44	12/07/21 19:34	1
Calcium	ND		500	130	ug/L		12/06/21 14:44	12/07/21 19:34	1
Iron	ND		50	20	ug/L		12/06/21 14:44	12/07/21 19:34	1
Vanadium	ND		1.0	0.99	ug/L		12/06/21 14:44	12/07/21 19:34	1
Silver	ND		1.0	0.18	ug/L		12/06/21 14:44	12/07/21 19:34	1
Magnesium	ND		500	83	ug/L		12/06/21 14:44	12/07/21 19:34	1
Copper	ND		2.0	0.63	ug/L		12/06/21 14:44	12/07/21 19:34	1
Zinc	ND		5.0	3.2	ug/L		12/06/21 14:44	12/07/21 19:34	1
Manganese	ND		5.0	0.87	ug/L		12/06/21 14:44	12/07/21 19:34	1
Chromium	ND		2.0	1.5	ug/L		12/06/21 14:44	12/07/21 19:34	1
Cobalt	ND		0.50	0.13	ug/L		12/06/21 14:44	12/07/21 19:34	1
Molybdenum	ND		5.0	0.61	ug/L		12/06/21 14:44	12/07/21 19:34	1
Strontium	ND		5.0	0.93	ug/L		12/06/21 14:44	12/07/21 19:34	1
Tin	1.10	J	5.0	0.96	ug/L		12/06/21 14:44	12/07/21 19:34	1

Lab Sample ID: MB 180-381123/1-A
Matrix: Water
Analysis Batch: 381477

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 381123

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	ND		80	39	ug/L		12/06/21 14:44	12/08/21 11:48	1

Lab Sample ID: LCS 180-381123/2-A
Matrix: Water
Analysis Batch: 381302

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 381123

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	5000	4930		ug/L		99	80 - 120

Eurofins TestAmerica, Pittsburgh

QC Sample Results

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Method: EPA 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 180-381123/2-A
Matrix: Water
Analysis Batch: 381302

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 381123

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nickel	500	500		ug/L		100	80 - 120
Cadmium	500	498		ug/L		100	80 - 120
Antimony	250	238		ug/L		95	80 - 120
Sodium	25000	26100		ug/L		104	80 - 120
Beryllium	500	485		ug/L		97	80 - 120
Barium	1000	989		ug/L		99	80 - 120
Calcium	25000	26800		ug/L		107	80 - 120
Iron	5000	5080		ug/L		102	80 - 120
Vanadium	500	505		ug/L		101	80 - 120
Silver	250	247		ug/L		99	80 - 120
Magnesium	25000	25200		ug/L		101	80 - 120
Copper	500	503		ug/L		101	80 - 120
Zinc	250	249		ug/L		100	80 - 120
Manganese	500	496		ug/L		99	80 - 120
Chromium	500	501		ug/L		100	80 - 120
Cobalt	500	515		ug/L		103	80 - 120
Molybdenum	500	507		ug/L		101	80 - 120
Strontium	500	486		ug/L		97	80 - 120
Tin	1000	984		ug/L		98	80 - 120

Lab Sample ID: LCS 180-381123/2-A
Matrix: Water
Analysis Batch: 381477

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 381123

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	1250	1140		ug/L		91	80 - 120

Lab Sample ID: MB 180-381125/1-A
Matrix: Water
Analysis Batch: 381477

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 381125

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	ND		80	39	ug/L		12/06/21 14:46	12/08/21 10:10	1

Lab Sample ID: LCS 180-381125/2-A
Matrix: Water
Analysis Batch: 381477

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 381125

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	1250	1120		ug/L		90	80 - 120

Method: EPA 9040C - pH

Lab Sample ID: LCS 180-381831/1
Matrix: Water
Analysis Batch: 381831

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Eurofins TestAmerica, Pittsburgh

QC Association Summary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

HPLC/IC

Analysis Batch: 381392

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-1	06169-01	Dissolved	Water	EPA 9056A	
180-130726-3	06169-03	Dissolved	Water	EPA 9056A	
180-130726-4	06169-04	Dissolved	Water	EPA 9056A	
180-130726-5	06169-05	Dissolved	Water	EPA 9056A	
180-130726-6	06169-06	Dissolved	Water	EPA 9056A	
180-130726-7	06169-07	Dissolved	Water	EPA 9056A	
MB 180-381392/33	Method Blank	Total/NA	Water	EPA 9056A	
LCS 180-381392/32	Lab Control Sample	Total/NA	Water	EPA 9056A	
180-130726-6 MS	06169-06	Dissolved	Water	EPA 9056A	
180-130726-6 MSD	06169-06	Dissolved	Water	EPA 9056A	

Analysis Batch: 381482

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-8	06169-08	Dissolved	Water	EPA 9056A	
MB 180-381482/7	Method Blank	Total/NA	Water	EPA 9056A	
LCS 180-381482/6	Lab Control Sample	Total/NA	Water	EPA 9056A	

Analysis Batch: 381484

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-2	06169-02	Dissolved	Water	EPA 9056A	
180-130726-10	06169-10	Dissolved	Water	EPA 9056A	
180-130726-11	06169-11	Dissolved	Water	EPA 9056A	
180-130726-12	06169-12	Dissolved	Water	EPA 9056A	
MB 180-381484/7	Method Blank	Total/NA	Water	EPA 9056A	
LCS 180-381484/6	Lab Control Sample	Total/NA	Water	EPA 9056A	

Analysis Batch: 381697

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-9	06169-09	Dissolved	Water	EPA 9056A	
MB 180-381697/30	Method Blank	Total/NA	Water	EPA 9056A	
LCS 180-381697/29	Lab Control Sample	Total/NA	Water	EPA 9056A	

Metals

Prep Batch: 381123

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-2	06169-02	Dissolved	Water	3005A	
180-130726-3	06169-03	Dissolved	Water	3005A	
180-130726-4	06169-04	Dissolved	Water	3005A	
180-130726-5	06169-05	Dissolved	Water	3005A	
180-130726-6	06169-06	Dissolved	Water	3005A	
180-130726-7	06169-07	Dissolved	Water	3005A	
180-130726-8	06169-08	Dissolved	Water	3005A	
180-130726-9	06169-09	Dissolved	Water	3005A	
180-130726-10	06169-10	Dissolved	Water	3005A	
180-130726-11	06169-11	Dissolved	Water	3005A	
180-130726-12	06169-12	Dissolved	Water	3005A	
MB 180-381123/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 180-381123/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Eurofins TestAmerica, Pittsburgh

QC Association Summary

Client: Sirem, div of Geosyntec Consultants
 Project/Site: Kelset, Golder

Job ID: 180-130726-1

Metals

Prep Batch: 381125

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-1	06169-01	Dissolved	Water	3005A	
MB 180-381125/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 180-381125/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Analysis Batch: 381302

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 180-381123/1-A	Method Blank	Total Recoverable	Water	EPA 6020B	381123
LCS 180-381123/2-A	Lab Control Sample	Total Recoverable	Water	EPA 6020B	381123

Analysis Batch: 381477

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-1	06169-01	Dissolved	Water	EPA 6020B	381125
180-130726-2	06169-02	Dissolved	Water	EPA 6020B	381123
180-130726-3	06169-03	Dissolved	Water	EPA 6020B	381123
180-130726-4	06169-04	Dissolved	Water	EPA 6020B	381123
180-130726-5	06169-05	Dissolved	Water	EPA 6020B	381123
180-130726-6	06169-06	Dissolved	Water	EPA 6020B	381123
180-130726-7	06169-07	Dissolved	Water	EPA 6020B	381123
180-130726-8	06169-08	Dissolved	Water	EPA 6020B	381123
180-130726-9	06169-09	Dissolved	Water	EPA 6020B	381123
180-130726-10	06169-10	Dissolved	Water	EPA 6020B	381123
180-130726-11	06169-11	Dissolved	Water	EPA 6020B	381123
180-130726-12	06169-12	Dissolved	Water	EPA 6020B	381123
MB 180-381123/1-A	Method Blank	Total Recoverable	Water	EPA 6020B	381123
MB 180-381125/1-A	Method Blank	Total Recoverable	Water	EPA 6020B	381125
LCS 180-381123/2-A	Lab Control Sample	Total Recoverable	Water	EPA 6020B	381123
LCS 180-381125/2-A	Lab Control Sample	Total Recoverable	Water	EPA 6020B	381125

Analysis Batch: 382224

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-1	06169-01	Total Recoverable	Water	SM 2340B	
180-130726-2	06169-02	Total Recoverable	Water	SM 2340B	
180-130726-3	06169-03	Total Recoverable	Water	SM 2340B	
180-130726-4	06169-04	Total Recoverable	Water	SM 2340B	
180-130726-5	06169-05	Total Recoverable	Water	SM 2340B	
180-130726-6	06169-06	Total Recoverable	Water	SM 2340B	
180-130726-7	06169-07	Total Recoverable	Water	SM 2340B	
180-130726-8	06169-08	Total Recoverable	Water	SM 2340B	
180-130726-9	06169-09	Total Recoverable	Water	SM 2340B	
180-130726-10	06169-10	Total Recoverable	Water	SM 2340B	
180-130726-11	06169-11	Total Recoverable	Water	SM 2340B	
180-130726-12	06169-12	Total Recoverable	Water	SM 2340B	

General Chemistry

Analysis Batch: 381831

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-1	06169-01	Dissolved	Water	EPA 9040C	
180-130726-2	06169-02	Dissolved	Water	EPA 9040C	
180-130726-3	06169-03	Dissolved	Water	EPA 9040C	
180-130726-4	06169-04	Dissolved	Water	EPA 9040C	

Eurofins TestAmerica, Pittsburgh

QC Association Summary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Kelset, Golder

Job ID: 180-130726-1

General Chemistry (Continued)

Analysis Batch: 381831 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-130726-5	06169-05	Dissolved	Water	EPA 9040C	
180-130726-6	06169-06	Dissolved	Water	EPA 9040C	
180-130726-7	06169-07	Dissolved	Water	EPA 9040C	
180-130726-8	06169-08	Dissolved	Water	EPA 9040C	
180-130726-9	06169-09	Dissolved	Water	EPA 9040C	
180-130726-10	06169-10	Dissolved	Water	EPA 9040C	
180-130726-11	06169-11	Dissolved	Water	EPA 9040C	
180-130726-12	06169-12	Dissolved	Water	EPA 9040C	
LCS 180-381831/1	Lab Control Sample	Total/NA	Water	EPA 9040C	

Eurofins TestAmerica, Pittsburgh

301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone: 412-963-7058 Fax: 412-963-2468

Chain of Custody Record

Client Information		Sampler: <u>Robyn Chatwin-Davies</u>		Lab PM: Gamber, Carrie L		Carrier Tracking No(s):		COC No: 180-75250-14496.2			
Client Contact: Dr. Brent Pautler		Phone: <u>250-418-0378</u>		E-Mail: <u>Carrie.Gamber@Eurofinset.com</u>		State of Origin: <u>BC, Canada</u>		Page: <u>1</u> of 2			
Company: Sirem, div of Geosyntec Consultants				PWSID:		Analysis Requested					
Address: 130 Stone Rd West		Due Date Requested: <u>Standard post shipping</u>		Field Filtered Sample (Yes or No) Perform MS/MSD (Yes or No) <u>Disolved metals</u> <u>Bromide (IC Br)</u>		Total Number of containers		Preservation Codes:			
City: Guelph		TAT Requested (days): <u>10-15</u>						A - HCL		M - Hexane	
State, Zip: ON, N1G 3Z2		Compliance Project: <input type="checkbox"/> Yes <input type="checkbox"/> No						B - NaOH		N - None	
Phone: 519-515-0837(Tel)		PO #: BR0457						C - Zn Acetate		O - AsNaO2	
Email: bpautler@siremlab.com		WO #:		D - Nitric Acid		P - Na2O4S		E - NaHSO4			
Project Name: Golder		Project #: 18022677		G - Amchlor		Q - Na2SO3		F - MeOH			
Site: <u>KELSET, Golder</u>		SSOW#:		H - Ascorbic Acid		R - Na2S2O3		S - H2SO4			
Sample Identification		Sample Date		Sample Time		Sample Type (C=Comp, G=grab)		Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)			
								Preservation Code:			
<u>06169-01</u>		<u>24/11/2021</u>		<u>13:45</u>		<u>C</u>		<u>W</u>			
<u>06169-02</u>		<u>24/11/2021</u>		<u>14:25</u>		<u>C</u>		<u>W</u>			
<u>06169-03</u>		<u>↓</u>		<u>15:00</u>		<u>C</u>		<u>W</u>			
<u>06169-04</u>		<u>↓</u>		<u>15:40</u>		<u>C</u>		<u>W</u>			
<u>06169-05</u>		<u>↓</u>		<u>16:05</u>		<u>C</u>		<u>W</u>			
<u>06169-06</u>		<u>24/11/2021</u>		<u>17:00</u>		<u>C</u>		<u>W</u>			
<u>06169-07</u>		<u>25/11/2021</u>		<u>09:15</u>		<u>C</u>		<u>W</u>			
<u>06169-08</u>		<u>↓</u>		<u>09:45</u>		<u>C</u>		<u>W</u>			
<u>06169-09</u>		<u>↓</u>		<u>10:30</u>		<u>C</u>		<u>W</u>			
<u>06169-10</u>		<u>↓</u>		<u>10:50</u>		<u>C</u>		<u>W</u>			
<u>06169-11</u>		<u>25/11/2021</u>		<u>11:30</u>		<u>C</u>		<u>W</u>			
Possible Hazard Identification					Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)						
<input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input checked="" type="checkbox"/> Unknown <input type="checkbox"/> Radiological					<input type="checkbox"/> Return To Client <input checked="" type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months						
Deliverable Requested: I, II, III, IV, Other (specify) <u>Standard for SIREM</u>					Special Instructions/QC Requirements: <u>Report to SIREM + Golder (AFast@golder.com)</u>						
Empty Kit Relinquished by:			Date:		Time:		Method of Shipment: <u>FedEX</u>				
Relinquished by: <u>Robyn Chatwin-Davies Relinquished</u>		Date/Time: <u>Nov 21 2021 11:00</u>		Company: <u>Golder</u>		Received by: <u>DW aton</u>		Date/Time: <u>12-3-21 9:30</u>			
Relinquished by:		Date/Time:		Company:		Received by:		Date/Time:			
Relinquished by:		Date/Time:		Company:		Received by:		Date/Time:			
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:			Cooler Temperature(s) °C and Other Remarks:						



Eurofins TestAmerica, Pittsburgh

301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone: 412-963-7058 Fax: 412-963-2468

Chain of Custody Record



Client Information		Sampler: <i>Robyn Chatwin-Davies</i>		Lab PM: Gamber, Carrie L		Carrier Tracking No(s):		COC No: 180-75250-14496.1					
Client Contact: Dr. Brent Pautler		Phone: <i>250-418-0378</i>		E-Mail: Carrie.Gamber@Eurofinset.com		State of Origin:		Page: <i>2</i> of 2					
Company: Sirem, div of Geosyntec Consultants				PWSID:				Job #:					
Address: 130 Stone Rd West		Due Date Requested: <i>Standard post shipping</i>		Analysis Requested Field Filtered Sample (Yes or No) / Perform MS/MSD (Yes or No) <i>Disolved metals</i> <i>Bromide (IC Br)</i>								Preservation Codes: A - HCL M - Hexane B - NaOH N - None C - Zn Acetate O - AsNaO2 D - Nitric Acid P - Na2O4S E - NaHSO4 Q - Na2SO3 F - MeOH R - Na2S2O3 G - Amchlor S - H2SO4 H - Ascorbic Acid T - TSP Dodecahydrate I - Ice U - Acetone J - DI Water V - MCAA K - EDTA W - pH 4-5 L - EDA Z - other (specify)	
City: Guelph		TAT Requested (days): <i>10-15</i>											
State, Zip: ON, N1G 3Z2		Regular (10-15 days)											
Phone: 519-515-0837(Tel)		Compliance Project: <input type="checkbox"/> Yes <input type="checkbox"/> No											
Email: bpautler@siremlab.com		PO #: BR0457		Project #: 18022677		SSOW#:		Other:					
Project Name: Golder		Site: <i>KELSET, Golder</i>											
Sample Identification			Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No) / Perform MS/MSD (Yes or No)		Total Number of containers	Special Instructions/Note:			
06169-12			25/11/2021	12:00	C	W	Y N X X		2				
Possible Hazard Identification <input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input checked="" type="checkbox"/> Unknown <input type="checkbox"/> Radiological						Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) <input type="checkbox"/> Return To Client <input checked="" type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months							
Deliverable Requested: I, II, III, IV, Other (specify) <i>Standard for SIREM</i>						Special Instructions/QC Requirements: <i>Report to SIREM + Golder (AFast@golder.com)</i>							
Empty Kit Relinquished by:			Date:		Time:		Method of Shipment: <i>FedEX</i>						
Relinquished by: <i>Robyn Chatwin-Davies Relinquished</i>		Date/Time: <i>Nov 29 2021 11:00</i>		Company: <i>Golder</i>		Received by: <i>D Watson</i>		Date/Time: <i>12.3.21 9:30</i>		Company: <i>EAFC</i>			
Relinquished by:		Date/Time:		Company:		Received by:		Date/Time:		Company:			
Relinquished by:		Date/Time:		Company:		Received by:		Date/Time:		Company:			
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:				Cooler Temperature(s) °C and Other Remarks:							

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Sender You must seal flap before shipping



180-130726 Waybill

ORIGIN ID: YYJA (236) 464-1384
GOLDER ASSOCIATES LTD
GOLDER ASSOCIATES LTD
185 LANGFORD STREET
VICTORIA, BC V9A3B8
CANADA CA

SHIP DATE: 29NOV21
ACTWGT: 24.00 LB
CAD: 4732829INET4400
DIMS: 24x16x14 IN
BILL SENDER

To TEST AMERICA
EUROFINS
301 ALPHA DRIVE

PITTSBURGH PA 15238

(US)

(412) 963-7058 REF: 21455123-3000-2000

DEPT: 7.6
UNcorrected temp 7.6
Thermometer ID X

CF D Initials Mo
PT-WI-SR-001 effective 11/8/18



11:30A

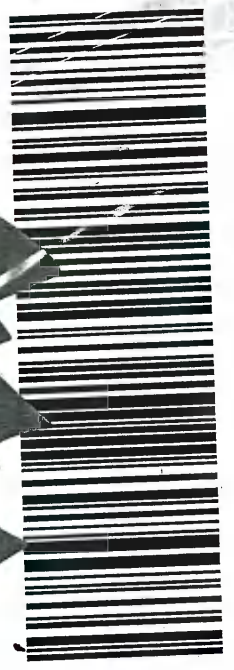
INTL PRIORITY

TRK# 7753 3324 8188

0430

XN AGCA

15238
PIT
PA-US



Login Sample Receipt Checklist

Client: Sirem, div of Geosyntec Consultants

Job Number: 180-130726-1

Login Number: 130726

List Source: Eurofins TestAmerica, Pittsburgh

List Number: 1

Creator: Watson, Debbie

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	False	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <math><6\text{mm}</math> (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	





CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)
219-800 BARRARD ST
VANCOUVER, BC V6Z 0B9
604-671-1831

ATTENTION TO: Alexis Fast
PROJECT: 21455123-3000

AGAT WORK ORDER: 21V836225

WATER ANALYSIS REVIEWED BY: Dana Solari, Lab Reporter

DATE REPORTED: Dec 03, 2021

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (778) 452-4000

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
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- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



Certificate of Analysis

AGAT WORK ORDER: 21V836225

PROJECT: 21455123-3000

Unit 120, 8600 Glenlyon Parkway
 Burnaby, British Columbia
 CANADA V5J 0B6
 TEL (778)452-4000
 FAX (778)452-4074
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Alexis Fast

SAMPLING SITE:

SAMPLED BY:

Water Analysis - Diss. Cr6

DATE RECEIVED: 2021-11-26

DATE REPORTED: 2021-12-03

		SAMPLE DESCRIPTION:		06169-01	06169-02	06169-03	06169-04	06169-05	06169-06	06169-07	06169-08
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:		2021-11-24 13:45	2021-11-24 14:25	2021-11-24 15:00	2021-11-24 15:40	2021-11-24 16:05	2021-11-24 17:00	2021-11-25 09:15	2021-11-25 09:45
Parameter	Unit	G / S	RDL	3260521	3260523	3260524	3260525	3260526	3260527	3260528	3260529
Dissolved Chromium (VI)	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		SAMPLE DESCRIPTION:		06169-09	06169-10	06169-11	06169-12				
		SAMPLE TYPE:		Water	Water	Water	Water				
		DATE SAMPLED:		2021-11-25 10:30	2021-11-25 10:50	2021-11-25 11:30	2021-11-25 12:00				
Parameter	Unit	G / S	RDL	3260530	3260531	3260532	3260533				
Dissolved Chromium (VI)	mg/L		0.01	<0.01	<0.01	<0.01	<0.01				

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:



Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V836225
PROJECT: 21455123-3000 ATTENTION TO: Alexis Fast
SAMPLING SITE: SAMPLED BY:

Water Analysis

RPT Date: Dec 03, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

Water Analysis - Diss. Cr6															
Dissolved Chromium (VI)	3266404		<0.01	<0.01	NA	< 0.01	80%	70%	130%	84%	80%	120%	79%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By: _____



Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21V836225

PROJECT: 21455123-3000

ATTENTION TO: Alexis Fast

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis Dissolved Chromium (VI)	WATR-0300	EPA SW 846-6010B, SM 3030B	SPECTROPHOTOMETER



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 06169 page 1 of 1

200 - 2920 Virtual Way
 Vancouver, British Columbia, Canada V5M 0C4
 Telephone (604) 296-4200 Fax (604) 298-5253

Project Number: 21455123 - 3000		Laboratory Name: AGAT	
Short Title: KELSEY		Golder Contact: Alexis Fast	
Golder E-mail Address 1: AFast@golder.com		Golder E-mail Address 2: RChabwin@Golder.com	
		Address: 8600 Glenlyon Parkway Burnaby	
		Telephone/Fax: 604-603-8081	
		Contact: Jennifer Yoon	

Office Name: VICTORIA	EQUIS Facility Code: 229666564	Analyses Required: 21V836223 25 NOV 8:32AM
Turnaround Time: <input type="checkbox"/> 24 hr <input type="checkbox"/> 48 hr <input type="checkbox"/> 72 hr <input checked="" type="checkbox"/> Regular (5 Days)	EQUIS upload: <input checked="" type="checkbox"/>	

Criteria: CSR CCME BC Water Quality Other

Note: Final Reports to be issued by e-mail

Quote No.: Bill to PSPC TA 700589422

Sample Control Number (SCN)	Sample Location	Sa. #	Sample Depth (m)	Sample Matrix (over)	Date Sampled (D/M/Y)	Time Sampled (HH:MM)	Sample Type (over)	QAQC Code (over)	Related SCN (over)	Number of Containers	Hexavalent Chromium (dissolved)	RUSH (Select TAT above)	Remarks (over)
06169 - 01	PS21-02	1	/	GW	24/11/21	13:45	/	N	/	1	X		0.25 mL NaOH
06169 - 02	PS21-01	1	/	GW	24/11/21	14:25	/	N	/	1	X		"
06169 - 03	PS21-03	1	/	GW	24/11/21	15:00	/	N	/	1	X		"
06169 - 04	PW21-01	1	/	GW	24/11/21	15:40	/	N	/	1	X		"
06169 - 05	PS21-04	1	/	GW	24/11/21	16:05	/	N	/	1	X		"
06169 - 06	PW21-03	1	/	GW	24/11/21	17:00	/	N	/	1	X		"
06169 - 07	PS21-07	1	/	GW	25/11/21	09:15	/	N	/	1	X		"
06169 - 08	PS21-05	1	/	GW	25/11/21	09:45	/	N	/	1	X		"
06169 - 09	PS21-06	1	/	GW	25/11/21	10:30	/	N	/	1	X		"
06169 - 10	TB21-01	1	/	GW	25/11/21	10:50	/	TB	/	1	X		"
06169 - 11	TB21-02	1	/	GW	25/11/21	11:30	/	TB	/	1	X		"
06169 - 12	TB21-03	1	/	GW	25/11/21	12:00	/	TB	/	1	X		"

Sampler's Signature: Robyn	Relinquished by: Signature Robyn	Company: Golder	Date: 25 Nov 2021	Time: 14:00	Received by: Signature	Company
Comments: Shipped w/ ice packs samples preserved	Method of Shipment: ground	Waybill No.:	Received for Lab by:		Date	Time
	Shipped by: ACE Carrier Victoria	Shipment Condition: Seal Intact:	Temp (°C)	Cooler opened by:	Date	Time

WHITE: Golder Copy YELLOW: Lab Copy



8:32

SAMPLE INTEGRITY RECEIPT FORM - BURNABY

Work Order # 210836225

RECEIVING BASICS:

Received From: ACE

Waybill #: 626387

SAMPLE QUANTITIES:

Coolers: 1 Containers: 12

TIME SENSITIVE ISSUES:

Earliest Date Sampled: _____ ALREADY EXCEEDED? Yes No

NON-CONFORMANCES:

3 temperatures of samples* and average of each cooler: (record differing temperatures on the CoC next to sample ID's) *use jars when available

(1) 5 + 5 + 6 = 5 °C (2) ___ + ___ + ___ = ___ °C (3) ___ + ___ + ___ = ___ °C (4) ___ + ___ + ___ = ___ °C

Was ice or ice pack present: Yes No

Integrity Issues:

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date and Time: _____

ADDITIONAL NOTES:

Custody seal intact



CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)
219-800 BURRARD ST
VANCOUVER, BC V6Z 0B9
604-671-1831

ATTENTION TO: Robin Chatwin-Davies

PROJECT: 21455123

AGAT WORK ORDER: 21C832945

WATER ANALYSIS REVIEWED BY: Jennifer Liu, Analyst

DATE REPORTED: Nov 30, 2021

PAGES (INCLUDING COVER): 19

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
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- The test results reported herewith relate only to the samples as received by the laboratory.
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Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

British Columbia CSR - Omnibus Dissolved Metals plus Mercury (ug/L)

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	G / S	RDL	Elutriate CTL		Elutriate Site			
				SAMPLE DESCRIPTION:	Lab	CTL	Elutriate 1.6%	Elutriate 3.2%	Elutriate 100%
				SAMPLE TYPE:	Water	Water	Water	Water	Water
				DATE SAMPLED:	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30
				3234004	3234005	3234006	3234007	3234013	
Dissolved Aluminum	µg/L		15	22	19	17	<15	1100	
Dissolved Antimony	µg/L		1	<1	<1	<1	<1	<1	
Dissolved Arsenic	µg/L		1	1	1	1	<1	1	
Dissolved Barium	µg/L		50	<50	<50	<50	<50	<50	
Dissolved Beryllium	µg/L		1	<1	<1	<1	<1	<1	
Dissolved Boron	µg/L		10	<10	16	18	19	121	
Dissolved Cadmium	µg/L		0.08	<0.08	<0.08	<0.08	<0.08	0.17	
Dissolved Calcium	µg/L		300	45800	16900	17100	16700	9600	
Dissolved Chromium	µg/L		1	<1	<1	<1	<1	1	
Dissolved Cobalt	µg/L		1	<1	<1	<1	<1	<1	
Dissolved Copper	µg/L		1	<1	4	4	3	14	
Dissolved Iron	µg/L		100	<100	<100	<100	<100	594	
Dissolved Lead	µg/L		0.5	<0.5	<0.5	<0.5	<0.5	0.9	
Dissolved Lithium	µg/L		1	4	<1	<1	<1	2	
Dissolved Magnesium	µg/L		200	15200	5470	5560	5470	4930	
Dissolved Manganese	µg/L		1	<1	<1	3	4	5	
Dissolved Mercury	µg/L		0.025	<0.025	<0.025	<0.025	<0.025	<0.025	
Dissolved Molybdenum	µg/L		1	<1	2	2	2	3	
Dissolved Nickel	µg/L		3	<3	<3	<3	<3	<3	
Dissolved Potassium	ug/L		600	2560	1040	1200	1070	2760	
Dissolved Selenium	µg/L		2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
Dissolved Silver	µg/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Dissolved Sodium	µg/L		600	5520	12700	13200	13300	27100	
Dissolved Strontium	µg/L		1	418	87	69	83	67	
Dissolved Thallium	µg/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Dissolved Tin	µg/L		0.5	4.4	<0.5	<0.5	<0.5	<0.5	
Dissolved Titanium	µg/L		2	<2	<2	<2	<2	46	
Dissolved Uranium	µg/L		1	<1	<1	<1	<1	<1	

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
 CALGARY, ALBERTA
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 TEL (403)735-2005
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<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

British Columbia CSR - Omnibus Dissolved Metals plus Mercury (ug/L)

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	G / S	RDL	Elutriate CTL	Elutriate Site	Elutriate 1.6%	Elutriate 3.2%	Elutriate 100%
				Lab	CTL			
SAMPLE DESCRIPTION:				Lab	CTL	Elutriate 1.6%	Elutriate 3.2%	Elutriate 100%
SAMPLE TYPE:				Water	Water	Water	Water	Water
DATE SAMPLED:				2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30
				3234004	3234005	3234006	3234007	3234013
Dissolved Vanadium	µg/L		1	<1	<1	<1	<1	3
Dissolved Zinc	µg/L		10	<10	14	11	11	15
Lab Filtration Performed				complete	complete	complete	complete	complete
Dissolved Bismuth	mg/L		0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Silicon	mg/L		0.032	1.51	3.93	4.10	3.78	6.86
Dissolved Sulfur	mg/L		0.3	19.3	4.9	5.0	4.9	5.4
Dissolved Zirconium	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3234004-3234013 < - Values refer to Method Detection Limit.

Hardness is a calculated parameter. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

British Columbia CSR - Omnibus Total Metals plus Mercury (ug/L)

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	G / S	RDL	Elutriate CTL		Elutriate Site						
				SAMPLE DESCRIPTION:		Lab	CTL	Elutriate 1.6%	Elutriate 3.2%	Elutriate 6.5%	Elutriate 12%	Elutriate 25%
				SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water
				DATE SAMPLED:		2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30
				3234004	3234005	3234006	3234007	3234008	RDL	3234010	3234011	
Total Aluminum	ug/L		4	19	168	657	1140	1840	100	2790	5910	
Total Antimony	ug/L		1	<1	<1	<1	<1	<1	1	<1	<1	
Total Arsenic	ug/L		1	<1	<1	1	<1	1	1	3	4	
Total Barium	ug/L		50	<50	<50	<50	<50	<50	50	<50	<50	
Total Beryllium	ug/L		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	
Total Boron	ug/L		10	<10	14	15	18	20	10	26	35	
Total Cadmium	ug/L		0.016	<0.016	0.045	0.145	0.228	0.526	0.016	1.08	1.78	
Total Calcium	ug/L		300	60900	23700	23200	23500	23600	300	24200	22300	
Total Chromium	ug/L		0.5	<0.5	0.6	1.9	2.6	3.7	0.5	7.8	13.8	
Total Cobalt	ug/L		0.9	<0.9	<0.9	<0.9	<0.9	<0.9	0.9	1.3	2.3	
Total Copper	ug/L		0.8	<0.8	6.1	5.7	7.2	8.8	0.8	14.5	22.8	
Total Iron	ug/L		100	<100	371	791	1290	2250	100	4320	7870	
Total Lead	ug/L		0.1	0.2	0.4	0.9	1.5	2.8	0.1	5.3	9.6	
Total Lithium	ug/L		1	4	<1	<1	1	2	1	3	5	
Total Magnesium	ug/L		200	18500	6840	6810	7030	7220	200	7660	810	
Total Manganese	ug/L		5	<5	17	29	48	91	5	178	326	
Total Mercury	ug/L		0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.025	<0.025	0.025	
Total Molybdenum	ug/L		1	<1	2	2	2	2	1	2	3	
Total Nickel	ug/L		3	<3	<3	<3	3	<3	3	5	8	
Total Potassium	ug/L		600	3260	1210	1230	1400	1460	600	1680	2070	
Total Selenium	ug/L		0.5	<0.5	<0.5	<0.5	0.8	0.8	0.5	<0.5	1.6	
Total Silver	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	
Total Sodium	ug/L		600	7150	16500	16500	17400	18100	600	20100	21300	
Total Strontium	ug/L		1	381	81	72	71	67	1	82	90	
Total Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	
Total Tin	ug/L		0.2	4.6	<0.2	<0.2	<0.2	0.2	0.2	0.3	0.4	
Total Titanium	ug/L		1	<1	8	27	47	66	1	92	155	
Total Uranium	ug/L		1	<1	<1	<1	<1	<1	1	<1	<1	

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
 CALGARY, ALBERTA
 CANADA T2E 7P7
 TEL (403)735-2005
 FAX (403)735-2771
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

British Columbia CSR - Omnibus Total Metals plus Mercury (ug/L)

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	G / S	RDL	Elutriate CTL		Elutriate Site					
				Lab	CTL	Elutriate 1.6%	Elutriate 3.2%	Elutriate 6.5%	Elutriate 12%	Elutriate 25%	
				Water	Water	Water	Water	Water	Water	Water	
				DATE SAMPLED:	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	
				3234004	3234005	3234006	3234007	3234008	RDL	3234010	3234011
Total Vanadium	ug/L		1	<1	2	4	3	5	1	8	14
Total Zinc	ug/L		10	<10	27	20	35	31	10	52	77
Total Bismuth	mg/L		0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Total Silicon	mg/L		0.1	1.9	5.2	5.7	6.3	7.2	0.3	11.2	16.2
Total Sulfur	mg/L		0.3	24.8	6.5	6.3	6.2	6.1	0.3	6.6	6.5
Total Zirconium	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

British Columbia CSR - Omnibus Total Metals plus Mercury (ug/L)

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	SAMPLE DESCRIPTION:		Elutriate 50%	Elutriate 100%
		G / S	RDL		
				3234012	3234013
				2021-11-19 15:30	2021-11-19 15:30
				Water	Water
Total Aluminum	ug/L		100	11700	22700
Total Antimony	ug/L		1	<1	<1
Total Arsenic	ug/L		1	7	9
Total Barium	ug/L		50	<50	63
Total Beryllium	ug/L		0.5	<0.5	<0.5
Total Boron	ug/L		10	53	94
Total Cadmium	ug/L		0.016	3.95	7.82
Total Calcium	ug/L		300	20800	18200
Total Chromium	ug/L		0.5	27.3	55.2
Total Cobalt	ug/L		0.9	4.5	9.9
Total Copper	ug/L		0.8	43.8	77.0
Total Iron	ug/L		100	16900	33500
Total Lead	ug/L		0.1	12.2	25.3
Total Lithium	ug/L		1	9	17
Total Magnesium	ug/L		200	9080	11800
Total Manganese	ug/L		5	647	1310
Total Mercury	ug/L		0.025	0.030	0.071
Total Molybdenum	ug/L		1	3	3
Total Nickel	ug/L		3	18	31
Total Potassium	ug/L		600	2890	4480
Total Selenium	ug/L		0.5	<0.5	1.7
Total Silver	ug/L		0.1	0.2	0.5
Total Sodium	ug/L		600	25200	34800
Total Strontium	ug/L		1	90	97
Total Thallium	ug/L		0.1	<0.1	<0.1
Total Tin	ug/L		0.2	0.9	1.3
Total Titanium	ug/L		25	268	413
Total Uranium	ug/L		1	<1	1
Total Vanadium	ug/L		1	28	43

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

British Columbia CSR - Omnibus Total Metals plus Mercury (ug/L)

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION:	
				Elutriate 50%	Elutriate 100%
				Water	Water
				2021-11-19 15:30	2021-11-19 15:30
				3234012	3234013
Total Zinc	ug/L		10	143	254
Total Bismuth	mg/L		0.001	<0.001	<0.001
Total Silicon	mg/L		0.3	28.0	45.2
Total Sulfur	mg/L		0.3	6.6	7.4
Total Zirconium	mg/L		0.01	<0.01	<0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3234004-3234013 < - Values refer to Method Detection Limit.

Hardness is a calculated parameter. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
 CALGARY, ALBERTA
 CANADA T2E 7P7
 TEL (403)735-2005
 FAX (403)735-2771
<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Water Analysis - DOC

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

Parameter	Unit	G / S	RDL	Elutriate CTL	Elutriate Site	Elutriate 1.6%	Elutriate 3.2%
				Lab	CTL	Water	Water
SAMPLE DESCRIPTION:				Lab	CTL	Elutriate 1.6%	Elutriate 3.2%
SAMPLE TYPE:				Water	Water	Water	Water
DATE SAMPLED:				2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30
				3234004	3234005	3234006	3234007
Dissolved Organic Carbon (DOC)	mg/L	1	1	7	7	8	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Water Analysis - Total & Diss. Cr6+

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

				Elutriate CTL	Elutriate Site
SAMPLE DESCRIPTION:				Lab	CTL
SAMPLE TYPE:				Water	Water
DATE SAMPLED:				2021-11-19 15:30	2021-11-19 15:30
Parameter	Unit	G / S	RDL	3234004	3234005
Hexavalent Chromium	mg/L		0.01	<0.01	<0.01
Dissolved Chromium (VI)	mg/L		0.01	<0.01	<0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

2910 12TH STREET NE
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CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Water Analysis - Total Cr6+

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

SAMPLE DESCRIPTION:		Elutriate 1.6%	Elutriate 3.2%	Elutriate 6.5%	Elutriate 12%	Elutriate 25%	Elutriate 50%	Elutriate 100%		
SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water		
DATE SAMPLED:		2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30		
Parameter	Unit	G / S	RDL	3234006	3234007	3234008	3234010	3234011	3234012	3234013
Hexavalent Chromium	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 21C832945

PROJECT: 21455123

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 CALGARY, ALBERTA
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 TEL (403)735-2005
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<http://www.agatlabs.com>

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Water Analysis - pH

DATE RECEIVED: 2021-11-19

DATE REPORTED: 2021-11-30

				Elutriate CTL	Elutriate Site						
SAMPLE DESCRIPTION:				Lab	CTL	Elutriate 1.6%	Elutriate 3.2%	Elutriate 6.5%	Elutriate 12%	Elutriate 25%	Elutriate 50%
SAMPLE TYPE:				Water	Water	Water	Water	Water	Water	Water	Water
DATE SAMPLED:				2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30	2021-11-19 15:30
Parameter	Unit	G / S	RDL	3234004	3234005	3234006	3234007	3234008	3234010	3234011	3234012
pH	pH Units	N/A		8.31	8.03	8.01	8.04	7.99	7.97	7.94	7.91
SAMPLE DESCRIPTION:				Elutriate 100%							
SAMPLE TYPE:				Water							
DATE SAMPLED:				2021-11-19 15:30							
Parameter	Unit	G / S	RDL	3234013							
pH	pH Units	N/A		7.80							

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
 Analysis performed at AGAT Calgary (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21C832945

PROJECT: 21455123

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

Water Analysis															
RPT Date: Nov 30, 2021			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
British Columbia CSR - Omnibus Dissolved Metals plus Mercury (ug/L)															
Dissolved Aluminum	3128440		<15	<15	NA	< 4	94%	70%	130%	90%	80%	120%	100%	70%	130%
Dissolved Antimony	3128440		<1	<1	NA	< 1	102%	70%	130%	93%	80%	120%	93%	70%	130%
Dissolved Arsenic	3128440		3	3	NA	< 1	108%	70%	130%	85%	80%	120%	90%	70%	130%
Dissolved Barium	3128440		<50	<50	NA	< 50	75%	70%	130%	100%	80%	120%	106%	70%	130%
Dissolved Beryllium	3128440		<1	<1	NA	< 1	103%	70%	130%	98%	80%	120%	99%	70%	130%
Dissolved Boron	3128440		1410	1450	2.8%	< 10	106%	70%	130%	100%	80%	120%	NA	70%	130%
Dissolved Cadmium	3128440		<0.08	<0.08	NA	< 0.05	107%	70%	130%	91%	80%	120%	92%	70%	130%
Dissolved Calcium	3235379		73600	72600	1.4%	< 300	98%	70%	130%	91%	80%	120%	NA	70%	130%
Dissolved Chromium	3128440		<1	<1	NA	< 1	101%	70%	130%	100%	80%	120%	104%	70%	130%
Dissolved Cobalt	3128440		3	3	NA	< 1	103%	70%	130%	99%	80%	120%	101%	70%	130%
Dissolved Copper	3128440		2	2	NA	< 1	100%	70%	130%	97%	80%	120%	91%	70%	130%
Dissolved Iron	3235379		<100	<100	NA	< 100	90%	70%	130%	88%	80%	120%	89%	70%	130%
Dissolved Lead	3128440		<0.5	<0.5	NA	< 0.5	103%	70%	130%	102%	80%	120%	93%	70%	130%
Dissolved Lithium	3128440		194	194	0.2%	< 1	104%	70%	130%	104%	80%	120%	NA	70%	130%
Dissolved Magnesium	3235379		31900	31000	2.7%	< 200	92%	70%	130%	84%	80%	120%	NA	70%	130%
Dissolved Manganese	3235379		1	1	NA	< 1	92%	70%	130%	84%	80%	120%	85%	70%	130%
Dissolved Mercury	3233630	3233630	< 0.025	< 0.025	NA	< 0.025	101%	70%	130%	102%	80%	120%	109%	70%	130%
Dissolved Molybdenum	3128440		8	8	0.9%	< 1	100%	70%	130%	98%	80%	120%	105%	70%	130%
Dissolved Nickel	3128440		10	9	NA	< 3	111%	70%	130%	95%	80%	120%	99%	70%	130%
Dissolved Potassium	3235379		2670	2670	NA	< 600	88%	70%	130%	84%	80%	120%	83%	70%	130%
Dissolved Selenium	3128440		10.4	12.0	NA	< 0.5	100%	70%	130%	97%	80%	120%	104%	70%	130%
Dissolved Silver	3128440		0.2	<0.1	NA	< 0.1	92%	70%	130%	86%	80%	120%	83%	70%	130%
Dissolved Sodium	3235379		78200	76100	2.8%	< 600	92%	70%	130%	86%	80%	120%	NA	70%	130%
Dissolved Strontium	3128440		1390	1260	9.8%	< 1	106%	70%	130%	96%	80%	120%	NA	70%	130%
Dissolved Thallium	3128440		<0.1	<0.1	NA	< 0.1	95%	70%	130%	99%	80%	120%	88%	70%	130%
Dissolved Tin	3128440		1.1	1.1	NA	< 0.5	98%	70%	130%	94%	80%	120%	97%	70%	130%
Dissolved Titanium	3128440		<2	<2	NA	< 1	100%	70%	130%	98%	80%	120%	104%	70%	130%
Dissolved Uranium	3128440		3	3	NA	< 1	95%	70%	130%	100%	80%	120%	98%	70%	130%
Dissolved Vanadium	3128440		<1	<1	NA	< 1	94%	70%	130%	101%	80%	120%	108%	70%	130%
Dissolved Zinc	3128440		<10	<10	NA	< 10	95%	70%	130%	90%	80%	120%	87%	70%	130%
Dissolved Bismuth	3128440		<0.001	<0.001	NA	< 0.001	98%	70%	130%	98%	80%	120%	88%	70%	130%
Dissolved Silicon	3235379		4.21	4.09	3.1%	< 0.032	93%	70%	130%	91%	80%	120%	NA	70%	130%
Dissolved Sulfur	3235379		28.6	28.6	0.1%	< 0.3	86%	70%	130%	80%	80%	120%	NA	70%	130%
Dissolved Zirconium	3235379		< 0.01	< 0.01	NA	< 0.01	92%	70%	130%	81%	80%	120%	83%	70%	130%

Comments: Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.
 Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

British Columbia CSR - Omnibus Total Metals plus Mercury (ug/L)

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21C832945
 PROJECT: 21455123 ATTENTION TO: Robin Chatwin-Davies
 SAMPLING SITE: SAMPLED BY:

Water Analysis (Continued)															
RPT Date: Nov 30, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Aluminum	3121837		8	11	NA	< 4	95%	70%	130%	70%	80%	120%	72%	70%	130%
Total Antimony	3121837		<1	<1	NA	< 1	101%	70%	130%	108%	80%	120%	102%	70%	130%
Total Arsenic	3121837		8	7	6.6%	< 1	81%	70%	130%	93%	80%	120%	102%	70%	130%
Total Barium	3121837		<50	<50	NA	< 50	73%	70%	130%	80%	80%	120%	NA	70%	130%
Total Beryllium	3121837		<0.5	<0.5	NA	< 0.5	110%	70%	130%	94%	80%	120%	80%	70%	130%
Total Boron	3121837		<10	<10	NA	< 10	106%	70%	130%	90%	80%	120%	78%	70%	130%
Total Cadmium	3121837		<0.016	<0.016	NA	< 0.016	99%	70%	130%	104%	80%	120%	100%	70%	130%
Total Calcium	3121837		44200	44300	0.2%	< 300	107%	70%	130%	104%	80%	120%	NA	70%	130%
Total Chromium	3121837		<0.5	<0.5	NA	< 0.5	104%	70%	130%	88%	80%	120%	92%	70%	130%
Total Cobalt	3121837		<0.9	<0.9	NA	< 0.9	97%	70%	130%	95%	80%	120%	91%	70%	130%
Total Copper	3121837		<0.8	<0.8	NA	< 0.8	99%	70%	130%	97%	80%	120%	88%	70%	130%
Total Iron	3121837		<100	<100	NA	< 100	111%	70%	130%	104%	80%	120%	98%	70%	130%
Total Lead	3121837		0.2	0.2	NA	< 0.1	80%	70%	130%	82%	80%	120%	77%	70%	130%
Total Lithium	3121837		12	12	4.5%	< 1	104%	70%	130%	102%	80%	120%	88%	70%	130%
Total Magnesium	3121837		17000	17500	2.9%	< 200	100%	70%	130%	104%	80%	120%	NA	70%	130%
Total Manganese	3121837		17	19	NA	< 5	110%	70%	130%	102%	80%	120%	112%	70%	130%
Total Molybdenum	3121837		1	2	NA	< 1	104%	70%	130%	103%	80%	120%	102%	70%	130%
Total Nickel	3121837		<3	<3	NA	< 3	95%	70%	130%	95%	80%	120%	90%	70%	130%
Total Potassium	3121837		82800	85600	3.3%	< 600	94%	70%	130%	99%	80%	120%	NA	70%	130%
Total Selenium	3121837		1.0	1.6	NA	< 0.5	101%	70%	130%	104%	80%	120%	102%	70%	130%
Total Silver	3121837		<0.1	<0.1	NA	< 0.1	95%	70%	130%	86%	80%	120%	79%	70%	130%
Total Sodium	3121837		34500	34500	0.0%	< 600	103%	70%	130%	99%	80%	120%	NA	70%	130%
Total Strontium	3121837		339	302	11.5%	< 1	117%	70%	130%	97%	80%	120%	NA	70%	130%
Total Thallium	3121837		<0.1	<0.1	NA	< 0.1	95%	70%	130%	100%	80%	120%	95%	70%	130%
Total Tin	3121837		<0.2	<0.2	NA	< 0.2	102%	70%	130%	104%	80%	120%	101%	70%	130%
Total Titanium	3121837		3	4	NA	< 1	103%	70%	130%	90%	80%	120%	88%	70%	130%
Total Uranium	3121837		<1	1	NA	< 1	105%	70%	130%	97%	80%	120%	96%	70%	130%
Total Vanadium	3121837		<1	<1	NA	< 1	99%	70%	130%	96%	80%	120%	93%	70%	130%
Total Zinc	3121837		<10	<10	NA	< 10	101%	70%	130%	89%	80%	120%	92%	70%	130%
Total Bismuth	3121837		<0.001	<0.001	NA	< 0.001	100%	70%	130%	104%	80%	120%	97%	70%	130%
Total Silicon	3121837		2.3	2.4	2.3%	< 0.1	111%	70%	130%	104%	80%	120%	NA	70%	130%
Total Sulfur	3121837		44.1	45.5	3.1%	< 0.3	102%	70%	130%	99%	80%	120%	NA	70%	130%
Total Zirconium	3121837		<0.01	<0.01	NA	< 0.01	108%	70%	130%	80%	80%	120%	101%	70%	130%

Comments: Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.
 Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.
 With multi element scans it is acceptable for a maximum of 10% (including non-reported elements) of each QC criteria to fail to an absolute maximum of 10%.

Water Analysis - pH
 pH 3233671 8.78 8.79 0.1% N/A 101% 90% 110%

Results relate only to the items tested. Results apply to samples as received.

Quality Assurance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21C832945
 PROJECT: 21455123 ATTENTION TO: Robin Chatwin-Davies
 SAMPLING SITE: SAMPLED BY:

Water Analysis (Continued)

RPT Date: Nov 30, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.
 Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

Water Analysis - Total & Diss. Cr6+

Hexavalent Chromium	3234004	3234004	< 0.01	< 0.01	NA	< 0.01	84%	70%	130%	82%	80%	120%	83%	70%	130%
Dissolved Chromium (VI)	3234004	3234004	< 0.01	< 0.01	NA	< 0.01	84%	70%	130%	82%	80%	120%	83%	70%	130%

Comments: Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.
 Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.

Certified By: _____



QC Exceedance

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21C832945
 PROJECT: 21455123 ATTENTION TO: Robin Chatwin-Davies

RPT Date: Nov 30, 2021										REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE			
PARAMETER	Sample Id	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits										
			Lower	Upper		Lower	Upper		Lower	Upper									
British Columbia CSR - Omnibus Total Metals plus Mercury (ug/L)											95%	70%	130%	70%	80%	120%	72%	70%	130%
Total Aluminum																			

Comments: Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.
 Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.
 With multi element scans it is acceptable for a maximum of 10% (including non-reported elements) of each QC criteria to fail to an absolute maximum of 10%.

Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21C832945
PROJECT: 21455123 ATTENTION TO: Robin Chatwin-Davies
SAMPLING SITE: SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Dissolved Aluminum	INST 0141	SM 3125 B	ICP-MS
Dissolved Antimony	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Arsenic	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Barium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Beryllium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Boron	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Cadmium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Calcium	INST 0140	SM 3120 B-D	ICP/OES
Dissolved Chromium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Cobalt	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Copper	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Iron	INST 0140	SM 3120 B-D	ICP/OES
Dissolved Lead	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Lithium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Magnesium	INST 0140	SM 3120 B-D	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B-D	ICP/OES
Dissolved Mercury	INST 0160	SM 3112 B DW	CV/AA
Dissolved Molybdenum	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Nickel	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Potassium	INST 0140	SM 3120 B	ICP/OES
Dissolved Selenium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Silver	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Sodium	INST 0140	SM 3120 B-D	ICP/OES
Dissolved Strontium	INST 0141	SM 3125 B	ICP-MS
Dissolved Thallium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Tin	INST 0141	SM 3125 B	ICP-MS
Dissolved Titanium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Uranium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Vanadium	INST 0141	SM 3125 B-D	ICP/MS
Dissolved Zinc	INST 0141	SM 3125 B-D	ICP/MS
Lab Filtration Performed			N/A
Dissolved Bismuth	INST 0141	SM 3125 B	ICP-MS
Dissolved Silicon	INST 0140	SM 3120 B	ICP/OES
Dissolved Sulfur	INST 0140	SM 3120 B	ICP/OES
Dissolved Zirconium	INST 0140	SM 3120 B	ICP/OES
Total Aluminum	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP/MS
Total Antimony	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Arsenic	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Barium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Beryllium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Boron	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Cadmium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Calcium	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Chromium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Cobalt	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Copper	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Iron	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Lead	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Lithium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP/MS

Method Summary

CLIENT NAME: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC) AGAT WORK ORDER: 21C832945

PROJECT: 21455123

ATTENTION TO: Robin Chatwin-Davies

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Magnesium	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Manganese	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Mercury	INST-0160	BC Lab Manual	CV/AA
Total Molybdenum	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP/MS
Total Nickel	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Potassium	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Selenium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Silver	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Sodium	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Strontium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Thallium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Tin	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Titanium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Uranium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Vanadium	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Zinc	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Bismuth	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Total Silicon	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Sulfur	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Total Zirconium	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Dissolved Organic Carbon (DOC)	INST 0170	SM 5310 B	COMBUSTION
Hexavalent Chromium	WATR-0300	SM 3500-Cr. B	SPECTROPHOTOMETER
Dissolved Chromium (VI)	WATR-0300	EPA SW 846-6010B, SM 3030B	SPECTROPHOTOMETER
pH	INST 0101, INST 0104	SM 4500 H+	PH METER



Laboratory Use Only

Arrival Temperature: 14°C

AGAT Job Number: 21C832945

Notes:

19-NOV '21 PM 5:03

Chain of Custody Record

Report Information

Company: Golden Associates
Contact: Robin Chattwin-Davies, Alexis Fast
Address: _____
Phone: _____ Fax: _____
AGAT Quote #: PSPC Lab TA # 700589422
Client Project #: 21455123

Report Information

1. Name: Robin Chattwin-Davies
Email: RChattwin.Davies@golder.com
2. Name: Alexis Fast
Email: A.Fast@golder.com

Report Format

Single
 Sample per Page
Multiple
 Samples per Page
 Excel Format Included

Turnaround Time Required (TAT)

Regular TAT 5 to 7 working days
Rush TAT Same Business Day - 200%
 1 Business Day - 100%
 2 Business Days - 50%
 3 Business Days - 25%

Date Required: _____

PLEASE CONTACT LABORATORY IF RUSH REQUIRED SAMPLE SUBMISSION CUT OFF FOR EFFECTIVE DATE BY 3 PM

Invoice To

Same as above Yes / No

Company: Public Services and Procurement
Contact: Chris Major
Address: 800 Burrard Street
Vancouver BC V6Z0B9
Phone: _____ Fax: _____
PO/AFE#: _____

Requirements (Please Check)

BC CSR Soil BC CSR - Water
 AL DW
 IL AW
 PL IW
 CL LW
 RL-LD RL-HD
 WL-N WLR

Schedule 3.3 (Please Specify)

CCME (Please Specify)

Other (Please Specify)

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	Total Metals in Water	Dissolved Metals in Water	pH in Water	DOC	Hexavalent Cr in Water	Dissolved Hexavalent Cr in Water	Sample (unpreserved, unfiltered)	NUMBER OF CONTAINERS	PRESERVED (Y/N)	HAZARDOUS (Y/N)	Hold for: <input type="checkbox"/> 60 DAYS
<u>3234104</u>	<u>Elutriate CTL LAB</u>	<u>Water</u>	<u>1530/19/11/21</u>		<	<	<	<	<	<	<	8			
<u>05</u>	<u>20244 Elutriate Site CTL</u>				<	<	<	<	<	<	<	8			
<u>06</u>	<u>Elutriate 1-b/1</u>				<	<	<	<	<	<	<	8			
<u>07</u>	<u>Elutriate 3.2/1</u>				<	<	<	<	<	<	<	5			
<u>08</u>	<u>Elutriate 6.5/1</u>				<	<	<	<	<	<	<	5			
<u>10</u>	<u>Elutriate 12/1</u>				<	<	<	<	<	<	<	5			
<u>11</u>	<u>Elutriate 25/1</u>				<	<	<	<	<	<	<	5			
<u>12</u>	<u>Elutriate 50/1</u>				<	<	<	<	<	<	<	5			
<u>13</u>	<u>Elutriate 100/1</u>				<	<	<	<	<	<	<	5			

Samples Relinquished By (Print Name and Sign): <u>SS</u>	Date/Time: <u>16:30/19/11/21</u>	Samples Received By (Print Name and Sign): <u>Anthony</u>	Date/Time: _____	Page _____ of _____ No: 048333
Samples Relinquished By (Print Name and Sign): _____	Date/Time: _____	Samples Received By (Print Name and Sign): _____	Date/Time: <u>NOV 19 2021</u>	
Samples Relinquished By (Print Name and Sign): _____	Date/Time: _____	Samples Received By (Print Name and Sign): _____	Date/Time: _____	



AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: Golder Associates
 Courier: Jazoo Prepaid Collect
 Waybill# _____
 Branch: EDM GP FN FM RD VAN LYD FSJ EST SASK Other: C
 If multiple sites were submitted at once: Yes No
 Custody Seal Intact: Yes No NA
 TAT: <24hr 24-48hr 48-72hr Reg Other _____
 Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No
 Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Color , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*
 Earliest Expiry: _____
 Hydrocarbons: Earliest Expiry _____

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken: _____
 Legal Samples: Yes No
 International Samples: Yes No
 Tape Sealed: Yes No
 Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 4 + 15 + 13 = 14 °C 2 (Bottle/Jar) ___ + ___ + ___ = ___ °C
 3 (Bottle/Jar) ___ + ___ + ___ = ___ °C 4 (Bottle/Jar) ___ + ___ + ___ = ___ °C
 5 (Bottle/Jar) ___ + ___ + ___ = ___ °C 6 (Bottle/Jar) ___ + ___ + ___ = ___ °C
 7 (Bottle/Jar) ___ + ___ + ___ = ___ °C 8 (Bottle/Jar) ___ + ___ + ___ = ___ °C
 9 (Bottle/Jar) ___ + ___ + ___ = ___ °C 10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 21C832945
 Samples Damaged: Yes No If YES why?
 No Bubble Wrap Frozen Courier
 Other: _____
 Account Project Manager: _____ have they been notified of the above issues: Yes No
 Whom spoken to: _____ Date/Time: _____
 CPM Initial _____
 General Comments: _____

* Subcontracted Analysis (See CPM)

ATTACHMENT 3

Toxicity Testing Results



Toxicity Test Results

Elutriate

Final Report

January 10, 2022

Submitted to: **Golder Associates Ltd.**
Victoria, BC

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APPENDIX A – *Pimephales promelas* Toxicity Test Data

APPENDIX B – Chain-of-Custody Forms

SIGNATURE PAGE



Report By:
Émilie Viczko, MSc
Project Biologist



Reviewed By:
Leila Oosterbroek, P Biol
Environmental Scientist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample and Test Type Information

Sample ID (Internal ID)	5400-01 (2122-0611) Elutriate (2122-0677) ¹
Sample collection date	November 8, 2021
Elutriate preparation date	November 17, 2021
Sample receipt date	November 11, 2021 November 19, 2021
Sample receipt temperature	12.6°C 10.7°C
Test types	7-d <i>Pimephales promelas</i> survival and biomass

¹The elutriate was prepared at the Nautilus Environmental laboratory in Burnaby, BC by combining samples identified as 06188-01 (sediment) and 5399-01 (water), as submitted by Golder Associates Ltd.

Summary of Results

Endpoint	% v/v
	Elutriate
<i>P. promelas</i>	
Survival LC50	> 100
Biomass IC25	> 100

LC = Lethal Concentration, IC = Inhibition Concentration

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted a toxicity test for Golder Associates Ltd. (Golder). Sample 5400-01 (site water) was collected on November 8, 2021 and delivered to the Nautilus Environmental laboratory in Calgary, AB on November 11, 2021. The sample was transported in four 20-L plastic containers and was received at a temperature of 12.6°C. Elutriate was prepared on November 17, 2021 at the Nautilus Environmental laboratory in Burnaby, BC using samples identified by Golder as 06188-01 (sediment) and 5399-01 (water). The prepared elutriate sample was delivered to the Nautilus Environmental laboratory in Calgary, AB on November 19, 2021. The elutriate sample was transported in six 2-L plastic containers and was received at a temperature of 10.7°C. Testing was initiated on November 19, 2021. Both samples were stored in the dark at $4 \pm 2^\circ\text{C}$ prior to testing. The following toxicity test was performed on the sample:

- 7-d *Pimephales promelas* survival and biomass

This report describes the results of this toxicity test. Copies of raw laboratory data sheets and statistical analyses are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

2.0 METHODS

2.1 Elutriate Preparation

The elutriate sample was prepared at the Nautilus Environmental laboratory in Burnaby, BC using the procedure described by the United States Environmental Protection Agency (1998). To begin, a sediment sample (06188-01) and a water sample (5399-01), as submitted by Golder, were acclimated to room temperature overnight. Both samples were homogenized before use. The sediment sample was hand-stirred for 5 minutes and large, woody debris were removed and the water sample was shaken. The sediment and water were then combined in a sediment-to-water ratio of 1:4 on a volume basis. This mixture was stirred vigorously for 30 minutes via magnetic stirrer. Every 10 minutes the mixture was also stirred manually to ensure complete mixing. After the 30-minute mixing period, the mixture was left to settle for 1 hour. The supernatant was then removed using a siphon, yielding the elutriate sample. The elutriate was centrifuged at approximately 2,000 rpm for 30 minutes to remove any remaining particulates. The centrifugation was repeated once more to further clarify the elutriate. Prepared elutriate was stored in dark at $4 \pm 2^{\circ}\text{C}$ until required for testing.

2.2 Toxicity Tests

The method for the toxicity test is summarized in Table 1. Testing was conducted according to the procedure described by the Environment Canada protocol (2011). Both a negative laboratory and site control were included in the test design. The site control was used for endpoint calculation. Statistical analyses for this test were performed using CETIS (Tidepool Scientific Software, version 1.9.4.11).

Table 1. Summary of test conditions: fathead minnow (*Pimephales promelas*) survival and growth test.

Test species	<i>Pimephales promelas</i>
Organism source	Aquatox Inc., Hot Springs, Arkansas
Organism age	<24 hours post hatch
Test type	Static-renewal
Test duration	7 days
Test vessel	385 mL plastic containers
Test volume	250 mL
Test solution depth	6.5 cm
Test concentrations	Seven concentrations, plus laboratory and site control
Test replicates	3 per treatment
Number of organisms	10 per replicate
Laboratory control water	De-chlorinated City of Calgary tap water amended with 4 mg/L KCl
Site control/dilution water	Site water
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice each day with approximately 1500-2250 newly hatched brine shrimp (<i>Artemia nauplii</i>) per 10 fish.
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	pH, conductivity, dissolved oxygen and temperature were measured daily; evaluated for survival daily
Test protocol	Environment Canada (2011), EPS 1/RM/22
Statistical software	CETIS version 1.9.4.11
Test endpoints	Survival and biomass
Test acceptability criteria for controls	≥80% survival, ≥0.25 mg mean dry weight
Reference toxicant	Sodium chloride (NaCl)

3.0 RESULTS

Results of the toxicity test are summarized in Table 2 for the elutriate sample. There were no adverse effects observed on survival or biomass of *P. promelas*, resulting in an LC50 and IC25 of >100%, respectively.

Table 2. Results: fathead minnow (*Pimephales promelas*) survival and biomass test.

Concentration (% v/v)	Survival (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)
Laboratory Control	100.0 ± 0.0	0.22 ± 0.01
Site Control	100.0 ± 0.0	0.54 ± 0.03
1.56	100.0 ± 0.0	0.50 ± 0.02
3.12	100.0 ± 0.0	0.50 ± 0.05
6.25	90.0 ± 10.0	0.45 ± 0.05
12.5	100.0 ± 0.0	0.50 ± 0.08
25	100.0 ± 0.0	0.56 ± 0.11
50	96.7 ± 5.8	0.47 ± 0.04
100	96.7 ± 5.8	0.48 ± 0.02
Test endpoint (% v/v)		
LC50	>100	--
IC25	--	>100

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration

4.0 QA/QC

The health history of the test organisms used in the exposures were acceptable and met the requirements of the Environment Canada protocols. The laboratory control met the control acceptability for survival, but did not meet the control acceptability criteria for biomass. The site control, which met both control acceptability criteria, was used as the negative control for the test. Water quality parameters remained within ranges specified in the protocol throughout the tests. There were no deviations from the test methodology with the exception of feeding the test organisms on day zero of testing. On day zero, the test organisms were not fed due to a technical error, resulting in a protocol deviation. Uncertainty associated with this test is best described by the standard deviations around the means.

Results of the reference toxicant test conducted during the testing program are summarized in Table 3. The reference toxicant test was performed under the same conditions as those used during testing. Results for this test fell within the acceptable range for organism performance of two standard deviations of the mean, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in this test was appropriate.

Table 3. Reference toxicant test results.

Test Species	Endpoint (95% CL)	Historical Mean (2 SD Range)	CV (%)	Test Date
<i>P. promelas</i>	Survival (LC50): 8.5 (7.7-9.3) g/L NaCl	5.8 (3.8-8.9)	14.3	November 19, 2021
	Biomass (IC25): 3.0 (2.7-3.9) g/L NaCl	3.4 (2.2-5.3)	14.3	

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, CL=Confidence Limit

5.0 REFERENCES

- Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. EPS 1/RM/22, Second Edition, March 2011.
- Tidepool Scientific Software. 2018. CETIS comprehensive environmental toxicity information system, version 1.9.4.11 Tidepool Scientific Software, McKinleyville, CA. 275 pp.
- US EPA/US ACE. 1998. Evaluation of dredged material proposed for discharge in waters of the U.S. – testing manual. Standard elutriate preparation. EPA-823-B-98-004, February 1998.

APPENDIX A – *Pimephales promelas* Toxicity Test Data

Dans labeled DM



Fathead Minnow Extra Concentrations Bench Sheet

Method FMD-mod

Client NAUICM

Reference 2122-0677

Test Log

Sample Information

Date	Day	Time	Technicians	Chem. Cart Used	Fed		Daily Data Review	Subsample Used	Sample Information	
					AM	PM			Initial pH:	Initial EC (µS/cm):
2021/11/19	0	0515	MF/MF/icc	2	-	-	AW	Day 0	✓	Initial DO (mg/L):
2021/11/20	1	0930	KTM	2	✓	✓	AW	Day 1	✓	Filtered with 60 µm nitex screen
2021/11/21	2	0930	J	6	✓	✓	JCC	Day 2	✓	Yes/No
2021/11/22	3	1115	J	6	✓	✓	JCC	Day 3	✓	Sample pre-aerated/hardness/pH adjust:
2021/11/23	4	1035	MF	6	✓	✓	MF	Day 4	✓	Yes/No
2021/11/24	5	0850	MF	6	✓	✓	MF	Day 5	✓	*If yes, describe procedure, rate and duration
2021/11/25	6	1030	MF	5	✓	✓	AW	Day 6	✓	
2021/11/26	7	0850	MF	5	-	-	AW	Day 7	-	

Test Organisms

Fish Feeding Normally: Yes/No
 Inflated Swim Bladders: Yes/No

Organism Source: Aquatox
 Batch Number: 20211119 FM
 Breeding Stock Mortality: <1%

Organisms upon receipt:

Mortality: <1%
 Temperature (°C): 22 *temp. must be between 22 °C - 28 °C
 Dissolved Oxygen (mg/L): 12.2

Biology (# of organisms alive and # of live organisms displaying atypical swimming behaviour per vessel)

conc. (%)	10	3.2	6.3	12	25	50	100
Day 1	10	10	10	10	10	10	10
Day 2	10	10	10	10	10	10	10
Day 3	10	10	10	10	10	10	10
Day 4 MF	10	10	10	10	10	10	10

conc. (%)	10	3.2	6.3	12	25	50	100
Day 5	10	10	10	10	10	10	10
Day 6	10	10	10	10	10	10	10
Day 7	10	10	10	10	10	10	10

Atypical Swimming Behaviour:

Unless otherwise noted, behavior is considered to be normal. Any fish that appear moribund (lethargic), display a loss of equilibrium or show atypical swimming behaviour

Scoring Convention: # alive (# atypically swimming)

e.g. 10 (4) indicates 10 alive but 4 swimming atypically in vessel
 No bracketed # indicates no atypical swimming within test vessel

Reviewed By: ST

Date Reviewed: 2021/12/02

Fathead Minnow Extra Concentrations Bench Sheet

Method FMO-mod

Client NAU104

Reference 2122-0077

Chemistry

		New Solutions									
		1	2	3	4	5	6	7	8	9	10
conc. (%)	5	1.0	3.2	6.3	12	25	50	100			
day											

		Old Solutions									
		1	2	3	4	5	6	7	8	9	10
conc. (%)	5	1.0	3.2	6.3	12	25	50	100			
day											

5 mMF pH (units) (range: 6.5-8.5)

0	7.6	7.8	7.7	7.6	7.5	7.5	7.5	7.5
1	8.4	8.7	8.0	7.9	7.8	7.8	7.8	7.7
2 *	8.1	8.2	8.1	8.0	7.9	7.9	7.9	7.8
3	8.0	8.0	8.0	7.9	7.8	7.8	7.8	7.7
4	7.8	7.7	7.7	7.7	7.7	7.7	7.7	7.6
5	8.0	8.1	8.0	7.9	7.8	7.8	7.7	7.7
6	8.2	8.3	8.1	8.0	7.9	7.8	7.8	7.7
7								
8								

pH (units) (range: 6.5-8.5)

0	8.1	8.7	8.1	8.0	8.0	8.0	8.0	7.9	7.9
1	8.1	8.2	8.0	7.9	7.8	7.8	7.8	7.8	7.8
2 *	8.0	8.0	8.0	7.9	7.8	7.8	7.8	7.7	7.7
3	7.9	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
4	7.8	7.8	7.7	7.7	7.7	7.6	7.6	7.5	7.5
5	7.8	8.0	7.9	7.8	7.7	7.6	7.6	7.6	7.6
6	7.8	8.0	7.9	7.8	7.7	7.6	7.6	7.6	7.6
7	7.6	7.7	7.7	7.6	7.6	7.6	7.6	7.5	7.5
8									

4.67 mMF Conductivity (µS/cm)

0	486	238	243	240	239	243	241	256	274
1	457	246	239	241	243	246	252	264	291
2 *	416	244	244	242	243	248	253	274	274
3	408	243	243	243	247	244	252	278	278
4	401	244	239	234	235	237	241	250	260
5	395	241	235	234	230	238	242	251	265
6	431	248	236	234	232	235	240	248	264
7									
8									

Conductivity (µS/cm)

0	474	268	258	259	255	257	260	269	267
1	457	259	251	255	256	256	261	273	298
2 *	435	263	251	251	253	254	264	268	289
3	403	260	248	249	249	251	250	265	279
4	414	261	249	245	245	250	250	260	280
5	419	261	249	245	245	250	250	265	280
6	451	267	250	244	255	257	257	265	281
7									
8									

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
7									
8									

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.5	7.5	7.4	7.3	7.4	7.3	7.3	7.2	7.2
1	6.8	6.9	6.4	6.4	6.3	6.4	6.3	6.1	6.1
2 *	7.2	7.1	6.7	6.3	6.7	6.6	6.6	6.2	6.1
3	7.0	7.2	7.0	6.9	6.9	6.9	6.5	6.4	6.4
4	6.8	7.0	6.5	6.5	6.7	6.7	6.5	6.2	6.2
5	6.5	6.4	6.5	6.3	6.5	6.4	6.5	6.4	6.5
6	5.0	5.5	6.0	6.4	6.5	6.5	6.5	6.4	6.4
7									
8									

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24
7									
8									

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24
7									
8									

DO Levels (40-100% saturation)* - 2.9 to 7.3 mg/L at 24°C 2.9 to 7.2 mg/L at 25°C 2.8 to 7.1 mg/L at 26°C
*corrected for altitude

Reviewed By: ST Date Reviewed: 2011/20/2

* Day 2 pH: 7.7, 8.2, 8.1, 8.0, 7.9, 8.0
EC: 236, 247, 244, 242, 243

Organism Weights Bench Sheet

Client NAAL104 Sample 2122-0677 Organism FMD Batch 20211119FM

Item Weighed	Date	Initials	Balance*
dried pan	2021/11/23	NA	Mettler 3
dried pan + organisms	2021/11/29	AC	Mettler 3

* same balance must be used for initial and final weights
* for FM/HA/CT, must use scale with 0.01 mg accuracy

Concentration

Replicate	CTL		1.6		3.2		6.3		12	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a	426.06	428.10	428.51	428.30	426.16	431.42	421.62	425.66	423.79	428.13
b	431.00	433.28	423.32	428.48	425.47	430.67	427.60	432.17	425.19	429.94
c	429.16	431.35	425.70	430.62	420.54	424.99	425.53	430.50	425.35	431.22
d	424.94	424.46	421.19	—	421.62	—	428.55	—	423.79	—
e	—	—	—	—	—	—	—	—	—	—

* d replicate
has no fish for
all conc. *

Concentration

Replicate	25		50		100	
	Initial	Final	Initial	Final	Initial	Final
a	427.08	433.06	426.23	431.33	421.87	426.83
b	425.98	431.78	423.98	428.36	420.96	425.89
c	427.04	431.40	423.29	428.29 *	423.87	428.45
d	425.57	—	423.07	—	424.24	—
e	—	—	—	—	—	—

Balance Calibration Check:

Initial	Final
CTLA	CAB, CTLA
426.06	428.12
426.07	428.10

Test Validity Met: Yes/No/NA

Results are Logical**: Yes/No

** no negative numbers, consistent values across replicates

% difference < 5%: Yes/No

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

Reviewed By: ST

Date Reviewed: 2021/12/10/21

If "no" is circled for any parameter, notify Lab Supervisor/
QA Group to determine appropriate action

CETIS Analytical Report

Report Date: 21 Dec-21 07:54 (p 1 of 2)
 Test Code/ID: 2122-0677 FMD / 14-3746-8772

Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 15-0130-6526	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 21 Dec-21 7:53	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 09-2262-4419	Test Type: Growth-Survival (7d)	Analyst: Michelle Provincial
Start Date: 19 Nov-21	Protocol: EC/EPS 1/RM/22	Diluent: Dechlorinated Tap Water
Ending Date: 26 Nov-21	Species: Pimephales promelas	Brine:
Test Length: 7d 0h	Taxon: Actinopterygii	Source: Aquatox, AR Age: <24
Sample ID: 07-8319-2887	Code: 2122-0677	Project:
Sample Date: 17 Nov-21	Material: Water Sample	Source: Golder Associates Ltd
Receipt Date: 19 Nov-21	CAS (PC):	Station: Elutriate
Sample Age: 2d 0h (10.7 °C)	Client: Golder Associates Ltd.	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1142329	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.612	2.802	0.1139	No Outliers Detected

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

7d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)						Isotonic Variate		
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	30/30	1	0.0%
1.6		3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	30/30	1	0.0%
3.2		3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	30/30	1	0.0%
6.3		3	0.9000	0.8000	1.0000	0.1000	11.11%	10.0%	27/30	0.9667	3.33%
12		3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	30/30	0.9667	3.33%
25		3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	30/30	0.9667	3.33%
50		3	0.9667	0.9000	1.0000	0.0577	5.97%	3.33%	29/30	0.9667	3.33%
100		3	0.9667	0.9000	1.0000	0.0577	5.97%	3.33%	29/30	0.9667	3.33%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	XC	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000
6.3		0.8000	1.0000	0.9000
12		1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000
50		1.0000	1.0000	0.9000
100		0.9000	1.0000	1.0000

CETIS Analytical Report

Report Date: 21 Dec-21 07:54 (p 2 of 2)
Test Code/ID: 2122-0677 FMD / 14-3746-8772

Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

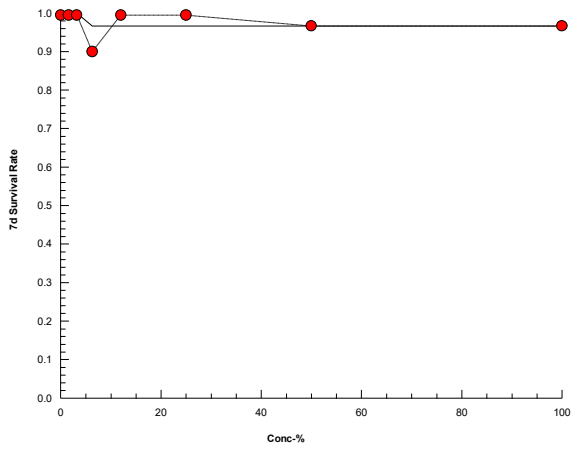
Analysis ID: 15-0130-6526 Endpoint: 7d Survival Rate
Analyzed: 21 Dec-21 7:53 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4
Status Level: 1

7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	XC	10/10	10/10	10/10
1.6		10/10	10/10	10/10
3.2		10/10	10/10	10/10
6.3		8/10	10/10	9/10
12		10/10	10/10	10/10
25		10/10	10/10	10/10
50		10/10	10/10	9/10
100		9/10	10/10	10/10

Graphics



CETIS Analytical Report

Report Date: 21 Dec-21 07:55 (p 1 of 2)
 Test Code/ID: 2122-0677 FMD / 14-3746-8772

Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 07-5334-8903	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.9.4
Analyzed: 21 Dec-21 7:54	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 09-2262-4419	Test Type: Growth-Survival (7d)	Analyst: Michelle Provincial
Start Date: 19 Nov-21	Protocol: EC/EPS 1/RM/22	Diluent: Dechlorinated Tap Water
Ending Date: 26 Nov-21	Species: Pimephales promelas	Brine:
Test Length: 7d 0h	Taxon: Actinopterygii	Source: Aquatox, AR Age: <24
Sample ID: 07-8319-2887	Code: 2122-0677	Project:
Sample Date: 17 Nov-21	Material: Water Sample	Source: Golder Associates Ltd
Receipt Date: 19 Nov-21	CAS (PC):	Station: Elutriate
Sample Age: 2d 0h (10.7 °C)	Client: Golder Associates Ltd.	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	744595	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.597	2.802	0.1213	No Outliers Detected

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.96	n/a	80.8	104.2	1.238	n/a
IC10	39.52	n/a	n/a	2.53	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	3	0.539	0.516	0.574	0.03081	5.72%	0.0%	0.539	0.0%
1.6		3	0.4957	0.479	0.516	0.01877	3.79%	8.04%	0.5007	7.1%
3.2		3	0.497	0.445	0.526	0.04513	9.08%	7.79%	0.5007	7.1%
6.3		3	0.4543	0.404	0.502	0.04905	10.80%	15.71%	0.5007	7.1%
12		3	0.4987	0.434	0.587	0.0792	15.88%	7.48%	0.5007	7.1%
25		3	0.558	0.436	0.64	0.1077	19.30%	-3.53%	0.5007	7.1%
50		3	0.4717	0.438	0.51	0.03623	7.68%	12.49%	0.477	11.5%
100		3	0.4823	0.458	0.496	0.02113	4.38%	10.51%	0.477	11.5%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	XC	0.527	0.574	0.516
1.6		0.479	0.516	0.492
3.2		0.526	0.52	0.445
6.3		0.404	0.457	0.502
12		0.434	0.475	0.587
25		0.598	0.64	0.436
50		0.51	0.438	0.467
100		0.496	0.493	0.458

CETIS Analytical Report

Report Date: 21 Dec-21 07:55 (p 2 of 2)
Test Code/ID: 2122-0677 FMD / 14-3746-8772

Fathead Minnow 7-d Larval Survival and Growth Test

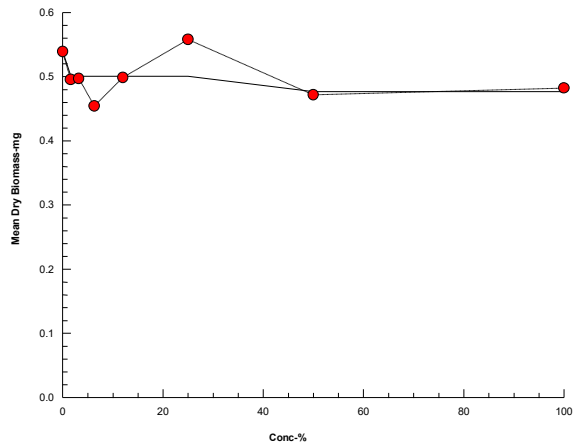
Nautilus Environmental Calgary

Analysis ID: 07-5334-8903
Analyzed: 21 Dec-21 7:54

Endpoint: Mean Dry Biomass-mg
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4
Status Level: 1

Graphics



APPENDIX B – Chain-of-Custody Forms



CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No 5400

page 1 of 1

500-4260 Still Creek Drive
Burnaby, British Columbia, Canada V5C 6C6
Telephone 604-298-6623 Fax 604-298-5253

Project Number: 21455123		Laboratory Name: Nautilus Environmental	
		Address: 10823 27 Street SE Calgary AB	
Golder Contact: R. Chatwin-Davies	Golder E-mail Address: rchatwindavies@golder.com	Tel/Fax: 604-420-8773	Contact: Armando Tang

Office the final reports should be sent to:

- 500 - 4260 Still Creek Dr. Burnaby, B.C. V5C 6C6
 Tel: 604-298-6623 Fax: 604-298-5253
- 300 - 2190 West Railway St. Abbotsford, B.C. V2S 2E2
 Tel: 604-850-8786 Fax: 604-850-8756
- 185 Langford St. 3795 Carey Rd., 2nd floor Victoria, B.C. V8Z 6T8 V9A 3B8
 Tel: 250-881-7372 Fax: 250-881-7470

Analyses Required

Sample Control Number (SCN)	Sample Matrix (over)	Date Sampled (D/M/Y)	Number of Containers	Remarks (over)
2122-0611				
5400 -01	SW	8/11/20	4	for dechlorinate (both head minnow)
2021/11/11 -02				
09:30 Perculator -03				
SC 4x20L -04				
carboys No. 1062 -05				
Good Condition -06				
12.6cc -07				
-08				
-09				
-10				
-11				
-12				

Sampler's Signature: <i>Rolyn</i>	Relinquished by: Signature <i>Rolyn</i>	Company: Golder	Date: 8 Nov 2021	Time: 11:00	Received by: Signature	Company:
Sample Storage (°C): ice packs	Relinquished by: Signature	Company:	Date:	Time:	Received by: Signature	Company:
Comments: site water for dechlorinate (BOD) for fathead minnow	Method of Shipment: ground	Waybill No.:	Received for Lab by:		Date:	Time:
	Shipped by: Perculator	Shipment Condition:	Temp (°C):	Cooler opened by:	Date:	Time:
		Seal Intact:				



TESTING LOCATION (Please Circle)

Burnaby
 8664 Commerce Court
 Burnaby, British Columbia, Canada
 V5A 4N7
 Phone 604.420.8773

Calgary
 10823 27 Street SE
 Calgary, Alberta, Canada
 T2Z 3V9
 Phone 403.253.7121

Point Edward
 704 Mara Street, Suite 122
 Point Edward, Ontario, Canada
 N7V 1X4
 Phone 519.339.8787

Chain of Custody

Date _____ Page ____ of ____

Report to:					Invoice To:					ANALYSES REQUIRED												7-D Fathead Minnow Test	Receipt Temperature (°C)										
Company <u>Golder Associates</u> Address _____ City/Prov/PC _____ Contact <u>Robin Chatwin-Davies; Alexis Fast</u> Phone _____ Email _____					Company _____ Address _____ City/Prov/PC _____ Contact _____ Phone _____ Email _____ PO No. _____																												
Sample Collection By: <u>AD</u>										Sample Type: <u>Grab</u> <input type="radio"/> <u>OR</u> <input type="radio"/> <u>Composite</u> <input type="radio"/>																							
SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS																												
1	Elutriate	17/11/21		6 x 2 L																													
2	<u>20240677</u>																																
3	<u>20211119</u>																																
4	<u>11:40</u>																																
5	<u>Fedex</u>																																
6	<u>JC</u>																																
7	<u>6x2L bottles</u>																																
8	<u>NoS/NoS</u>																																
9	<u>Good Condition</u>																																
10	<u>10.7°C</u>																																
SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)					SAMPLE RECEIPT DETAILS (LABORATORY)					SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)																							
					1. Total No. of Containers		4. Ice Present in Cooler?			Y / N			Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.																				
					2. Courier		5. Seal Present?			Y / N																							
					3. Good Condition?		Y / N			6. Initials Present on Seal?												Y / N											
RELINQUISHED BY (CLIENT)					RECEIVED BY (LABORATORY)																												
(Printed Name) _____ (Signature) _____					(Printed Name) _____ (Signature) _____																												
(Company) _____ (Date DD/MM/YY and Time) _____					(Company) _____ (Date DD/MM/YY and Time) _____																												
Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.																																	

END OF REPORT

APPENDIX B

Screened Data Tables

Table B-1a: Screening of Freshwater Sediment Analytical Results

Table B-1b: Screening of Marine Sediment Analytical Results

Table B-2: Screening of Surface Water Analytical Results

Table B-3: Screening of Pore Water Analytical Results

Table B-4: Screening of Elutriate Analytical Results

Table B-5: Screening of Soil Analytical Results

Table B-6: Sediment QA/QC Results

Table B-7: Soil QA/QC Results

Table B-8: Surface Water QA/QC Results

Table B-1a: Screening of Freshwater Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Location	Sample Name	Sample Date	Sample Depth	BC CSR Sediment Standard for Freshwater Sensitive Use ¹	BC CSR Soil Standard for Human Health ²	CCME Freshwater Sediment Guideline ISQG ³	CCME Freshwater Sediment Guideline PEL ³	CCME Soil Guideline for Human Health ⁴	RC17-01	RC17-01	RC17-01	RC17-01	RC17-02	RC17-02	RC17-02	RC17-03	RC17-03	RC17-03	RC17-04	RC17-05	RC17-06	RC17-07		
									RC17-01SED1	RC17-01SED2	RC17-DUP1SED	RC17-01SED3	RC17-02SED1	RC17-02SED2	RC17-02SED3	RC17-03SED1	RC17-03SED2	RC17-03SED3	RC17-04SED	RC17-05SED	RC17-06SED	RC17-07SED		
									0.14 m	0.1 - 0.15 m	0.1 - 0.15 m	0.2 m	2017-12-06	2017-12-06	2017-12-06	0-0.2 m	0-0.2 m	0-0.2 m	0-0.2 m	0-0.13 m	0-0.17 m	0-0.19 m	0-0.16 m	0-0.13 m
									FDA				FD											
Field and Physical																								
pH	-	-	-	-	-	-	-	-	6.17	6.5	6.74	6.48	6.66	6.29	6.34	5.53	5.81	6.17	6.42	6.08	6.8	6.83		
Sieve - #1 (≥4.75mm) (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sieve - #4 (≥0.75mm) (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sieve - #200 (≥0.075mm) (%)	-	-	-	-	-	-	-	-	3.38	28.6	29.5	55	9.03	10	5.11	26.2	34.3	16.4	68.4	50.1	61.2	68.2		
Texture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clay (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silt (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil Texture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Carbon (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon (%)	-	-	-	-	-	-	-	-	6.4	5.9	5.3	2.1	7	6.6	6.4	8.1	4.4	3.8	2.2	2.3	2.1	2.1	2.1	
Total Inorganic Carbon (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Metals																								
Aluminum	-	40,000	-	-	-	-	-	-	22800	22700	20800	15600	23900	25800	27700	20500	21500	25600	12900	14200	13800	14000		
Antimony	-	500	-	-	-	-	-	-	0.48	0.41	0.27	0.22	0.6	0.66	0.53	0.91	0.39	0.25	0.43	0.35	0.42	0.29		
Arsenic	11	40	5.9	17	31				4.81	6.05	4.73	3.86	7.45	7.15	9.84	6.6	7.17	5.59	4.17	2.99	3.78	3.73		
Barium	-	15,000	-	-	6,800				79.9	86.4	74.1	59.6	129	152	124	132	114	129	68.3	64.9	65.7	60.7		
Beryllium	-	150	-	-	75				0.43	0.41	0.32	0.31	0.47	0.51	0.56	0.39	0.46	0.52	0.26	0.25	0.31	0.26		
Bismuth	-	-	-	-	-				0.15	0.11	0.1	<0.10	0.13	0.16	0.17	0.14	0.11	<0.10	<0.10	<0.10	<0.10	<0.10		
Boron	-	15,000	-	-	-				8.6	10	9.7	4.2	14.3	10.2	9.6	8.5	8	5.4	5	3.9	4.7	4		
Cadmium	2.2	40	0.6	3.5	14				3.59	7.23	5.08	4.55	25.4	16.4	13.7	14.4	9.1	0.509	7.87	4.22	5.77	3.76		
Calcium	-	-	-	-	-				4950	6740	5640	4190	6890	8480	6990	9670	5310	5620	6610	6310	6100	5920		
Chromium	56	250	37.3	90	220				48.1	64.2	53.8	39.8	105	121	104	75	73.6	41.6	40.4	33.1	40.1	32.2		
Chromium Trivalent (Cr(III))	-	-	-	-	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Chromium Hexavalent (Cr(VI))	-	-	-	-	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Cobalt	-	25	-	-	50				13	14.4	11.7	8.99	15.3	16.4	15.9	15.3	16.9	19.6	11.3	10.2	12.1	11		
Copper	120	7,500	35.7	197	1,100				42.3	38	31.5	24.4	51.8	55.7	50.9	61.8	36.9	29.4	32.5	29	29.8	24		
Iron	-	35,000	-	-	-				29,700	27,900	24,400	20,200	31,400	33,800	35,600	29,900	33,500	34,200	19,200	20,900	21,800	21,800		
Lead	57	120	35	91.3	140				26.8	28	21	12.5	60.2	56.1	39.9	41.7	33.5	9.04	16.7	10.8	13.2	10		
Lithium	-	65	-	-	-				24.6	20.5	17.8	13.5	21.3	19.6	27.8	12.5	18.6	22.1	11.3	8.7	11.4	11.2		
Magnesium	-	10,000	-	-	-				401	516	428	317	1060	875	965	1070	992	1160	541	418	345	307		
Manganese	-	10,000	-	-	-				0.082	0.069	0.053	<0.050	0.097	0.121	0.095	0.112	0.069	<0.050	<0.050	<0.050	<0.050	<0.050		
Mercury	0.3	25	0.17	0.486	6.6				0.99	1.26	1.18	0.56	0.91	1.16	0.97	1.37	0.78	1.59	0.75	0.53	0.66	0.61		
Molybdenum	-	400	-	-	10				30.7	31.1	26.7	21.4	33.4	36.1	36.9	30	29.4	31.2	19.6	19.1	22.1	20.6		
Nickel	-	900	-	-	200				1040	892	758	587	1650	1520	1690	1080	1910	986	530	539	504	523		
Phosphorus	-	-	-	-	-				1160	1220	1110	638	1140	1180	1270	925	839	749	495	532	664	623		
Potassium	-	400	-	-	80				<0.50	<0.50	<0.50	<0.50	<0.50	0.75	<0.50	0.7	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		
Selenium	-	400	-	-	20				1.24	0.243	0.168	0.13	0.245	0.293	0.31	0.33	0.196	0.156	0.152	0.084	0.079	<0.050		
Silver	-	1,000,000	-	-	-				578	854	850	306	823	842	454	419	331	302	252	300	253	234		
Sodium	-	10,000	-	-	-				41.2	54.7	49.6	27.3	53.5	65.5	59	59.6	38.2	40.9	34.4	32.5	32.5	28		
Strontium	-	-	-	-	1				0.072	0.089	0.072	0.052	0.077	0.101	0.1	0.073	0.064	0.104	<0.050	<0.050	0.056	<0.050		
Thallium	-	-	-	-	-				1.43	1	0.72	0.46	1.23	1.39	1.47	1.54	1.08	0.6	0.65	0.59	0.53	1.78		
Tin	-	50,000	-	-	50				<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		
Titanium	-	-	-	-	-				1.05	1.94	1.89	0.547	0.939	1.31	1.2	1.63	0.789	1.09	0.838	0.64	0.833	0.534		
Tungsten	-	250	-	-	23				72.7	72.9	60.8	53.7	77	81	82.2	72.6	78.1	80.3	48.2	55.6	56	54.4		
Uranium	-	400	-	-	130				194	166	132	74	359	378	196	502	273	102	259	187	265	187		
Zinc	200	25,000	123	315	10,000				2.2	2.61	2.06	1.79	2.82	3.17	2.22	2.58	2.34	1.81	2.52	2.61	3.56	3.47		
Zirconium	-	-	-	-	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Petroleum Hydrocarbons																								
Acenaphthene	0.055	2,000	0.00671	0.0889	-				0.0026	0.0013	0.002	0.00064	0.011	0.009	0.0016	0.0099	0.006	<0.0011	0.0041	0.0025	0.002	0.0019		
Acenaphthylene	0.08	-	0.00587	0.128	-				0.01	0.0054	0.0053	0.0034	0.006	0.0062	0.011	0.009	0.0048	0.0029	0.0076	0.0029	0.0029	0.0027		
Anthracene	0.15	25,000	0.0075	0.245	-				0.021	0.0075	0.0075	0.0035	0.019	0.018	0.014	0.026	0.0098	0.0022	0.015	0.008	0.008	0.0078		
Benz(a)anthracene	0.24	95	0.0317	0.385	-				0.055	0.013	0.013	0.0089	0.055	0.041	0.031	0.15	0.021	0.0048	0.069	0.031	0.043	0.028		
Benz(b)fluoranthene	-	-	-	-	-				0.11	0.03	0.03	0.018	0.09	0.072	0.06	0.34	0.033	0.0094	0.12	0.05	0.083	0.05		
Benz(k)fluoranthene	-	95	-	-	-				0.052	0.011	0.011	0.0076	0.05	0.034	0.026	0.16	0.016	0.004	0.075	0.032	0.052	0.033		
Benzofluorene	0.48	10	0.0319	0.782																				

Table B-1a: Screening of Freshwater Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Table with columns: Location, Sample Name, Sample Date, Sample Depth, BC CSR Sediment Standard for Freshwater Sensitive Use, BC CSR Soil Standard for Human Health, CCME Freshwater Sediment Guideline ISQG, CCME Freshwater Sediment Guideline PEL, CCME Soil Guideline for Human Health, and 18 RC17-01 to RC17-07 columns. Rows include Pesticides, Polychlorinated Biphenyls, Per- and Polyfluoroalkyl Substances, and Volatile Organic Compounds + BTEX.

Notes:
All parameter units in milligrams per kilogram (mg/kg), unless otherwise noted.
QA/QC = Quality Assurance/Quality Control
FDA = Field Duplicate Available; FD = Field Duplicate
< Indicates parameter was below laboratory equipment detection limit.
Italics indicates the laboratory detection limit was greater than the standard
*- indicates no standard or parameter was not analysed

For calculation of "PAHs, total", only PAH parameters outlined in Schedule 3.4 of the CSR were used in the calculation (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene). Where the parameter was below the laboratory detection limit, a value corresponding to half the laboratory detection limit was conservatively used in the summation.

- 1. BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.4 sediment standards for freshwater sensitive use
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- 4. Canadian Council of Ministers of the Environment (CCME). 1999. Environmental and Human Health Soil Quality Guidelines; soil ingestion pathway to protect human health. If a pathway specific guideline was not available, the generic guideline was applied (residential / parkland [R/PL] land use). 1 in 100,000 cancer risk level.
- 5. Health Canada. 2019. Updates to Health Canada Soil Screening Values for Perfluoroalkylated Substances (PFAS). May 2019.

Legend table with 4 rows: Shaded (Parameter concentration exceeds applicable BC CSR Sediment Standard for freshwater sensitive use), Underlined (Parameter concentration exceeds applicable BC CSR Soil Standard for intake of contaminated soil for urban park land use), Black Border (Parameter concentration exceeds applicable CCME Interim Sediment Quality Guideline (ISQG) for protection of freshwater aquatic life), Pattern (Parameter concentration exceeds applicable CCME Predicted Effect Level (PEL) guideline for protection of freshwater aquatic life), Bold (Parameter concentration exceeds applicable CCME Soil Guideline for Protection of human health for residential / park land use)

Data Sources
WSP 2023 = Samples collected in October 2021, as part of the 2022/2023 WSP HHERA (this report)
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Table B-1a: Screening of Freshwater Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Location						SED21-06	SED21-07	SED21-08	SED21-09	SED21-10	SED21-11	SED21-12	SED21-13	SED21-13	SED21-14	SED21-15	SED21-16	SED21-17			
Sample Name	BC CSR Sediment Standard for Freshwater Sensitive Use ¹	BC CSR Soil Standard for Human Health ²	CCME Freshwater Sediment Guideline ISQG ³	CCME Freshwater Sediment Guideline PEL ³	CCME Soil Guideline for Human Health ⁴	14412-11 2021-06-14 0-0.2 m	14414-12 2021-06-15 0-0.2 m	14415-01 2021-06-15 0-0.2 m	14412-12 2021-06-14 0-0.2 m	14413-01 2021-06-14 0-0.2 m	14413-02 2021-06-14 0-0.2 m	14413-03 2021-06-14 0-0.2 m	14413-04 2021-06-14 0-0.2 m	14414-09 2021-06-15 0-0.2 m	14414-10 2021-06-15 0-0.2 m	14414-11 2021-06-14 0-0.2 m	14413-06 2021-06-14 0-0.2 m	14413-05 2021-06-14 0-0.2 m	14414-02 2021-06-15 0-0.2 m		
QA/QC						FDA				FD				FDA				FD			
Field and Physical																					
pH	-	-	-	-	-	5.84	6.87	5.84	6.53	5.29	6.18	5.90	5.73	6.26	6.32	6.34	6.32	6.2	6.72		
Sieve (>19mm) (%)	-	-	-	-	-	<1	<1	<1	<1	-	<1	<1	<1	12	<1	<1	<1	<1			
Sieve -#4 (>4.75mm) (%)	-	-	-	-	-	<1	<1	<1	<1	-	<1	<1	<1	50	<1	<1	<1	13			
Sieve -#200 (>0.075mm) (%)	-	-	-	-	-	23	37	3	11	27	52	68	62	99	24	28	53	36			
Texture	-	-	-	-	-	Fine	Fine	Fine	Fine	Fine	Coarse	Coarse	Coarse	Coarse	Fine	Fine	Coarse	Fine			
Clay (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Gravel (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Sand (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Silt (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Soil Texture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total Carbon (%)	-	-	-	-	-	3.19	6.57	4	5.43	12.5	4.75	4.96	2.29	3.27	3.15	4.67	6	4.12			
Total Organic Carbon (%)	-	-	-	-	-	3.19	6.50	4.00	5.41	12.4	4.72	4.96	2.29	3.24	3.12	4.67	5.95	4.12			
Total Inorganic Carbon (%)	-	-	-	-	-	<0.02	0.07	<0.02	0.02	0.07	0.03	<0.02	<0.02	0.03	0.03	<0.02	0.05	<0.02			
Metals																					
Aluminum	-	40,000	-	-	-	27500	18800	30400	26300	20900	-	-	-	20800	21400	19400	19400	23500			
Antimony	-	500	-	-	-	0.6	0.8	0.5	0.7	0.8	-	-	-	0.5	0.5	0.6	0.6	-			
Arsenic	11	40	5.9	17	31	5.4	6.1	7.2	7.2	5.2	5	6.3	7	7.4	5.7	5.5	22.4	6			
Barium	-	15,000	-	-	6,800	101	113	116	123	106	-	-	-	104	110	107	97.1	113			
Beryllium	-	150	-	-	75	0.4	0.4	0.5	0.4	0.3	-	-	-	0.4	0.4	0.3	0.4	-			
Bismuth	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5			
Boron	-	15,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Cadmium	2.2	40	0.6	3.5	14	5.95	9.47	2.58	13.3	5.22	9.02	14.7	5.27	12.4	11.9	9.36	4.3	11.1			
Calcium	-	-	-	-	-	6220	9030	6640	8070	7190	-	-	-	6810	7150	7380	8720	7950			
Chromium	56	250	37.3	90	220	71	54	54	85	48	71	73	42	71	63	60	43	68			
Chromium Trivalent (Cr(III))	-	-	-	-	-	71	54	54	85	48	71	73	42	71	63	60	43	68			
Chromium Hexavalent (Cr(VI))	-	-	-	-	-	<8	<8	<8	<8	<8	<4	<8	<8	<8	<8	<8	<8	<8			
Cobalt	-	25	-	-	50	12.3	12.5	15	14.9	12.4	-	-	-	13.8	12	11.4	11.8	14			
Copper	120	7,500	35.7	197	1,100	39.2	48.2	40.7	49	54.7	-	-	-	38.1	33.7	37.3	40.6	44.4			
Iron	-	35,000	-	-	-	33,500	27,700	37,500	31,300	26,700	-	-	-	28,900	30,900	27,700	31,200	31,000			
Lead	57	120	35	91.3	140	49.1	29	23	49.7	23.7	-	-	-	29.2	28.6	31.8	19.8	34.4			
Lithium	-	65	-	-	-	17.8	13	22.7	17.9	13.9	-	-	-	14.8	14.7	14	11.7	15			
Magnesium	-	-	-	-	-	7,680	5,700	8,960	7,030	5,510	-	-	-	6,180	6,400	5,630	6,160	7,200			
Manganese	-	10,000	-	-	-	457	1,230	813	1,470	1,120	-	-	-	730	843	1,050	1,710	1,710			
Mercury	0.3	25	0.17	0.486	6.6	0.07	0.06	0.06	0.1	0.08	-	-	-	0.05	0.06	0.06	0.04	0.06			
Molybdenum	-	400	-	-	10	0.6	0.9	0.9	1.1	1.5	-	-	-	0.7	0.7	0.9	0.8	1			
Nickel	-	900	-	-	200	30.5	23.9	34.9	32.3	25.5	-	-	-	28	24.7	24.3	21.3	28.9			
Phosphorus	-	-	-	-	-	826	1300	827	1480	1140	-	-	-	1240	1420	1250	1210	1160			
Potassium	-	400	-	-	80	929	901	1090	1100	1010	-	-	-	763	830	761	897	839			
Selenium	-	400	-	-	80	0.6	1.2	0.8	0.6	0.8	-	-	-	0.6	0.6	0.7	0.4	0.6			
Silver	-	40	-	-	20	<0.5	<0.5	0.7	<0.5	<0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5			
Sodium	-	1,000,000	-	-	-	601	780	575	392	572	-	-	-	316	343	365	355	449			
Strontium	-	20,000	-	-	-	39	72	47	61	47	-	-	-	44	49	53	44	46			
Thallium	-	-	-	-	1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1			
Tin	-	50,000	-	-	50	1.1	1.6	1.4	1.4	1.5	-	-	-	1	1	1.1	1	1.4			
Titanium	-	-	-	-	-	1,290	960	1,040	1,110	837	-	-	-	823	921	801	815	731			
Tungsten	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Uranium	-	250	-	-	23	0.8	1.1	1	1.1	1.2	-	-	-	0.8	0.8	0.9	0.6	0.9			
Vanadium	-	400	-	-	130	72	55	85	74	58	-	-	-	66	68	58	51	67			
Zinc	200	25,000	123	315	10,000	186	394	173	333	371	272	268	224	228	193	280	301	318			
Zirconium	-	-	-	-	-	0.8	1.5	1.3	0.9	0.8	-	-	-	1.1	0.9	1.4	0.9	0.9			
Petroleum Hydrocarbons																					
Acenaphthene	0.055	2,000	0.00671	0.0889	-	<0.005	-	-	-	-	-	-	-	<0.005	<0.005	0.007	-	-			
Acenaphthylene	0.08	-	0.00587	0.128	-	<0.005	-	-	-	-	-	-	-	<0.005	<0.005	0.007	-	-			
Anthracene	0.15	25,000	0.0469	0.245	-	0.007	-	-	-	-	-	-	-	0.009	0.007	0.029	-	-			
Benz(a)anthracene	0.24	95	0.0317	0.385	-	<0.03	-	-	-	-	-	-	-	0.04	0.04	0.17	-	-			
Benzo(g,h,i)perylene	-	-	-	-	-	<0.05	-	-	-	-	-	-	-	0.06	0.07	0.39	-	-			
Benzo(j)fluoranthene	-	95	-	-	-	<0.02	-	-	-	-	-	-	-	0.02	0.03	0.11	-	-			
Benzo(k)fluoranthene	-	95	-	-	-	<0.02	-	-	-	-	-	-	-	0.04	0.04	0.16	-	-			
Benzo(a)pyrene	0.48	10	0.0319	0.782	-	<0.03	-	-	-	-	-	-	-	0.05	0.05	0.25	-	-			
Benzo(b)fluoranthene	-	95	-	-	-	0.03	-	-	-	-	-	-	-	0.09	0.09	0.41	-	-			
Benzo(b,l)fluoranthene	-	95	-	-	-	0.03	-	-	-	-	-	-	-	0.11	0.12	0.52	-	-			
Chrysene	0.53	400	0.0571	0.862	-	<0.05	-	-	-	-	-	-	-	0.06	0.06	0.26	-	-			
Dibenz(a,h)anthracene	0.084	10	0.00622	0.135	-	0.008	-	-	-	-	-	-	-	0.011	0.009	0.066	-	-			
Fluoranthene	1.5	3,500	0.111	2.355	-	0.05	-	-	-	-	-	-	-	0.1	0.11	0.45	-	-			
Fluorene	0.089	1,000	0.0212	0.144	-	<0.02	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	-	-			
Indeno(1,2,3-c,d)pyrene	-	95	-	-	-	<0.02	-	-	-	-	-	-	-	0.04	0.05	0.26	-	-			
1-Methylnaphthalene	-	500	-	-	-	<0.005	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	-	-			
2-methylnaphthalene	0.12	100	0.0202	0.201	-	<0.005	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	-	-			
Naphthalene	0.24	1,500	0.0346	0.391	-	<0.005	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	-	-			
Phenanthrene	0.32	3,500	0.0419	0.515	-	0.02	-	-	-	-	-	-	-	0.03	0.04	0.15	-	-			
Pyrene	0.54	2,500	0.053	0.875	-																

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Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Table with columns for Location, Sample Name, Sample Date, Sample Depth, QA/QC, Field and Physical, Metals, and Petroleum Hydrocarbons. It contains analytical data for 18 sediment samples (SED21-29 to SED21-40) across various parameters including pH, grain size, organic carbon, and a wide range of metals and hydrocarbons.

Table B-1a: Screening of Freshwater Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Location Sample Name Sample Date Sample Depth QA/QC	BC CSR Sediment Standard for Freshwater Sensitive Use ¹	BC CSR Soil Standard for Human Health ²	CCME Freshwater Sediment Guideline ISQG ³	CCME Freshwater Sediment Guideline PEL ³	CCME Soil Guideline for Human Health ⁴	SED21-29	SED21-30	SED21-31	SED21-31	SED21-32	SED21-33	SED21-34	SED21-34	SED21-35	SED21-36	SED21-37	SED21-38	SED21-39	SED21-40
						06185-02 2021-10-21 0-0.1 m	06185-03 2021-10-21 0-0.1 m	06185-04 2021-10-21 0-0.1 m	06185-05 2021-10-21 0-0.1 m	06185-06 2021-10-21 0-0.1 m	06185-07 2021-10-21 0-0.1 m	06185-08 2021-10-21 0-0.1 m	06185-09 2021-10-21 0-0.1 m	06185-10 2021-10-21 0-0.1 m	06185-11 2021-10-21 0-0.1 m	06187-01 2021-10-21 0-0.1 m	06187-02 2021-10-21 0-0.1 m	06187-03 2021-10-21 0-0.1 m	06187-04 2021-10-21 0-0.1 m
QA/QC						FDA	FD	FDA					FD						
Pesticides																			
4,4-DDD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4-DDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4-DDT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o,p'-DDD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o,p'-DDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o,p'-DDT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DDD, Total	0.0053	-	0.00354	0.00851	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DDE, Total	0.0042	-	0.00142	0.00675	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DDT, Total	0.003	-	0.00119	0.00477	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DDT + DDD + DDE, Total	-	40	0.00119	0.00477	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
alpha-BHC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
beta-BHC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
delta-BHC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Chlordane	0.0055	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane	-	15	0.0045	0.00887	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane, technical mixture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	0.0041	0.85	0.00285	0.00667	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endosulfan	-	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Endosulfan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
beta-Endosulfan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endosulfan Sulfate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	0.039	9	0.00267	0.0624	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin Ketone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin Aldehyde	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	0.0017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	0.0017	3	0.0006	0.00274	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methoxychlor	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mirex	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octachlorostyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toxaphene	-	15	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polychlorinated Biphenyls																			
Total Polychlorinated Biphenyls (PCBs)	0.17	10	0.0341	0.277	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1232	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1242	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1248	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1254	-	-	0.06	0.340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Per- and Polyfluoroalkyl Substances ⁵																			
Perfluorooctanoic acid (PFOA)	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorooctane sulfonate (PFOS)	-	2.5	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorobutanoic acid (PFBA)	-	-	-	-	114	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorohexanoic Acid (PFHxA)	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorohexane sulfonate (PFHxS)	-	-	-	-	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluoroheptanoic Acid (PFHpA)	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorononanoic Acid (PFNA)	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluoropentanoic Acid (PFPeA)	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorodecane Sulfonate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorodecanoic Acid (PFDA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorododecanoic Acid (PFDoA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorooctane Sulfonamide (PFOSA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorotetradecanoic Acid (PFTEDA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluorotridecanoic Acid (PFTTDA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
perfluorobutane sulphonate (PFBS)	-	650	-	-	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluoroheptanesulfonic acid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perfluoroundecanoic Acid (PFUnA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds + BTEX																			
Hexachlorobenzene	-	65	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lindane (Hexachlorocyclohexane)	0.00086	2	0.00094	0.00138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl tert-Butyl Ether	-	8,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	15,000	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	350	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	-	6,500	-	-	22,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	8,500	-	-	10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m,p-Xylenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes, Total	-	15,000	-	-	150,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
 All parameter units in milligrams per kilogram (mg/kg), unless otherwise noted.
 QA/QC = Quality Assurance/Quality Control
 FDA = Field Duplicate Available; FD = Field Duplicate
 < Indicates parameter was below laboratory equipment detection limit.
italics indicates the laboratory detection limit was greater than the standard
 ** indicates no standard or parameter was not analysed

For calculation of "PAHs, total", only PAH parameters outlined in Schedule 3.4 of the CSR were used in the calculation (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene). Where the parameter was below the laboratory detection limit, a value corresponding to half the laboratory detection limit was conservatively used in the summation.

- BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.4 sediment standards for freshwater sensitive use
- BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.1 Part 1 soil standards for intake of contaminated soil or Schedule 3.1 Part 2 soil standards to protect human health (urban park; PL).
- Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life; interim sediment quality guidelines (ISQG) and probable effect levels (PEL).
- Canadian Council of Ministers of the Environment (CCME). 1999. Environmental and Human Health Soil Quality Guidelines; soil ingestion pathway to protect human health. If a pathway specific guideline was not available, the generic guideline was applied (residential / parkland [RL, PL] and use). 1 in 100,000 cancer risk level.
- Health Canada. 2019. Updates to Health Canada Soil Screening Values for Perfluoroalkylated Substances (PFAS), May 2019.

Shaded	Parameter concentration exceeds applicable BC CSR Sediment Standard for freshwater sensitive use
Underlined	Parameter concentration exceeds applicable BC CSR Soil Standard for intake of contaminated soil for urban park land use
Black Border	Parameter concentration exceeds applicable CCME Interim Sediment Quality Guideline (ISQG) for protection of freshwater aquatic life
Pattern	Parameter concentration exceeds applicable CCME Predicted Effect Level (PEL) guideline for protection of freshwater aquatic life
Bold	Parameter concentration exceeds applicable CCME Soil Guideline for Protection of human health for residential / park land use

Data Sources
 WSP 2023 = Samples collected in October 2021, as part of the 2022/2023 WSP HHERA (this report)
 Golder 2021 = Samples collected in October 2021, as part of the Supplemental Sediment Sampling in Support of the 2022 HHERA
 SLR 2018 = Reay (KELSET) Creek Downstream Sediment and Surface water Assessment. Reay Creek, Sidney and North Saanich, BC. Prepared for PSPC.

Table B-1a: Screening of Freshwater Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Location Sample Name Sample Date Sample Depth	BC CSR Sediment Standard for Freshwater Sensitive Use ¹	BC CSR Soil Standard for Human Health ²	CCME Freshwater Sediment Guideline ISQG ³	CCME Freshwater Sediment Guideline PEL ³	CCME Soil Guideline for Human Health ⁴	SED21-41	SED21-42	SED21-BG-01	SED21-BG-01	SED21-BG-02	SED21-BG-03
						06187-05 2021-10-21 0-0.1 m	06187-06 2021-10-21 0-0.1 m	06189-01 2021-10-22 0-0.1 m	06189-02 2021-10-22 0-0.1 m	06189-03 2021-10-22 0-0.1 m	06189-04 2021-10-22 0-0.1 m
QA/QC						FDA		FD			
Field and Physical											
pH	-	-	-	-	-	6.26	5.92	7.87	7.87	6.85	7.42
Sieve (>19mm) (%)	-	-	-	-	-	<1	<1	<1	<1	<1	31
Sieve - #4 (>4.75mm) (%)	-	-	-	-	-	<1	<1	11	29	8	25
Sieve - #200 (>0.075mm) (%)	-	-	-	-	-	84	16	52	47	23	9
Texture	-	-	-	-	-	Coarse	Fine	Coarse	Fine	Fine	Fine
Clay (%)	-	-	-	-	-	4	12	9	5	29	31
Gravel (%)	-	-	-	-	-	5	<1	6	9	6	7
Sand (%)	-	-	-	-	-	84	45	72	77	33	34
Silt (%)	-	-	-	-	-	7	42	11	7	32	28
Soil Texture	-	-	-	-	-	Sand	Loam	Sandy Loam	Loamy Sand	Clay Loam	Clay Loam
Total Carbon (%)	-	-	-	-	-	2.25	4.90	0.89	0.89	1.09	0.85
Total Organic Carbon (%)	-	-	-	-	-	2.25	4.90	0.89	0.89	1.09	0.83
Total Inorganic Carbon (%)	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	0.02
Metals											
Aluminum	-	40,000	-	-	-	9,270	19,300	15,200	16,000	26,700	25,500
Antimony	-	500	-	-	20	0.5	0.5	0.5	0.4	0.3	0.3
Arsenic	11	40	5.9	17	31	4	7	2	4	6	6
Barium	-	15,000	-	-	6,800	55.1	109	57.4	59.2	106	133
Beryllium	-	150	-	-	75	0.2	0.4	0.3	0.4	0.4	0.4
Bismuth	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	-	15,000	-	-	-	-	-	-	-	-	-
Cadmium	2.2	40	0.6	3.5	14	6.18	12.6	0.17	0.17	0.23	0.21
Calcium	-	-	-	-	-	7340	6920	6700	6470	6870	7920
Chromium	56	250	37.3	90	220	30	86	21	26	40	45
Chromium Trivalent (Cr(III))	-	-	-	-	-	-	-	21.0	26.0	40.0	45.0
Chromium Hexavalent (Cr(VI))	-	-	-	-	-	-	-	<0.3	<0.3	<0.3	<0.3
Cobalt	-	25	-	-	50	9.1	13.0	8.0	9.9	13.1	15.8
Copper	120	7,500	35.7	197	1,100	30.8	46.1	29.0	31.0	39.1	42.4
Iron	-	35,000	-	-	-	15,900	25,700	22,200	22,500	33,300	39,400
Lead	57	120	35	91.3	140	11.3	44.0	14.4	8.8	8.1	6.7
Lithium	-	65	-	-	-	5.8	14.5	9.4	9.6	17.0	22.2
Magnesium	-	-	-	-	-	3,320	6,130	5,430	5,640	8,090	9,750
Manganese	-	10,000	-	-	-	594	629	572	637	528	1,500
Mercury	0.3	25	0.17	0.486	6.6	0.04	0.07	0.03	0.03	0.04	0.03
Molybdenum	-	400	-	-	10	1.0	0.9	0.6	0.5	0.5	1.9
Nickel	-	900	-	-	200	15.1	27.6	18.1	21.1	31.3	44.7
Phosphorus	-	-	-	-	-	529	1320	619	596	491	777
Potassium	-	-	-	-	-	443	921	700	740	1190	1770
Selenium	-	400	-	-	80	0.5	0.5	0.1	0.3	0.3	0.4
Silver	-	400	-	-	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium	-	1,000,000	-	-	-	233	474	309	307	404	649
Strontium	-	20,000	-	-	-	38	49	33	32	45	64
Thallium	-	-	-	-	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	-	50,000	-	-	50	0.6	1.0	0.5	0.7	0.6	0.5
Titanium	-	-	-	-	-	684	952	1,050	1,170	1,470	1,220
Tungsten	-	-	-	-	-	-	-	-	-	-	-
Uranium	-	250	-	-	23	0.9	0.9	0.3	0.3	0.6	0.8
Vanadium	-	400	-	-	130	38	60	51	63	85	87
Zinc	200	25,000	123	315	10,000	277	322	110	124	66	107
Zirconium	-	-	-	-	-	1.3	2.2	3.1	3.3	4.8	4.1
Petroleum Hydrocarbons											
Acenaphthene	0.055	2,000	0.00671	0.0889	-	-	-	-	-	-	-
Acenaphthylene	0.08	-	0.00587	0.128	-	-	-	-	-	-	-
Anthracene	0.15	25,000	0.0469	0.245	-	-	-	-	-	-	-
Benzo(a)anthracene	0.24	95	0.0317	0.385	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-
Benzo(j)fluoranthene	-	95	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	95	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	0.48	10	0.0319	0.782	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	95	-	-	-	-	-	-	-	-	-
Benzo(b,j) fluoranthene	-	95	-	-	-	-	-	-	-	-	-
Chrysene	0.53	400	0.0571	0.862	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.084	10	0.00622	0.135	-	-	-	-	-	-	-
Fluoranthene	1.5	3,500	0.111	2.355	-	-	-	-	-	-	-
Fluorene	0.089	1,000	0.0212	0.144	-	-	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	-	95	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	500	-	-	-	-	-	-	-	-	-
2-methylnaphthalene	0.12	100	0.0202	0.201	-	-	-	-	-	-	-
Naphthalene	0.24	1,500	0.0346	0.391	-	-	-	-	-	-	-
Phenanthrene	0.32	3,500	0.0419	0.515	-	-	-	-	-	-	-
Pyrene	0.54	2,500	0.053	0.875	-	-	-	-	-	-	-
Quinoline	-	4.5	-	-	-	-	-	-	-	-	-
PAHs, total	10	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene Total Potency Equivalence (TPE)	-	-	-	-	0.6	-	-	-	-	-	-
Index of Additive Cancer Risk (IACR; unitless)	-	-	-	-	-	-	-	-	-	-	-
EPH (C10-C19)	-	1,000	-	-	-	-	-	-	-	-	-
EPH (C19-C32)	-	1,000	-	-	-	-	-	-	-	-	-
Light Extractable Petroleum Hydrocarbons (LEPH)	-	1,000	-	-	-	-	-	-	-	-	-
Heavy Extractable Petroleum Hydrocarbons (HEPH)	-	1,000	-	-	-	-	-	-	-	-	-

Table B-1a: Screening of Freshwater Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Table with columns: Location, Sample Name, Sample Date, Sample Depth, BC CSR Sediment Standard for Freshwater Sensitive Use, BC CSR Soil Standard for Human Health, CCME Freshwater Sediment Guideline ISQG, CCME Freshwater Sediment Guideline PEL, CCME Soil Guideline for Human Health, and sampling dates (SED21-41 to SED21-BG-03).

Notes: All parameter units in milligrams per kilogram (mg/kg), unless otherwise noted. QAIQC = Quality Assurance/Quality Control. FDA = Field Duplicate Available; FD = Field Duplicate. < Indicates parameter was below laboratory equipment detection limit. /italic indicates the laboratory detection limit was greater than the standard. "-" indicates no standard or parameter was not analysed.

Data Sources: WSP 2023 = Samples collected in October 2021, as part of the 2022/2023 WSP HHERA (this report). Golder 2021 = Samples collected in October 2021, as part of the Supplemental Sediment Sampling in Support of the 2022 HHERA. SLR 2016 = Reay (KELSET) Creek Downstream Sediment and Surface Water Assessment. Reay Creek, Sidney and North Saanich, BC. Prepared for PSPC.

Table B-1b: Screening of Marine Sediment Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Location	BC CSR Sediment Standard for Marine and Estuarine Aquatic Life Sensitive Use ¹	BC CSR Soil Standard for Human Health ²	CCME Marine Sediment Guideline (ISQG) for Aquatic Life ³	CCME Marine Sediment Guideline (PEL) for Aquatic Life ³	CCME Soil Guideline for Human Health ⁴	SED21-01 14412-06 2021-06-14 0-0.2 m	SED21-01 14412-07 2021-06-14 0.35-0.45 m	SED21-02 14412-03 2021-06-14 0-0.2 m	SED21-02 14412-04 2021-06-14 0-0.2 m	SED21-02 14412-05 2021-06-14 0.35-0.45 m	SED21-03 14412-01 2021-06-14 0-0.2 m	SED21-03 14412-02 2021-06-14 0.4-0.5 m
Field and Physical												
Moisture (%)	-	-	-	-	-	-	-	-	-	-	6.19	3.22
Sieve - #200, 0.075mm (%)	-	-	-	-	-	99	99	27	-	99	99	99
Sieve Texture (unitless)	-	-	-	-	-	Coarse	Coarse	Fine	Coarse	Coarse	Coarse	Coarse
pH (pH units)	-	-	-	-	-	9.13	9.09	8.65	8.59	8.53	9	9.14
Total Inorganic Carbon (%)	-	-	-	-	-	0.13	0.02	0.06	0.03	0.07	0.19	0.03
Total Carbon (%)	-	-	-	-	-	0.6	0.33	0.74	0.58	0.97	0.95	0.43
Metals												
Aluminum	-	40,000	-	-	-	9,760	8,610	10,200	8,490	8,880	9,640	9,550
Antimony	-	500	-	-	20	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Arsenic	26	40	-	-	12	1.6	1.5	1	1.7	1.6	1.7	2.2
Barium	-	15,000	-	-	6,800	9.6	9.8	10.8	15	9.5	8.7	13.1
Beryllium	-	150	-	-	75	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bismuth	-	-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cadmium	2.6	40	-	-	14	0.11	0.09	0.12	0.12	0.11	0.09	0.09
Calcium	-	-	-	-	-	11,800	8,720	11,300	6,100	6,810	13,600	6,910
Chromium	99	250	-	-	220	14	14	10	10	11	9	9
Chromium, Hexavalent	-	-	-	-	-	< 0.8	< 0.4	< 0.8	< 0.8	< 4	< 0.4	< 0.4
Chromium, Trivalent	-	-	-	-	-	14	14	10	11	11	9	9
Cobalt	-	25	-	-	50	6.2	4.8	5.7	5.1	5	5.4	5.1
Copper	67	7,500	18.7	108	1,100	12.8	9.7	10.3	10.5	8.9	12.1	7.9
Iron	-	35,000	-	-	-	15,000	12,500	15,000	12,700	12,800	16,200	14,100
Lead	69	120	-	-	140	4.5	7.3	5.3	5.8	5.7	5.2	6.5
Lithium	-	65	-	-	-	7.2	6.9	6.2	6	6.3	7.2	6.2
Magnesium	-	-	-	-	-	5,410	4,350	5,180	4,440	4,530	5,160	4,980
Manganese	-	10,000	-	-	-	231	193	206	195	205	219	199
Mercury	0.43	25	0.13	0.7	7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01
Molybdenum	-	400	-	-	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.9	0.2
Nickel	-	900	-	-	200	12.1	9.7	10.1	9.7	9.3	9.6	8.9
Phosphorus	-	-	-	-	-	283	291	377	342	436	435	366
Potassium	-	-	-	-	-	417	406	425	360	415	411	491
Selenium	-	400	-	-	80	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver	-	400	-	-	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	-	1,000,000	-	-	-	471	509	496	441	452	628	619
Strontium	-	20,000	-	-	-	72	61	72	30	31	101	34
Thallium	-	-	-	-	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Tin	-	50,000	-	-	50	0.2	0.3	0.2	< 0.2	0.2	0.5	0.6
Titanium	-	-	-	-	-	838	726	1,080	774	874	789	923
Uranium	-	250	-	-	23	< 0.2	< 0.2	0.2	< 0.2	0.3	< 0.2	< 0.2
Vanadium	-	400	-	-	130	38	32	40	33	35	36	34
Zinc	170	25,000	-	-	10,000	35	29	29	28	30	44	28
Zirconium	-	-	-	-	-	2.5	2.2	3.3	2.8	2.8	1.8	2.5
Petroleum Hydrocarbons												
Acenaphthene	0.055	2,000	0.00671	0.0889	-	-	-	-	-	-	< 0.005	< 0.005
Acenaphthylene	0.079	-	0.00587	0.128	-	-	-	-	-	-	< 0.005	< 0.005
Anthracene	0.15	25,000	0.0469	0.245	-	-	-	-	-	-	< 0.004	< 0.004
Benz(a)anthracene	0.43	95	0.0748	0.693	-	-	-	-	-	-	< 0.03	< 0.03
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	< 0.05	< 0.05
Benzo(j)fluoranthene	-	95	-	-	-	-	-	-	-	-	< 0.02	< 0.02
Benzo(k)fluoranthene	-	95	-	-	-	-	-	-	-	-	< 0.02	< 0.02
Benzo(a)pyrene	0.47	10	0.0888	0.763	-	-	-	-	-	-	< 0.03	< 0.03
Benzo(b)fluoranthene	-	95	-	-	-	-	-	-	-	-	< 0.02	< 0.02
Benzo(i,j)fluoranthene	-	95	-	-	-	-	-	-	-	-	< 0.03	< 0.03
Chrysene	0.52	400	0.108	0.846	-	-	-	-	-	-	< 0.05	< 0.05
Dibenz(a,h)anthracene	0.084	10	0.00622	0.135	-	-	-	-	-	-	< 0.005	< 0.005
Fluoranthene	0.93	3,500	0.113	1.494	-	-	-	-	-	-	< 0.01	< 0.01
Fluorene	0.089	1,000	0.0212	0.144	-	-	-	-	-	-	< 0.02	< 0.02
Indeno(1,2,3-c,d)pyrene	-	95	-	-	-	-	-	-	-	-	< 0.02	< 0.02
1-Methylnaphthalene	-	500	-	-	-	-	-	-	-	-	< 0.005	< 0.005
2-methylnaphthalene	0.12	100	0.0202	0.201	-	-	-	-	-	-	< 0.005	< 0.005
Naphthalene	0.24	1,500	0.0346	0.391	-	-	-	-	-	-	< 0.005	< 0.005
Phenanthrene	0.34	3,500	0.0867	0.544	-	-	-	-	-	-	< 0.02	< 0.02
Pyrene	0.87	2,500	0.153	1.398	-	-	-	-	-	-	< 0.01	< 0.01
Quinoline	-	5	-	-	-	-	-	-	-	-	< 0.05	< 0.05
PAHs, total	10	-	-	-	-	-	-	-	-	-	0.100	0.100
EPH (C10-C19)	-	1,000	-	-	-	-	-	-	-	-	< 20	< 20
EPH (C19-C32)	-	1,000	-	-	-	-	-	-	-	-	< 20	< 20
Light Extractable Petroleum Hydrocarbons (LEPH)	-	1,000	-	-	-	-	-	-	-	-	< 20	< 20
Heavy Extractable Petroleum Hydrocarbons (HEPH)	-	1,000	-	-	-	-	-	-	-	-	< 20	< 20
Pesticides												
4,4-DDT	-	-	-	-	-	-	-	-	-	-	< 0.003	< 0.003
o,p'-DDT	-	-	-	-	-	-	-	-	-	-	< 0.003	< 0.003
DDT, Total	0.003	-	0.00119	0.00477	-	-	-	-	-	-	< 0.007	< 0.007

Notes:
All parameter units in milligrams per kilogram (mg/kg), unless otherwise noted.
QA/QC = Quality Assurance/Quality Control
FDA = Field Duplicate Available; FD = Field Duplicate
< Indicates parameter was below laboratory equipment detection limit.
Italics indicates the laboratory detection limit was greater than the standard
- indicates no standard or parameter was not analysed

For calculation of "PAHs, total", only PAH parameters outlined in Schedule 3.4 of the CSR were used in the calculation (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene). Where the parameter was below the laboratory detection limit, a value corresponding to half the laboratory detection limit was conservatively used in the summation.

1. BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.4 sediment standards for marine water sensitive use
2. BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.1 Part 1 soil standards for intake of contaminated soil or Schedule 3.1 Part 2 soil standards to protect human health (urban park; PL).
3. Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life; interim sediment quality guidelines (ISQG) and probable effect levels (PEL).
4. Canadian Council of Ministers of the Environment (CCME). 1999. Environmental and Human Health Soil Quality Guidelines; soil ingestion pathway to protect human health. If a pathway specific guideline was not available, the generic guideline was applied (residential / parkland [RL/PL] land use).

Shaded	Parameter concentration exceeds applicable BC CSR Sediment Standard for marine and estuarine sensitive use
Underlined	Parameter concentration exceeds applicable BC CSR Soil Standard for human health (intake of contaminated soil or generic) for urban park land use
Black Border	Parameter concentration exceeds applicable CCME Ineterim Sediment Quality Guideline (ISQG) for protection of marineaquatic life
Pattern	Parameter concentration exceeds applicable CCME Predicted Effect Level (PEL) guideline for protection of marine aquatic life
Bold	Parameter concentration exceeds applicable CCME soil guideline for human health (intake of contaminated soil or generic) for residential / park land (RL/PL) land use

Data Sources
WSP 2023 = Samples collected in October 2021, as part of the Supplemental Sediment Sampling in Support of the 2022/2023 HHERA

Table B-2: Screening of Surface Water Analytical Results Detailed Human Health and Ecological Risk Assessment KELSET, Downstream of KELSET Pond, BC

Table with columns for Location, Sample Name, Sample Date, QA/QC, and various analytical parameters (BC WQG for Freshwater Aquatic Life, BC WQG for Drinking Water, CCME Freshwater Aquatic Life, Health Canada Guideline for Canadian Drinking Water Quality, RC17-01 to RC17-17, SW21-01 to SW21-07) and rows for Field and Physical, Metals, Dissolved, and Metals, Total.

Notes: All parameter units in micrograms per litre (ug/L), unless otherwise noted. QA/QC = Quality Assurance/Quality Control; FDA = Field Duplicate Available; FD = Field Duplicate. < Indicates parameter was below laboratory equipment detection limit. *Italics* indicates the detection limit was greater than one or more screening criteria. 1. BC Approved (BC ENV 2023) and Working (BC ENV 2021) Water Quality Guidelines (WQGs) for the protection of freshwater aquatic life. Long-term chronic guidelines were applied. (H) indicates hardness dependent standards, (pH) indicates pH dependent standards, (III) indicates trivalent chromium, (VI) indicates hexavalent chromium. 2. Canadian Council of Ministers of the Environment (CCME). 2007. Water Quality guidelines for the protection of freshwater aquatic life. 3. Health Canada. 2022. Guidelines for Canadian Drinking Water Quality, maximum allowable concentration (MAC). If a MAC was not available or if the the operational guidance (OG) was more conservative, then the OG was applied. The aesthetic objective guidelines were not applied.

Legend table with 4 rows: Shaded (Parameter concentration exceeds applicable BC WQG for freshwater aquatic life), Underlined (Parameter concentration exceeds applicable BC WQG for drinking water), Bold (Parameter concentration exceeds applicable CCME guideline for freshwater aquatic life), Pattern (Parameter concentration exceeds applicable Health Canada guideline for drinking water)

Data Sources WSP 2023 = Samples collected in October 2021, in Support of the 2022/2023 HHERA. SLR 2018 = Reay (KELSET) Creek Downstream Sediment and Surface water Assessment. Reay Creek, Sidney and North Saanich, BC. Prepared for PSPC

**Table B-3: Screening of Porewater Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC**

Location	BC WQG for Freshwater Aquatic Life	CCME Freshwater Aquatic Life	PS21-01 PW	PW21-01 SW	PS21-02 SW	PS21-03 SW	PW21-03 SW	PS21-04 PW	PS21-05 PW	PS21-06 PW	PS21-07 PW
Sample Type			06169-02	06169-04	06169-01	06169-03	06169-06	06169-05	06169-08	06169-09	06169-07
Sample Name											
Date Deployed	(Long-term Chronic) ¹	(Long-term Chronic) ²	2021-10-25	2021-10-25	2021-10-25	2021-10-25	2021-10-25	2021-10-25	2021-10-25	2021-10-26	2021-10-26
Date Retrieved			2021-11-24	2021-11-24	2021-11-24	2021-11-24	2021-11-24	2021-11-24	2021-11-24	2021-11-24	2021-11-24
pH	-	-	7.4	7.8	7.7	7.8	8.0	8.0	7.6	7.9	7.7
Hardness as calcium carbonate (mg/L)	-	-	63.0	84.0	43	80.0	77.0	80.0	82.0	120.0	120.0
Metals, Dissolved											
Aluminum	100 (pH)	100 (pH)	< 120	53.0	< 47	25	25	< 18	69.6	< 83	169
Antimony	-	-	< 2.4	< 0.38	< 1	< 0.38	< 0.38	< 0.43	< 1.5	< 1.6	< 1.7
Barium	1,000	-	274.1	8.2	32.6	8.6	7.6	9.1	137.2	157.6	118.3
Beryllium	0.13	-	< 1.5	< 0.18	< 0.6	< 0.18	< 0.18	< 0.23	< 0.96	< 1	< 1.08
Boron	1,200	1,500	< 210	< 39	< 87	< 39	66	< 43	< 130	144	533
Cadmium	0.11 - 0.24 (H)	0.11 - 0.18 (H)	< 1.6	< 0.22	< 0.63	< 0.22	< 0.22	< 0.26	< 0.99	< 1.1	< 1.11
Calcium	-	-	98,305	21,000	28,745	20,000	19,000	23,200	86,653	134,858	96,936
Chromium	8.9 (III)	8.9 (III)	< 13	< 1.5	< 5	< 1.5	< 1.5	< 1.9	< 8	< 8.8	< 9
Hexavalent Chromium	1 (IV)	1 (IV)	< 440	< 10	< 150	< 10	< 10	< 41	< 260	< 290	< 300
Cobalt	4	-	3.06	< 0.13	0.84	< 0.13	< 0.13	< 0.16	8.01	20.83	5.49
Copper	1.4 - 2.8 (pH, H, DOC)	2.0 - 2.8 (H)	< 4.6	3.7	< 1.8	4.1	4.1	2.5	< 2.9	< 3.1	< 3.2
Iron	-	-	136,408	71.0	1,907	49	55	29.6	44,357	47,208	59,301
Magnesium	-	-	44,953	7,600	10,707	7,300	7,100	8,941	33,546	50,026	87,557
Manganese	882 - 1,130 (H)	350 - 470 (H)	16,083	3.1	2,212	3.9	2.0	26.4	11,402	31,774	10,221
Molybdenum	1,000	73	< 1.8	2.0	1.6	1.9	1.9	1.8	1.9	4.6	< 1.36
Nickel	25 - 110 (H)	67 - 110 (H)	< 2.5	0.98	1.33	0.85	0.69	0.94	4.51	11.02	4.28
Silver	0.05 - 1.5 (H)	0.25	< 0.62	< 0.18	< 0.29	< 0.18	< 0.18	< 0.18	< 0.41	< 0.44	< 0.45
Sodium	-	-	58,127	18,000	11,430	18,000	17,000	17,636	45,817	58,162	328,410
Strontium	-	-	657	89.0	141	86.0	81.0	102	496	720	740
Tin	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	30.9	1.0	< 4.9	1.0	1.0	2.0	13.1	< 8.9	14.8
Zinc	7.5 - 30 (H)	8.9 - 31 (pH, H, DOC)	< 24	13	< 9.3	12	11	< 3.9	< 15	< 16	< 16.5

Notes:

All parameter units in micrograms per litre (ug/L), unless otherwise noted.

QA/QC = Quality Assurance/Quality Control; FDA = Field Duplicate Available; FD = Field Duplicate; PW = porewater; SW = surface water.

< Indicates parameter was below laboratory equipment detection limit.

Italics indicates the detection limit was greater than one or more screening criteria

1. BC Approved (BC ENV 2023) and Working (BC ENV 2021) Water Quality Guidelines (WQGs) for the protection of freshwater aquatic life. Long-term chronic guidelines were applied. (H) indicates hardness dependent standards, (pH) indicates pH dependent standards, (III) indicated trivalent chromium, (VI) indicates hexavalent chromium.

2. Canadian Council of Ministers of the Environment (CCME). 2007. Water Quality guidelines for the protection of freshwater aquatic life; long-term chronic guidelines were applied. (H) indicates hardness dependent standards, (pH) indicates pH dependent standards, (III) indicated trivalent chromium, (VI) indicates hexavalent chromium.

Shaded	Parameter concentration exceeds applicable BC WQG for freshwater aquatic life
<u>Underlined</u>	Parameter concentration exceeds applicable CCME guideline for freshwater aquatic life
Shaded Blue	Damaged or removed from sediment

Data Sources

WSP 2023 = Samples collected in October 2021, as part of the 2022/2023 WSP HHERA (this report)

Table B-4: Screening of Elutriate Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Main data table with columns for Location, Sample Name, QA/QC, BC WQG for Freshwater Aquatic Life, CCME Freshwater Aquatic Life, and Elutriate Lab/Site Control. Rows include Field + Physical (pH, Dissolved Organic Carbon), Dissolved Metals (Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium (Cr(VI)), Cobalt, Copper, Iron, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Sulphur, Thallium, Tin, Titanium, Uranium, Vanadium, Zinc, Zirconium), and Total Metals.

Notes:

All parameter units in micrograms per litre (ug/L), unless otherwise noted.
QA/QC = Quality Assurance/Quality Control; N = no duplicate sample available.
< Indicates parameter was below laboratory equipment detection limit.
/italicized/ indicates the detection limit was greater than one or more screening criteria
1. BC Approved (BC ENV 2023) and Working (BC ENV 2021) Water Quality Guidelines (WQGs) for the protection of freshwater aquatic life. Long-term chronic guidelines were applied. (H) indicates hardness dependent standards, (pH) indicates pH dependent standards, (III) indicated trivalent chromium, (VI) indicates hexavalent chromium.
2. Canadian Council of Ministers of the Environment (CCME). 2007. Water Quality guidelines for the protection of freshwater aquatic life; long-term chronic guidelines were applied. (H) indicates hardness dependent standards, (pH)

Legend table with 2 rows: Shaded (Parameter concentration exceeds applicable BC WQG for freshwater aquatic life), Underlined (Parameter concentration exceeds applicable CCME guideline for freshwater aquatic life)

Data Sources

WSP 2023 = Samples collected in October 2021, as part of the 2022/2023 WSP HHERA (this report)

**Table B-5: Screening of Soil Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC**

Location	BC CSR		CCME	CCME	TP19-4	TP19-5	TP19-6	TP19-7	TP19-8	TP19-8	TP19-9	CS21-01	CS21-02	CS21-03	CS21-04	CS21-05	CS21-05	CS21-06	CS21-07	CS21-08	CS21-09	CS21-10
Sample Name	Soil Standard for Ecological Health ¹	Soil Standard for Human Health ¹	Soil Guideline for Environmental Health ₂	Soil Guideline for Human Health ²	264120	264121	264122	264123	264124	264126	264125	06190-01	06190-02	06190-03	06190-04	06190-05	06190-06	06190-07	06191-06	06190-09	06190-08	06190-10
Sample Date					2019-06-07	2019-06-07	2019-06-07	2019-06-07	2019-06-07	2019-06-07	2019-06-07	2021-10-26	2021-10-26	2021-10-26	2021-10-26	2021-10-27	2021-10-27	2021-10-27	2021-10-29	2021-10-27	2021-10-27	2021-10-27
Sample Depth					0.1 m	0.1 m	0.1 m	0.1 m	0.1 m	0.1 m	0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m
QA/QC									FDA	FD					FDA	FD						
Field + Physical																						
pH (pH units)	-	-	-	-	5.84	5.94	5.39	5.45	5.69	5.78	5.63	5.4	5.99	5.47	5.7	5.18	5.16	5.47	5.7	5.64	5.85	5.57
Sieve >19mm (%)	-	-	-	-	-	-	-	-	-	-	-	< 1	< 1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	7
Sieve >4.75mm (%)	-	-	-	-	-	-	-	-	-	-	-	8	4	34	< 1	< 1	< 1	4	< 1	< 1	< 1	12
Sieve >0.075mm (%)	-	-	-	-	-	-	-	-	-	-	-	25	23	19	35	37	32	23	20	20	32	32
Grain Size	-	-	-	-	-	-	-	-	-	-	-	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
Total Carbon (%)	-	-	-	-	-	-	-	-	-	-	-	4.78	5.26	4.89	4.29	7.28	6.16	6.34	4.98	5.71	4.05	3.55
Total Organic Carbon (%)	-	-	-	-	-	-	-	-	-	-	-	4.72	5.2	4.83	4.24	7.2	6.06	6.3	4.94	5.67	4	3.55
Total Inorganic Carbon (%)	-	-	-	-	-	-	-	-	-	-	-	0.06	0.06	0.06	0.05	0.08	0.1	0.04	0.04	0.04	0.05	< 0.02
Metals																						
Aluminum	-	40,000	-	-	19,100	21,000	16,600	14,400	20,700	17,300	20,000	21,500	22,700	20,400	18,800	17,800	18,700	18,500	20,400	22,800	20,500	20,200
Antimony	20	500	20	20	0.3	0.2	0.3	0.2	0.2	0.2	0.5	0.5	0.3	0.4	0.5	0.4	0.4	0.3	0.5	0.5	0.4	0.3
Arsenic	25	40	17	31	4.3	4.3	2.3	1.7	2.6	3.3	4.1	4	5	5	5	5	5	4	6	5	5	3
Barium	700	15,000	500	6,800	100	108	105	89.6	66.9	64.7	83.4	129	109	99.7	103	103	110	87.5	122	122	108	102
Beryllium	150	150	4	75	0.3	0.3	0.3	0.2	0.2	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.3	0.4	0.5	0.4	0.4
Bismuth	-	-	-	-	-	-	-	-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cadmium	30	40	10	14	2.3	0.48	3.16	0.5	0.67	0.66	4.92	1.08	1.18	9.63	9.89	2.83	3.2	0.31	9.23	4.15	9.59	0.23
Calcium	-	-	-	-	-	-	-	-	-	-	-	6,370	8,670	8,190	7,420	7,060	7,240	6,660	7,330	7,700	7,560	5,670
Chromium	200	250	65	220	38	28	40	17	23	23	50	39	44	78	78	45	52	30	80	53	67	34
Cobalt	45	25	50	50	10.5	10.3	8.4	6.3	7.3	7.3	12.3	12.8	13.9	12.5	13.4	11.5	12.9	10.2	13.9	14.6	13.1	11.8
Copper	150	7,500	63	1,100	19.9	20	21.1	12.5	16.8	17.5	39.7	21.7	35.9	36.8	36.9	30.2	33.8	17	41.6	40.6	36.3	29.3
Iron	-	35,000	-	-	23,900	26,200	18,100	18,300	25,300	20,900	28,200	27,400	31,500	27,400	27,000	23,800	25,000	24,400	26,900	29,200	27,200	26,500
Lead	550	120	300	140	17.7	9.1	18.7	10.1	11.7	11.9	24.4	14.3	10.6	26.2	32.2	25.1	26.7	10.9	37.4	25.9	28.7	11.9
Lithium	-	65	-	-	10.4	11.3	9.6	7.4	8.8	9.5	13.9	14.9	17.2	13.6	14.1	12.8	14	13.1	16	16.9	14.6	14.1
Magnesium	-	-	-	-	-	-	-	-	-	-	-	6,220	7,580	6,990	6,230	5,450	5,690	6,280	6,430	6,560	6,540	6,180
Manganese	2000	10,000	-	-	700	690	474	525	411	417	950	909	630	574	825	588	627	688	1010	1160	866	633
Mercury	40	25	12	7	0.07	0.04	0.07	0.04	0.04	0.05	0.07	0.02	0.04	0.03	0.04	0.05	0.05	0.03	0.06	0.07	0.04	< 0.01
Molybdenum	80	400	10	10	0.5	0.5	0.5	0.3	0.4	0.4	0.8	1.2	0.4	0.7	0.8	0.6	0.7	0.4	0.8	1	0.6	0.4
Nickel	150	900	45	200	19.6	21.9	17.5	13.6	17.4	17.8	26	25.2	32.7	24.7	27	22.9	26.7	22.8	29	29.8	27.4	27.6
Phosphorus	-	-	-	-	-	-	-	-	-	-	-	650	733	1290	1080	814	879	681	960	987	1020	660
Potassium	-	-	-	-	-	-	-	-	-	-	-	771	1350	834	747	715	729	636	826	909	920	894
Selenium	1.5	400	1	80	< 0.1	< 0.1	0.4	< 0.1	0.4	0.2	0.4	0.1	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.6	0.6	0.2
Silver	20	400	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	-	1,000,000	-	-	-	-	-	-	-	-	-	214	241	222	267	233	244	163	341	298	307	211
Strontium	-	20,000	-	-	34	36	43	32	25	24	41	37	53	47	45	46	47	44	55	52	46	34
Thallium	9	-	1.4	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Tin	50	50,000	50	50	0.5	0.4	0.7	0.4	0.6	0.7	1.2	0.6	0.5	1	1.5	1	1.4	0.4	1.6	1.1	1.3	0.7
Titanium	-	-	-	-	-	-	-	-	-	-	-	1,060	1,050	838	776	707	751	1,060	832	858	919	884
Uranium	500	250	500	23	0.5	0.4	0.5	0.2	0.4	0.4	0.7	0.5	0.5	0.9	0.8	0.7	0.7	0.3	0.9	1	0.9	0.5
Vanadium	150	400	130	130	53	60	43	36	47	48	59	70	87	68	66	64	74	69	73	75	67	72
Zinc	450	25,000	250	10,000	117	85	94	71	74	75	210	107	99	132	179	103	118	81	200	179	179	85
Zirconium	-	-	-	-	-	-	-	-	-	-	-	0.7	1.1	0.4	0.4	0.4	0.5	0.8	0.8	0.4	0.7	0.5

Notes:

All parameter units in milligrams per kilogram (mg/kg), unless otherwise noted.

QA/QC = Quality Assurance/Quality Control; FDA = Field Duplicate Available; FD = Field Duplicate.

< Indicates parameter was below laboratory equipment detection limit.

1. BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.1 Part 1 soil standards for toxicity to soil invertebrates and plants or Schedule 3.1 Part 2 soil standards to protect ecological and human health (urban park; PL) and Schedule 3.1 Part 1 soil standards for intake of contaminated soil or Schedule 3.1 Part 2 soil standards to protect human health (urban park; PL).

2. Canadian Council of Ministers of the Environment (CCME). 1999. Environmental and Human Health Soil Quality Guidelines; soil ingestion or direct contact pathways to protect human and ecological health. If a pathway specific guideline was not available, the generic guideline was applied (residential / parkland [RL/PL] land use). 1 in 100,000 cancer risk level.

a. BC ENV, 2023. Protocol 4 for Contaminated Sites – Establishing Local Background Concentrations in Soil. BC Ministry of Environment and

Shaded	Parameter concentration exceeds applicable BC CSR Soil Standard for toxicity to soil invertebrates and plants for urban park land use
<u>Underlined</u>	Parameter concentration exceeds applicable BC CSR Soil Standard for intake of contaminated soil for urban park land use
Bold	Parameter concentration exceeds applicable Canadian Council of Ministers of the Environment (CCME) Soil guideline for environmental health for residential / park land use
Pattern	Parameter concentration exceeds applicable CCME Soil guideline for protection of human health for residential / park land use

Data Sources

Thurber 2019 = Reay Creek Dam Geotechnical Site Characterization Report. Report for the Town of Sidney.

WSP 2023 = Samples collected in October 2021, as part of the 2023 WSP HHERA (this report)

Table B-5: Screening of Soil Analytical Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Location					CS21-11	CS21-12	CS21-13	CS21-14	CS21-15	CS21-16	CS21-16	CS21-17	CS21-18	CS21-19	CS21-20
Sample Name	BC CSR	BC CSR	CCME	CCME	06190-11	06190-12	06191-05	06191-04	06191-03	06191-07	06191-08	06191-09	06191-10	06191-01	06191-02
Sample Date	Soil Standard for Ecological Health ¹	Soil Standard for Human Health ¹	Soil Guideline for Environmental Health ²	Soil Guideline for Human Health ²	2021-10-27	2021-10-27	2021-10-28	2021-10-28	2021-10-28	2021-10-29	2021-10-29	2021-10-29	2021-10-29	2021-10-28	2021-10-28
Sample Depth					0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m	0-0.1 m
QA/QC										FDA	FD				
Field + Physical															
pH (pH units)	-	-	-	-	5.68	5.76	4.73	5.41	5.79	6.19	9.27	5.45	4.95	5.52	4.57
Sieve >19mm (%)	-	-	-	-	5	< 1	< 1	< 1	< 1	< 1	< 1	11	< 1	< 1	< 1
Sieve >4.75mm (%)	-	-	-	-	15	< 1	< 1	1	< 1	< 1	< 1	3	< 1	< 1	< 1
Sieve >0.075mm (%)	-	-	-	-	26	10	8	9	1	3	1	8	23	10	16
Grain Size	-	-	-	-	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
Total Carbon (%)	-	-	-	-	3.38	5.99	6.96	9.15	6.15	7.4	7.54	11.2	3.62	7.89	9.9
Total Organic Carbon (%)	-	-	-	-	3.38	5.93	6.89	9.09	6.11	7.31	7.46	11.1	3.62	7.84	9.71
Total Inorganic Carbon (%)	-	-	-	-	< 0.02	0.06	0.07	0.06	0.04	0.09	0.08	0.1	< 0.02	0.05	0.19
Metals															
Aluminum	-	40,000	-	-	21,900	23,600	25,100	25,100	28,700	26,100	27,500	21,700	23,100	22,000	23,600
Antimony	20	500	20	20	0.3	0.5	0.8	0.4	0.9	0.9	0.8	0.5	0.3	0.4	0.7
Arsenic	25	40	17	31	4	6	6	4	6	8	7	4	3	5	4
Barium	700	15,000	500	6,800	98.8	125	134	139	148	166	158	118	116	105	103
Beryllium	150	150	4	75	0.4	0.5	0.5	0.5	0.6	0.6	0.5	0.4	0.6	0.4	0.4
Bismuth	-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cadmium	30	40	10	14	1.08	6.34	3.13	3.13	10.6	14.8	13.9	1.01	0.43	0.41	0.98
Calcium	-	-	-	-	6,470	8,890	7,710	9,000	8,910	9,900	11,100	7,950	4,210	8,230	8,010
Chromium	200	250	65^a	220	36	64	80	52	92	100	91	37	48	37	46
Cobalt	45	25	50	50	11.3	14.5	12.5	12.5	17.8	19.9	17.9	14.5	17.8	15.1	12.7
Copper	150	7,500	63	1,100	26.4	43.9	49.2	31.1	63.8	65.4	59.7	28.4	20.1	26.1	42.4
Iron	-	35,000	-	-	28,100	31,400	31,800	29,000	34,400	34,900	38,500	27,700	27,900	29,400	29,400
Lead	550	120	300	140	16	32.8	42.9	31.6	55	62.7	58.1	38	28.1	47.5	84.8
Lithium	-	65	-	-	14.3	16.7	17.9	16.2	21.0	22.1	20.3	14.3	21.7	15.7	16.5
Magnesium	-	-	-	-	6,490	7,230	7,570	7,870	8,600	7,880	8,490	6,440	6,810	7,470	8,780
Manganese	2000	10,000	-	-	638	1140	1080	676	1240	1930	1870	961	665	775	446
Mercury	40	25	12	7	0.01	0.05	0.07	0.06	0.08	0.1	0.07	0.06	0.02	0.04	0.04
Molybdenum	80	400	10	10	0.5	1	1.1	0.6	1.3	1.3	1.3	0.7	0.5	0.4	0.7
Nickel	150	900	45	200	24.2	31.2	31.6	29.1	39.1	41.4	36.9	25	32.6	27.7	30.5
Phosphorus	-	-	-	-	577	940	1320	696	1260	1540	1740	655	358	428	544
Potassium	-	-	-	-	1000	832	822	949	1220	1100	1170	708	576	832	786
Selenium	1.5	400	1	80	0.4	0.7	0.8	0.4	0.7	0.7	0.7	0.5	0.4	0.4	0.5
Silver	20	400	20	20	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	-	1,000,000	-	-	186	311	323	336	408	389	417	456	231	319	618
Strontium	-	20,000	-	-	37	56	49	59	55	76	73	59	46	52	45
Thallium	9	-	1.4	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Tin	50	50,000	50	50	0.8	1.1	1.6	1	1.8	1.7	1.6	0.8	0.8	0.6	1.2
Titanium	-	-	-	-	913	833	912	1,030	989	1,070	1,150	773	1,080	1,170	1,050
Uranium	500	250	500	23	0.6	0.9	1	0.7	1.4	1.4	1.3	0.6	0.4	0.4	0.5
Vanadium	150	400	130	130	69	74	77	70	87	90	85	68	100	80	77
Zinc	450	25,000	250	10,000	96	228	255	115	365	464	418	181	100	76	167
Zirconium	-	-	-	-	0.6	0.5	0.5	0.7	0.6	1.8	1.5	0.9	1.1	1.3	1.7

Notes:
 All parameter units in milligrams per kilogram (mg/kg), unless otherwise noted.
 QA/QC = Quality Assurance/Quality Control; FDA = Field Duplicate Available; FD = Field Duplicate.
 < Indicates parameter was below laboratory equipment detection limit.

- BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96; includes BC Reg 128/2022, App 2 and BC Reg 133/2022, amendments effective March 1, 2023 as amended by BC Reg 2/2023 and BC Reg 35/2023) Schedule 3.1 Part 1 soil standards for toxicity to soil invertebrates and plants or Schedule 3.1 Part 2 soil standards to protect ecological and human health (urban park; PL) and Schedule 3.1 Part 1 soil standards for intake of contaminated soil or Schedule 3.1 Part 2 soil standards to protect human health (urban park; PL).
- Canadian Council of Ministers of the Environment (CCME). 1999. Environmental and Human Health Soil Quality Guidelines; soil ingestion or direct contact pathways to protect human and ecological health. If a pathway specific guideline was not available, the generic guideline was applied (residential / parkland [RL/PL] land use). 1 in 100,000 cancer risk level.

a. BC ENV. 2023. Protocol 4 for Contaminated Sites – Establishing Local Background Concentrations in Soil. BC Ministry of Environment and

Shaded	Parameter concentration exceeds applicable BC CSR Soil Standard for toxicity to soil invertebrates and plants for urban park land use
<u>Underlined</u>	Parameter concentration exceeds applicable BC CSR Soil Standard for intake of contaminated soil for urban park land use
Bold	Parameter concentration exceeds applicable Canadian Council of Ministers of the Environment (CCME) Soil guideline for environmental health for residential / park land use
Pattern	Parameter concentration exceeds applicable CCME Soil guideline for protection of human health for residential / park land use

Data Sources
 Thurber 2019 = Reay Creek Dam Geotechnical Site Characterization Report. Report for the Town of Sidney.
 WSP 2023 = Samples collected in October 2021, as part of the 2023 WSP HHERA (this report)

https://wsponlinecan.sharepoint.com/sites/CA-CA00078675135/Shared%20Documents/06_Deliverables/3.0_ISSUE/CA0007867.5135-004-R-Rev0/APPI/App B - Screened Data Tables/Table B1 to B5 Analytical Results_DR

Table B-6: Sediment QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location Sample Name Sample Collection Date Sample Matrix	Units	RDL	SED21-31 06185-04 2021-10-21 SE	SED21-31 06185-05 2021-10-21 SE	RPD (%)	DF (unitless)
Field and Physical						
pH	pH units	0.1	7.54	7.61	1	n/c
Total Carbon	%	0.02	0.46	0.31	<u>39</u>	n/c
Total Inorganic Carbon	%	0.02	< 0.02	< 0.02	n/c	0
Total Organic Carbon	%	0.02	0.46	0.31	39	n/c
Metals						
Aluminum	ug/g	10	13000	11100	16	n/c
Antimony	ug/g	0.1	0.2	4.2	<u>182</u>	n/c
Arsenic	ug/g	1	5	13	<u>89</u>	n/c
Barium	ug/g	0.5	54.8	36.5	40	n/c
Beryllium	ug/g	0.1	0.3	0.2	n/c	1
Bismuth	ug/g	0.5	< 0.5	< 0.5	n/c	0
Cadmium	ug/g	0.01	1.11	0.93	18	n/c
Calcium	ug/g	10	6960	6060	14	n/c
Chromium	ug/g	1	21	19	10	n/c
Chromium Hexavalent (Cr(VI))	mg/L	0.3	< 0.3	< 0.3	n/c	0
Chromium Trivalent (Cr(III))	ug/g	0.4	21	19	10	n/c
Cobalt	ug/g	0.1	11.3	8.9	24	n/c
Copper	ug/g	0.2	19.5	22.2	13	n/c
Iron	ug/g	10	24500	21800	12	n/c
Lead	ug/g	0.1	4.4	12.5	<u>96</u>	n/c
Lithium	ug/g	0.5	6.3	5.6	12	n/c
Magnesium	ug/g	10	6000	5050	17	n/c
Manganese	ug/g	1	935	563	<u>50</u>	n/c
Mercury	ug/g	0.01	0.02	0.02	n/c	0
Molybdenum	ug/g	0.2	0.6	1	n/c	2
Nickel	ug/g	0.5	17.6	14.9	17	n/c
Phosphorus	ug/g	5	763	527	<u>37</u>	n/c
Potassium	ug/g	5	374	296	23	n/c
Selenium	ug/g	0.1	0.3	0.2	n/c	1
Silver	ug/g	0.5	< 0.5	< 0.5	n/c	0
Sodium	ug/g	5	219	224	2	n/c
Strontium	ug/g	1	34	29	16	n/c
Thallium	ug/g	0.1	< 0.1	< 0.1	n/c	0
Tin	ug/g	0.2	1.6	1.3	21	n/c
Titanium	ug/g	1	1050	1030	2	n/c
Uranium	ug/g	0.2	0.3	0.2	n/c	0.5
Vanadium	ug/g	1	55	47	16	n/c
Zinc	ug/g	1	144	253	<u>55</u>	n/c
Zirconium	ug/g	0.1	3.7	3.9	5	n/c

Notes:

RPD = Relative percent difference; the difference between two values divided by the mean of the two values.

RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

DF is calculated when the mean concentration is less than five times the laboratory reporting limit.

n/c = Not Calculated

LRL = Laboratory Reporting Limit

Red text and underline indicates that the RPD or DF exceeds Golder's data quality objectives.

Table B-6: Sediment QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location Sample Name Sample Collection Date Sample Matrix	Units	RDL	SED21-34 06185-08 2021-10-21 SE	SED21-34 06185-09 2021-10-21 SE	RPD (%)	DF (unitless)
Field and Physical						
pH	pH units	0.1	5.98	5.98	0	n/c
Total Carbon	%	0.02	0.57	0.54	5	n/c
Total Inorganic Carbon	%	0.02	< 0.02	< 0.02	n/c	0
Total Organic Carbon	%	0.02	0.57	0.54	5	n/c
Metals						
Aluminum	ug/g	10	18200	22000	19	n/c
Antimony	ug/g	0.1	0.3	0.3	n/c	0
Arsenic	ug/g	1	6	6	0	n/c
Barium	ug/g	0.5	71.8	79.6	10	n/c
Beryllium	ug/g	0.1	0.4	0.3	n/c	1
Bismuth	ug/g	0.5	< 0.5	< 0.5	n/c	0
Cadmium	ug/g	0.01	1.64	1.47	11	n/c
Calcium	ug/g	10	6360	6490	2	n/c
Chromium	ug/g	1	40	45	12	n/c
Chromium Hexavalent (Cr(VI))	mg/L	0.3	< 0.3	< 0.3	n/c	0
Chromium Trivalent (Cr(III))	ug/g	0.4	40	45	12	n/c
Cobalt	ug/g	0.1	14.5	16.8	15	n/c
Copper	ug/g	0.2	30.1	33.9	12	n/c
Iron	ug/g	10	29600	34600	16	n/c
Lead	ug/g	0.1	6.9	8.1	16	n/c
Lithium	ug/g	0.5	13.2	14.2	7	n/c
Magnesium	ug/g	10	7650	9260	19	n/c
Manganese	ug/g	1	481	565	16	n/c
Mercury	ug/g	0.01	0.03	0.02	n/c	1
Molybdenum	ug/g	0.2	0.3	0.3	n/c	0
Nickel	ug/g	0.5	29.3	36	21	n/c
Phosphorus	ug/g	5	676	670	1	n/c
Potassium	ug/g	5	952	1210	24	n/c
Selenium	ug/g	0.1	0.3	0.3	n/c	0
Silver	ug/g	0.5	< 0.5	< 0.5	n/c	0
Sodium	ug/g	5	433	496	14	n/c
Strontium	ug/g	1	29	31	7	n/c
Thallium	ug/g	0.1	< 0.1	< 0.1	n/c	0
Tin	ug/g	0.2	0.6	0.6	n/c	0
Titanium	ug/g	1	1320	1450	9	n/c
Uranium	ug/g	0.2	0.3	0.4	n/c	0.5
Vanadium	ug/g	1	73	84	14	n/c
Zinc	ug/g	1	148	164	10	n/c
Zirconium	ug/g	0.1	6.4	6.4	0	n/c

Notes:

RPD = Relative percent difference; the difference between two values divided by the mean of the two values.

RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

DF is calculated when the mean concentration is less than five times the laboratory reporting limit.

n/c = Not Calculated

LRL = Laboratory Reporting Limit

Red text and underline indicates that the RPD or DF exceeds Golder's data quality objectives.

Table B-6: Sediment QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location Sample Name Sample Collection Date Sample Matrix	Units	RDL	SED21-BG-01 06189-01 2021-10-22 SE	SED21-BG-01 06189-02 2021-10-22 SE	RPD (%)	DF (unitless)
Field and Physical						
pH	pH units	0.1	7.87	7.67	3	n/c
Total Carbon	%	0.02	0.89	0.89	0	n/c
Total Inorganic Carbon	%	0.02	< 0.02	< 0.02	n/c	0
Total Organic Carbon	%	0.02	0.89	0.89	0	n/c
Metals						
Aluminum	ug/g	10	15200	16000	5	n/c
Antimony	ug/g	0.1	0.5	0.4	n/c	1
Arsenic	ug/g	1	2	7	111	n/c
Barium	ug/g	0.5	57.4	59.2	3	n/c
Beryllium	ug/g	0.1	0.3	0.3	n/c	0
Bismuth	ug/g	0.5	< 0.5	< 0.5	n/c	0
Cadmium	ug/g	0.01	0.17	0.17	0	n/c
Calcium	ug/g	10	6700	6470	3	n/c
Chromium	ug/g	1	21	26	21	n/c
Chromium Hexavalent (Cr(VI))	mg/L	0.3	< 0.3	< 0.3	n/c	0
Chromium Trivalent (Cr(III))	ug/g	0.4	21	26	21	n/c
Cobalt	ug/g	0.1	8	9.9	21	n/c
Copper	ug/g	0.2	29	31	7	n/c
Iron	ug/g	10	22200	22500	1	n/c
Lead	ug/g	0.1	14.4	8.8	48	n/c
Lithium	ug/g	0.5	9.4	9.6	2	n/c
Magnesium	ug/g	10	5430	5640	4	n/c
Manganese	ug/g	1	572	637	11	n/c
Mercury	ug/g	0.01	0.03	0.03	n/c	0
Molybdenum	ug/g	0.2	0.6	0.5	n/c	0.5
Nickel	ug/g	0.5	18.1	21.1	15	n/c
Phosphorus	ug/g	5	619	596	4	n/c
Potassium	ug/g	5	700	740	6	n/c
Selenium	ug/g	0.1	0.1	0.3	n/c	2
Silver	ug/g	0.5	< 0.5	< 0.5	n/c	0
Sodium	ug/g	5	309	307	1	n/c
Strontium	ug/g	1	33	32	3	n/c
Thallium	ug/g	0.1	< 0.1	< 0.1	n/c	0
Tin	ug/g	0.2	0.5	0.7	n/c	1
Titanium	ug/g	1	1050	1170	11	n/c
Uranium	ug/g	0.2	0.3	0.3	n/c	0
Vanadium	ug/g	1	51	63	21	n/c
Zinc	ug/g	1	110	124	12	n/c
Zirconium	ug/g	0.1	3.1	3.3	6	n/c

Notes:

RPD = Relative percent difference; the difference between two values divided by the mean of the two values.

RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

DF is calculated when the mean concentration is less than five times the laboratory reporting limit.

n/c = Not Calculated

LRL = Laboratory Reporting Limit

Red text and underline indicates that the RPD or DF exceeds Golder's data quality objectives.

Table B-7: Soil QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location			CS21-05	CS21-05		
Sample Name			06190-05	06190-06		DF
Sample Collection Date	Units	RDL	2021-10-27	2021-10-27	RPD (%)	(unitless)
Sample Matrix			SO	SO		
Sample Depth			0 - 0.1 m	0 - 0.1 m		
Carbon Content						
Total Carbon	%	0.02	7.28	6.16	17	n/c
Total Inorganic Carbon	%	0.02	0.08	0.1	n/c	1
Total Organic Carbon	%	0.02	7.2	6.06	17	n/c
Field + Physical						
pH	pH units	0.1	5.18	5.16	0	n/c
Sieve >19mm (%)	%	1	< 1	< 1	n/c	0
Sieve >4.75mm (%)	%	1	< 1	< 1	n/c	0
Sieve >0.075mm (%)	%	1	32	37	14	n/c
Metals						
Aluminum	ug/g	10	17800	18700	5	n/c
Antimony	ug/g	0.1	0.4	0.4	n/c	0
Arsenic	ug/g	1	5	5	n/c	0
Barium	ug/g	0.5	103	110	7	n/c
Beryllium	ug/g	0.1	0.4	0.4	n/c	0
Bismuth	ug/g	0.5	< 0.5	< 0.5	n/c	0
Cadmium	ug/g	0.01	2.83	3.2	12	n/c
Calcium	ug/g	10	7060	7240	3	n/c
Chromium	ug/g	1	45	52	14	n/c
Cobalt	ug/g	0.1	11.5	12.9	11	n/c
Copper	ug/g	0.2	30.2	33.8	11	n/c
Iron	ug/g	10	23800	25000	5	n/c
Lead	ug/g	0.1	25.1	26.7	6	n/c
Lithium	ug/g	0.5	12.8	14	9	n/c
Magnesium	ug/g	10	5450	5690	4	n/c
Manganese	ug/g	1	588	627	6	n/c
Mercury	ug/g	0.01	0.05	0.05	n/c	0
Molybdenum	ug/g	0.2	0.6	0.7	n/c	0.5
Nickel	ug/g	0.5	22.9	26.7	15	n/c
Phosphorus	ug/g	5	814	879	8	n/c
Potassium	ug/g	5	715	729	2	n/c
Selenium	ug/g	0.1	0.5	0.5	n/c	0
Silver	ug/g	0.5	< 0.5	< 0.5	n/c	0
Sodium	ug/g	5	233	244	5	n/c
Strontium	ug/g	1	46	47	2	n/c
Thallium	ug/g	0.1	< 0.1	< 0.1	n/c	0
Tin	ug/g	0.2	1	1.4	33	n/c
Titanium	ug/g	1	707	751	6	n/c
Uranium	ug/g	0.2	0.7	0.7	n/c	0
Vanadium	ug/g	1	64	74	14	n/c
Zinc	ug/g	1	103	118	14	n/c
Zirconium	ug/g	0.1	0.4	0.5	n/c	1

Notes:

RPD = Relative percent difference; the difference between two values divided by the mean of the two values.

RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

DF is calculated when the mean concentration is less than five times the laboratory reporting limit.

n/c = Not Calculated

LRL = Laboratory Reporting Limit

Red text and underline indicates that the RPD or DF exceeds Golder's data quality objectives.

Table B-7: Soil QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location			CS21-16	CS21-16		
Sample Name			06191-07	06191-08		DF
Sample Collection Date	Units	RDL	2021-10-29	2021-10-29	RPD (%)	(unitless)
Sample Matrix			SO	SO		
Sample Depth			0 - 0.1 m	0 - 0.1 m		
Carbon Content						
Total Carbon	%	0.02	7.4	7.54	2	n/c
Total Inorganic Carbon	%	0.02	0.09	0.08	n/c	0.5
Total Organic Carbon	%	0.02	7.31	7.46	2	n/c
Field + Physical						
pH	pH units	0.1	6.19	9.27	40	n/c
Sieve >19mm (%)	%	1	< 1	< 1	n/c	0
Sieve >4.75mm (%)	%	1	< 1	< 1	n/c	0
Sieve >0.075mm (%)	%	1	3	1	n/c	2
Metals						
Aluminum	ug/g	10	26100	27500	5	n/c
Antimony	ug/g	0.1	0.9	0.8	12	n/c
Arsenic	ug/g	1	8	7	13	n/c
Barium	ug/g	0.5	166	158	5	n/c
Beryllium	ug/g	0.1	0.6	0.5	18	n/c
Bismuth	ug/g	0.5	< 0.5	< 0.5	n/c	0
Cadmium	ug/g	0.01	14.8	13.9	6	n/c
Calcium	ug/g	10	9900	11100	11	n/c
Chromium	ug/g	1	100	91	9	n/c
Cobalt	ug/g	0.1	19.9	17.9	11	n/c
Copper	ug/g	0.2	65.4	59.7	9	n/c
Iron	ug/g	10	34900	38500	10	n/c
Lead	ug/g	0.1	62.7	58.1	8	n/c
Lithium	ug/g	0.5	22.1	20.3	8	n/c
Magnesium	ug/g	10	7880	8490	7	n/c
Manganese	ug/g	1	1930	1870	3	n/c
Mercury	ug/g	0.01	0.1	0.07	35	n/c
Molybdenum	ug/g	0.2	1.3	1.3	0	n/c
Nickel	ug/g	0.5	41.4	36.9	11	n/c
Phosphorus	ug/g	5	1540	1740	12	n/c
Potassium	ug/g	5	1100	1170	6	n/c
Selenium	ug/g	0.1	0.7	0.7	0	n/c
Silver	ug/g	0.5	< 0.5	< 0.5	n/c	0
Sodium	ug/g	5	389	417	7	n/c
Strontium	ug/g	1	76	73	4	n/c
Thallium	ug/g	0.1	0.1	< 0.1	n/c	0
Tin	ug/g	0.2	1.7	1.6	6	n/c
Titanium	ug/g	1	1070	1150	7	n/c
Uranium	ug/g	0.2	1.4	1.3	7	n/c
Vanadium	ug/g	1	90	85	6	n/c
Zinc	ug/g	1	464	418	10	n/c
Zirconium	ug/g	0.1	1.8	1.5	18	n/c

Notes:

RPD = Relative percent difference; the difference between two values divided by the mean of the two values.

RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

DF is calculated when the mean concentration is less than five times the laboratory reporting limit.

n/c = Not Calculated

LRL = Laboratory Reporting Limit

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Table B-8: Water QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location Sample Name Sample Collection Date Sample Matrix	Units	RDL	SW21-03 06183-02 2021-10-25 WG	SW21-03 06183-03 2021-10-25 WG	RPD (%)	DF (unitless)
Metals, Dissolved						
Aluminum	ug/L	2	7	6	n/c	0.5
Antimony	ug/L	0.2	1	0.5	n/c	2.5
Arsenic	ug/L	0.1	0.6	0.5	18	n/c
Barium	ug/L	0.2	7.8	8.4	7	n/c
Beryllium	ug/L	0.01	< 0.01	< 0.01	n/c	0
Bismuth	ug/L	0.05	< 0.05	< 0.05	n/c	0
Boron	ug/L	2	26	28	7	n/c
Cadmium	ug/L	0.01	< 0.01	0.01	n/c	0
Calcium	ug/L	50	27800	27600	1	n/c
Chromium	ug/L	0.5	< 0.5	< 0.5	n/c	0
Cobalt	ug/L	0.05	0.07	0.07	n/c	0
Copper	ug/L	0.2	3.1	2.9	7	n/c
Hardness	ug/L	100	109000	108000	1	n/c
Iron	ug/L	10	40	36	n/c	0.4
Lead	ug/L	0.05	< 0.05	< 0.05	n/c	0
Lithium	ug/L	0.5	0.9	1	n/c	0.2
Magnesium	ug/L	50	9520	9460	1	n/c
Manganese	ug/L	1	12	12	0	n/c
Mercury	ug/L	0.005	< 0.005	< 0.005	n/c	0
Molybdenum	ug/L	0.05	1.98	1.94	2	n/c
Nickel	ug/L	0.2	0.8	0.5	n/c	1.5
pH	pH units	0.01	7.58	7.57	0	n/c
Potassium	ug/L	50	1510	1480	2	n/c
Selenium	ug/L	0.5	< 0.5	< 0.5	n/c	0
Silicon	ug/L	50	4640	4630	0	n/c
Silver	ug/L	0.02	< 0.02	< 0.02	n/c	0
Sodium	ug/L	50	23400	23800	2	n/c
Strontium	ug/L	0.1	108	110	2	n/c
Sulphur (Colloidal)	ug/L	500	7570	7570	0	n/c
Thallium	ug/L	0.01	< 0.01	< 0.01	n/c	0
Tin	ug/L	0.05	< 0.05	< 0.05	n/c	0
Titanium	ug/L	0.5	3.2	3	6	n/c
Uranium	ug/L	0.01	0.17	0.19	11	n/c
Vanadium	ug/L	0.5	0.7	0.5	n/c	0.4
Zinc	ug/L	2	5	6	n/c	0.5
Zirconium	ug/L	0.1	< 0.1	< 0.1	n/c	0

Notes:

RPD = Relative percent difference; the difference between two values divided by the mean of the two values.

RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

DF is calculated when the mean concentration is less than five times the laboratory reporting limit.

n/c = Not Calculated

LRL = Laboratory Reporting Limit

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Table B-8: Water QA/QC Results
Detailed Human Health and Ecological Risk Assessment
KELSET, Downstream of KELSET Pond, BC

Sample Location Sample Name Sample Collection Date Sample Matrix	Units	RDL	SW21-03 06183-02 2021-10-25 WG	SW21-03 06183-03 2021-10-25 WG	RPD (%)	DF (unitless)
Metals, Total						
Aluminum	ug/L	5	83	94	12	n/c
Antimony	ug/L	0.5	< 0.5	< 0.5	n/c	0
Arsenic	ug/L	0.1	0.4	< 0.1	n/c	<u>3</u>
Barium	ug/L	0.2	9.6	9.8	2	n/c
Beryllium	ug/L	0.05	< 0.05	< 0.05	n/c	0
Bismuth	ug/L	0.05	< 0.05	< 0.05	n/c	0
Boron	ug/L	5	33	30	10	n/c
Cadmium	ug/L	0.01	0.02	0.03	n/c	1
Calcium	ug/L	50	27900	27600	1	n/c
Chromium	ug/L	0.5	0.5	< 0.5	n/c	0
Cobalt	ug/L	0.05	0.12	0.12	n/c	0
Copper	ug/L	0.5	5.2	4.5	14	n/c
Hardness	ug/L	100	111000	108000	3	n/c
Iron	ug/L	10	175	169	3	n/c
Lead	ug/L	0.05	0.19	0.12	n/c	1.4
Lithium	ug/L	0.5	1.3	1.3	n/c	0
Magnesium	ug/L	50	10100	9610	5	n/c
Manganese	ug/L	1	16	15	6	n/c
Mercury	ug/L	0.005	< 0.005	< 0.005	n/c	0
Molybdenum	ug/L	0.1	2.2	2.2	0	n/c
Nickel	ug/L	0.5	0.8	0.7	n/c	0.2
pH	pH units	0.01	7.58	7.57	0	n/c
Potassium	ug/L	100	1580	1510	5	n/c
Selenium	ug/L	0.5	< 0.5	< 0.5	n/c	0
Silicon	ug/L	50	4950	4710	5	n/c
Silver	ug/L	0.02	< 0.02	< 0.02	n/c	0
Sodium	ug/L	100	24200	22900	6	n/c
Strontium	ug/L	0.1	143	137	4	n/c
Sulphur (S)	ug/L	500	7730	7410	4	n/c
Thallium	ug/L	0.02	< 0.02	< 0.02	n/c	0
Tin	ug/L	0.05	< 0.05	< 0.05	n/c	0
Titanium	ug/L	0.5	7.2	6.8	6	n/c
Uranium	ug/L	0.01	0.22	0.2	10	n/c
Vanadium	ug/L	1	1	1	n/c	0
Zinc	ug/L	5	9	9	n/c	0
Zirconium	ug/L	0.5	< 0.5	< 0.5	n/c	0

Notes:

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RPD is calculated when the mean concentration is greater than five times the laboratory reporting limit.

DF = Difference factor; the absolute difference between two values divided by the laboratory reporting limit.

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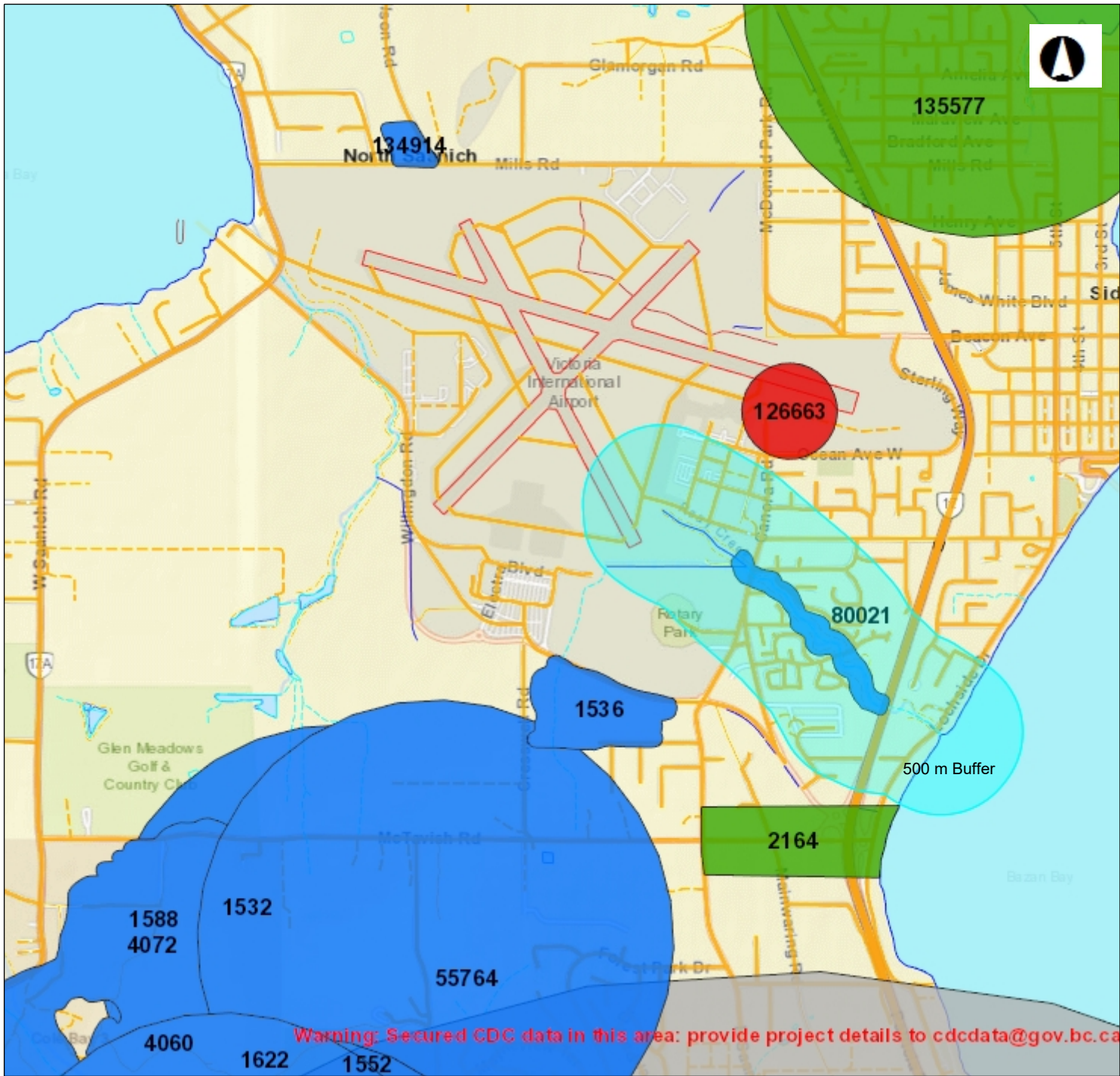
APPENDIX C

Listed Species Search

Scientific Name	English Name	BC List	COSEWIC	SARA Status
<i>Abies grandis / Mahonia nervosa</i>	grand fir / dull Oregon-grape	Red		
<i>Abies grandis / Tiarella trifoliata</i>	grand fir / three-leaved foamflower	Red		
<i>Abronia latifolia</i>	yellow sand-verbena	Blue		
<i>Accipiter gentilis laingi</i>	Northern Goshawk, <i>laingi</i> subspecies	Red	Threatened	Threatened
<i>Aechmophorus occidentalis</i>	Western Grebe	Red	Special Concern	Special Concern
<i>Allium ampletens</i>	slimleaf onion	Blue		
<i>Allogona townsendiana</i>	Oregon Forestsnail	Red	Endangered	Endangered
<i>Alnus rubra / Carex obtupta [Populus trichocarpa]</i>	red alder / slough sedge [black cottonwood]	Red		
<i>Alnus rubra / Lysichiton americanus</i>	red alder / skunk cabbage	Red		
<i>Alnus rubra / Rubus spectabilis / Equisetum arvense</i>	red alder / salmonberry / common horsetail	Blue		
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	Red		
<i>Anarta edwardsii</i>	Edwards' Beach Moth	Red	Endangered	Endangered
<i>Anaxyrus boreas</i>	Western Toad	Yellow	Special Concern	Special Concern
<i>Aneides vagrans</i>	Wandering Salamander	Blue	Special Concern	Special Concern
<i>Arbutus menziesii / Arctostaphylos columbiana</i>	arbutus / hairy manzanita	Red		
<i>Ardea herodias fannini</i>	Great Blue Heron, <i>fannini</i> subspecies	Blue	Special Concern	Special Concern
<i>Artemisia campestris - Festuca rubra / Racomitrium canescens</i>	northern wormwood - red fescue / grey rock-moss	Red		
<i>Asio flammeus</i>	Short-eared Owl	Blue	Threatened	Special Concern
<i>Athene cucularia</i>	Burrowing Owl	Red	Endangered	Endangered
<i>Balsamorhiza deltoidea</i>	deltoid balsamroot	Red	Endangered	Endangered
<i>Bartramia aprica</i>	rigid apple moss	Red	Endangered	Endangered
<i>Bartramia longicauda</i>	Upland Sandpiper	Red		
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	Special Concern	Special Concern
<i>Bolboschoenus maritimus var. paludosus</i> Alkali Marsh	seacoast bulrush Alkali Marsh	Red		
<i>Botaurus lentiginosus</i>	American Bittern	Blue		
<i>Brachyramphus marmoratus</i>	Marbled Murrelet	Blue	Threatened	Threatened
<i>Branta bernicla</i>	Brant	Blue		
<i>Buteo lagopus</i>	Rough-legged Hawk	Blue		
<i>Buteo swainsoni</i>	Swainson's Hawk	Red		
<i>Butorides virescens</i>	Green Heron	Blue		
<i>Calcarius pictus</i>	Smith's Longspur	Blue		
<i>Calidris canutus</i>	Red Knot	Red	Endangered/Threatened	Endangered/Threatened
<i>Callophrys eryphon sheltouensis</i>	Western Pine Elf, <i>sheltouensis</i> subspecies	Blue		
<i>Callophrys johnsoni</i>	Johnson's Hairstreak	Red		
<i>Callophrys mossii mossii</i>	Moss' Elf, <i>mossii</i> subspecies	Red		
<i>Camissonia contorta</i>	contorted-pod evening-primrose	Red	Endangered	Endangered
<i>Cardellina canadensis</i>	Canada Warbler	Blue	Special Concern	Threatened
<i>Carex lasiocarpa - Rhynchospora alba</i>	slender sedge - white beak-rush	Red		
<i>Carex lyngbyei</i> Herbaceous Vegetation	Lyngbye's sedge herbaceous vegetation	Red		
<i>Carex macrocephala</i> Herbaceous Vegetation	large-headed sedge Herbaceous Vegetation	Red		
<i>Carex tumulicola</i>	foothill sedge	Yellow	Endangered	Endangered
<i>Carychium occidentale</i>	Western Thorn	Blue		
<i>Castilleja levisecta</i>	golden paintbrush	Red	Endangered	Endangered
<i>Castilleja victoriae</i>	Victoria's owl-clover	Red	Endangered	Endangered
<i>Cephalanthera austini</i>	phantom orchid	Red	Endangered	Threatened
<i>Cercyonis pegala incana</i>	Common Wood-nymph, <i>incana</i> subspecies	Red		
<i>Chondestes grammacus</i>	Lark Sparrow	Blue		
<i>Chordeiles minor</i>	Common Nighthawk	Yellow	Special Concern	Threatened
<i>Chrysemys picta</i>	Northern Painted Turtle	No Status	Endangered/Special Concern	Endangered/Special Concern
<i>Chrysemys picta</i> pop. 1	Northern Painted Turtle - Pacific Coast Population	Red	Threatened	Endangered
<i>Cladonia decorticata</i>	strip-tease pixie	Blue		
<i>Clarkia purpurea ssp. quadrivulnera</i>	wine-cup clarkia	Red		
<i>Claytonia washingtoniana</i>	Washington springbeauty	Red		
<i>Coccythraustes vespertinus</i>	Evening Grosbeak	Yellow	Special Concern	Special Concern
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	Red		
<i>Coenonympha tullia insulana</i>	Common Ringlet, <i>insulana</i> subspecies	Red		
<i>Contia tenuis</i>	Common Sharp-Tailed Snake	Red	Threatened	Endangered
<i>Contopus cooperi</i>	Olive-sided Flycatcher	Blue	Special Concern	Threatened
<i>Copablepharon fuscum</i>	Sand-verbena Moth	Red	Endangered	Endangered
<i>Corallorhiza maculata var. ozettensis</i>	Ozette coralroot	Blue		
<i>Corynorhinus townsendii</i>	Townsend's Big-eared Bat	Blue		
<i>Crassula connata</i>	Erect Pigmyweed	Blue		
<i>Cryptomastix devia</i>	Puget Oregonian	Red	Extirpated	Extinct
<i>Cypseloides niger</i>	Black Swift	Blue	Endangered	Endangered
<i>Danaus plexippus</i>	Monarch	Red	Endangered	Special Concern
<i>Dermatocarpon intestiniforme</i>	quilted stippleback	Blue		
<i>Deschampsia cespitosa ssp. beringensis - Hordeum brachyantherum</i>	tufted hairgrass - meadow barley	Red		
<i>Distichlis spicata - Sarcocornia pacifica</i>	seashore saltgrass - Pacific swampfire	Red		
<i>Dolichonyx oryzivorus</i>	Bobolink	Blue	Threatened	Threatened
<i>Dulichium arundinaceum</i> Herbaceous Vegetation	three-way sedge	Red		
<i>Eleocharis palustris</i> Herbaceous Vegetation	common spike-rush Herbaceous Vegetation	Blue		
<i>Epargyreus clarus</i>	Silver-spotted Skipper	Blue		
<i>Epargyreus clarus californicus</i>	Silver-spotted Skipper, <i>californicus</i> subspecies	Red		
<i>Epilobium densiflorum</i>	dense spike-primrose	Red	Endangered	Endangered
<i>Epilobium torreyi</i>	brook spike-primrose	Red	Endangered	Endangered
<i>Eremophila alpestris strigata</i>	Horned Lark, <i>strigata</i> subspecies	Red	Endangered	Endangered
<i>Erigeron philadelphicus var. glaber</i>	salt marsh Philadelphia daisy	Red		
<i>Erynnis propertius</i>	Propertius Duskywing	Red		

Scientific Name	English Name	BC List	COSEWIC	SARA Status
<i>Erythemis collocata</i>	Western Pondhawk	Blue		
<i>Euchloe ausonides insulanus</i>	Large Marble, <i>insulanus</i> subspecies	Red	Extirpated	Extinct
<i>Eumetopias jubatus</i>	Steller Sea Lion	Blue	Special Concern	Special Concern
<i>Euphagus carolinus</i>	Rusty Blackbird	Blue	Special Concern	Special Concern
<i>Euphryas editha taylora</i>	Edith's Checkerspot, <i>taylora</i> subspecies	Red	Endangered	Endangered
<i>Euphyes vestris</i>	Dun Skipper	Blue	Threatened	Threatened
<i>Eurybia radulina</i>	rough-leaved aster	Red		
<i>Falco mexicanus</i>	Prairie Falcon	Red		
<i>Falco peregrinus</i>	Peregrine Falcon	No Status	Special Concern	Special Concern
<i>Falco peregrinus anatum</i>	Peregrine Falcon, <i>anatum</i> subspecies	Red		Special Concern
<i>Falco peregrinus pealei</i>	Peregrine Falcon, <i>pealei</i> subspecies	Blue	Special Concern	Special Concern
<i>Falco rusticolus</i>	Gyrfalcon	Blue		
<i>Festuca roemerii - Koeleria macrantha</i>	Roemer's fescue - junegrass	Red		
<i>Fratercula cirrhata</i>	Tufted Puffin	Blue		
<i>Fratercula corniculata</i>	Horned Puffin	Red		
<i>Fraxinus latifolia</i>	Oregon ash	Red		
<i>Fulmarus glacialis</i>	Northern Fulmar	Red		
<i>Galba bulimoides</i>	Prairie Fossaria	Blue		
<i>Galba vancouverensis</i>	Vancouver Fossaria	Red		
<i>Gasterosteus</i> sp. 2	Enos Lake Limnetic Stickleback	Red	Endangered	Endangered
<i>Gasterosteus</i> sp. 3	Enos Lake Benthic Stickleback	Red	Endangered	Endangered
<i>Githopsis specularioides</i>	common bluecup	Blue		
<i>Glaucidium gnoma swarthi</i>	Northern Pygmy-owl, <i>swarthi</i> subspecies	Blue		
<i>Glehnia littoralis</i> ssp. <i>leiocarpa</i>	American glehnia	Blue		
<i>Haliotis kamtschatkana</i>	Northern Abalone	Red	Endangered	Endangered
<i>Hemphillia dromedarius</i>	Dromedary Jumping-slug	Red	Threatened	Threatened
<i>Hemphillia glandulosa</i>	Warty Jumping-slug	Red	Special Concern	Special Concern
<i>Hesperia colorado oregonia</i>	Western Branded Skipper, <i>oregonia</i> subspecies	Red	Endangered	
<i>Hirundo rustica</i>	Barn Swallow	Blue	Special Concern	Threatened
<i>Hosackia gracilis</i>	seaside bird's foot lotus	Red	Endangered	Endangered
<i>Hosackia pinnata</i>	bog bird's-foot lotus	Red	Endangered	Endangered
<i>Hydroprogne caspia</i>	Caspian Tern	Blue		
<i>Icaricia icarioides blackmorei</i>	Boisduval's Blue, <i>blackmorei</i> subspecies	Blue		
<i>Icaricia saepiolus insulanus</i>	Greenish Blue, <i>insulanus</i> subspecies	Red	Endangered	Endangered
<i>Icteria virens</i>	Yellow-breasted Chat	Red	Endangered	Endangered
<i>Juncus arcticus - Plantago macrocarpa</i>	arctic rush - Alaska plantain	Red		
<i>Juncus kelloggii</i>	Kellogg's rush	Red	Endangered	Endangered
<i>Larus californicus</i>	California Gull	Blue		
<i>Lathyrus littoralis</i>	silky beach pea	Red	Threatened	
<i>Leymus mollis</i> ssp. <i>mollis</i> - <i>Lathyrus japonicus</i>	dune wildrye - beach pea	Red		
<i>Limnanthes macounii</i>	Macoun's meadow-foam	Red	Threatened	Threatened
<i>Limnodromus griseus</i>	Short-billed Dowitcher	Blue		
<i>Limosa haemastica</i>	Hudsonian Godwit	Red	Threatened	
<i>Lithobates pipiens</i>	Northern Leopard Frog	Red	Endangered	Endangered
<i>Lomatium dissectum</i>	fern-leaved desert-parsley	Red		
<i>Lomatium papilioniferum</i>	butterfly bearing lomatium	Red	Threatened	Threatened
<i>Lupinus lepidus</i>	prairie lupine	Red	Endangered	Endangered
<i>Lupinus microcarpus</i> var. <i>microcarpus</i>	dense-flowered lupine	Red	Endangered	1-E (2006)
<i>Lupinus oregonus</i> var. <i>kincaidii</i>	Kincaid's lupine	Unknown	Extirpated	Extinct
<i>Marah oregana</i>	coast manroot	Red	Endangered	
<i>Meconella oregana</i>	white meconella	Red	Endangered	Endangered
<i>Megascops kennicottii</i>	Western Screech-Owl	No Status	Threatened	Threatened
<i>Megascops kennicottii kennicottii</i>	Western Screech-Owl, <i>kennicottii</i> subspecies	Blue	Threatened	Threatened
<i>Melanerpes lewis</i>	Lewis's Woodpecker	Blue	Threatened	Threatened
<i>Melanitta americana</i>	Black Scoter	Blue		
<i>Melanitta perspicillata</i>	Surf Scoter	Blue		
<i>Menyanthes trifoliata - Carex lasiocarpa</i>	buckbean - slender sedge	Blue		
<i>Microseris bigelovii</i>	coast microseris	Red	Endangered	Endangered
<i>Mirounga angustirostris</i>	Northern Elephant Seal	Red		
<i>Musculium partumeium</i>	Swamp Fingernailclam	Blue		
<i>Musculium transversum</i>	Long Fingernailclam	Blue		
<i>Mustela richardsonii anguinae</i>	Ermine, <i>anguinae</i> subspecies	Blue		
<i>Myosurus minimus - Montia</i> spp. - <i>Limnanthes macounii</i>	tiny mousetail - montias - Macoun's meadow-foam	Red		
<i>Myotis lucifugus</i>	Little Brown Myotis	Yellow	Endangered	Endangered
<i>Myrica gale / Carex sitchensis</i>	sweet gale / Sitka sedge	Red		
<i>Nannopterum auritum</i>	Double-crested Cormorant	Blue		
<i>Nearctula</i> sp. 1	Threaded Vertigo	Blue	Special Concern	Special Concern
<i>Numenius americanus</i>	Long-billed Curlew	Blue	Special Concern	Special Concern
<i>Nuttallanthus texanus</i>	Texas toadflax	Blue		
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	Red		
<i>Onus audouini</i>	Audouin's Night-stalking Tiger Beetle	Red	Threatened	Threatened
<i>Oncorhynchus clarkii clarkii</i>	Cutthroat Trout, <i>clarkii</i> subspecies	Blue		
<i>Ophiogomphus occidentis</i>	Sinuous Snaketail	Blue		
<i>Oreoscoptes montanus</i>	Sage Thrasher	Red	Endangered	Endangered
<i>Orthocarpus bracteosus</i>	rosy owl-clover	Red	Endangered	Endangered
<i>Parnassius clodius claudianus</i>	Clodius Parnassian, <i>claudianus</i> subspecies	Blue		
<i>Parnassius smintheus olympianus</i>	Rocky Mountain Parnassian, <i>olympiannus</i> subspecies	Blue		
<i>Patagioenas fasciata</i>	Band-tailed Pigeon	Blue	Special Concern	Special Concern

Scientific Name	English Name	BC List	COSEWIC	SARA Status
<i>Pelecanus erythrorhynchos</i>	American White Pelican	Red		
<i>Phalaropus lobatus</i>	Red-necked Phalarope	Blue	Special Concern	Special Concern
<i>Physconia detersa</i>	bottlebrush frost	Red		
<i>Physella propinqua</i>	Rocky Mountain Physa	Blue		
<i>Physella virginea</i>	Sunset Physa	Blue		
<i>Pinus contorta</i> / <i>Sphagnum</i> spp. CDFmm	lodgpole pine / peat-mosses CDFmm	Red		
<i>Pituophis catenifer</i>	Gophersnake	No Status		Extinct
<i>Pituophis catenifer catenifer</i>	Gopher Snake, <i>catenifer</i> subspecies	Red	Extirpated	Extinct
<i>Plagiobothrys figuratus</i> ssp. <i>figuratus</i>	fragrant popcornflower	Red	Endangered	Endangered
<i>Plagiobothrys tenellus</i>	slender popcornflower	Red	Threatened	Threatened
<i>Planorbula campestris</i>	Meadow Rams-horn	Blue		
<i>Platanthera ephemerantha</i>	white-lip rein orchid	Blue		
<i>Pluvialis dominica</i>	American Golden-Plover	Blue		
<i>Poocetes gramineus affinis</i>	Vesper Sparrow, <i>affinis</i> subspecies	Red	Endangered	Endangered
<i>Populus tremuloides</i> / <i>Malus fusca</i> / <i>Carex obnupta</i>	trembling aspen / Pacific crab apple / slough sedge	Red		
<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	black cottonwood - red alder / salmonberry	Blue		
<i>Pristiloma johnsoni</i>	Broadwhorl Tightcoil	Blue		
<i>Progne subis</i>	Purple Martin	Blue		
<i>Promenetus umbilicatellus</i>	Umbilicate Sprite	Blue		
<i>Propyssaon coeruleum</i>	Blue-grey Taildropper	Blue	Threatened	Threatened
<i>Pseudotsuga menziesii</i> - <i>Arbutus menziesii</i>	Douglas-fir - arbutus	Red		
<i>Pseudotsuga menziesii</i> / <i>Mahonia nervosa</i>	Douglas-fir / dull Oregon-grape	Red		
<i>Pseudotsuga menziesii</i> / <i>Melica subulata</i>	Douglas-fir / Alaska oniongrass	Red		
<i>Psilocarphus elatior</i>	tall woolly-heads	Red	Endangered	Endangered
<i>Ptychoramphus aleuticus</i>	Cassin's Auklet	Red	Special Concern	Special Concern
<i>Pyrula aphylla</i>	leafless wintergreen	Blue		
<i>Quercus garryana</i> - <i>Arbutus menziesii</i>	Garry oak - arbutus	Red		
<i>Quercus garryana</i> / <i>Bromus carinatus</i>	Garry oak / California brome	Red		
<i>Quercus garryana</i> / <i>Holodiscus discolor</i>	Garry oak / oceanspray	Red		
<i>Rana aurora</i>	Northern Red-legged Frog	Blue	Special Concern	Special Concern
<i>Ranunculus alismifolius</i> var. <i>alismifolius</i>	water-plantain buttercup	Red	Endangered	Endangered
<i>Ranunculus californicus</i>	California buttercup	Red	Endangered	Endangered
<i>Ranunculus lobbii</i>	Lobb's water-buttercup	Red		
<i>Recurvirostra americana</i>	American Avocet	Blue		
<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum</i> spp.	Labrador-tea / western bog-laurel / peat-mosses	Blue		
<i>Ruppia maritima</i> Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	Red		
<i>Sabulina pusilla</i>	dwarf sandwort	Red	Endangered	Endangered
<i>Salix sitchensis</i> - <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i>	Sitka willow - Pacific willow / skunk cabbage	Red		
<i>Sanicula arctopoides</i>	bear's-foot sanicle	Red	Threatened	Threatened
<i>Sanicula bipinnatifida</i>	purple sanicle	Red	Threatened	Threatened
<i>Sarcocornia pacifica</i> - <i>Lysimachia maritima</i>	American glasswort - sea-milkwort	Red		
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	Blue		
<i>Scytinium californicum</i>	midlife vinyl	Blue		
<i>Scytinium platynum</i>	batwing vinyl	Yellow	Endangered	Endangered
<i>Scytinium polycarpum</i>	peacock vinyl	Yellow	Special Concern	Special Concern
<i>Selaginella wallacei</i> / <i>Cladina</i> spp.	Wallace's selaginella / reindeer lichens	Blue		
<i>Sericocarpus rigidus</i>	white-top aster	Blue	Special Concern	Special Concern
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue		
<i>Silene scouleri</i> ssp. <i>scouleri</i>	coastal Scouler's catchfly	Red	Endangered	Endangered
<i>Sisyrinchium idahoense</i> var. <i>segetum</i>	Idaho blue-eyed-grass	Red		
<i>Sorex navigator brooksi</i>	Western Water Shrew, <i>brooksi</i> subspecies	Blue		
<i>Speyeria zerene bremnerii</i>	Zerene Fritillary, <i>bremnerii</i> subspecies	Red		
<i>Sterna forsteri</i>	Forster's Tern	Red	Data Deficient	
<i>Sympetrum vicinum</i>	Autumn Meadowhawk	Blue		
<i>Synthliboramphus antiquus</i>	Ancient Murrelet	Blue	Special Concern	Special Concern
<i>Syntrichia laevipila</i>	twisted oak moss	Blue	Special Concern	Special Concern
<i>Tuja plicata</i> / <i>Achlys triphylla</i>	western redcedar / vanilla-leaf	Red		
<i>Tuja plicata</i> / <i>Oemleria cerasiformis</i>	Western Redcedar / Osoberry	Red		
<i>Tuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>	western redcedar / sword fern - skunk cabbage	Blue		
<i>Tuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Eurhynchium oregonum</i>	western redcedar - Douglas-fir / Oregon beaked-moss	Red		
<i>Tuja plicata</i> / <i>Symphoricarpos albus</i>	western redcedar / common snowberry	Red		
<i>Tonella tenella</i>	small-flowered tonella	Blue	Endangered	Endangered
<i>Tramea lacerata</i>	Black Saddlebags	Red		
<i>Trifolium depauperatum</i> var. <i>depauperatum</i>	poverty clover	Blue		
<i>Trifolium dichotomum</i>	Macrae's clover	Red		
<i>Tringa incana</i>	Wandering Tattler	Blue		
<i>Triphysaria versicolor</i> ssp. <i>versicolor</i>	bearded owl-clover	Red	Endangered	Endangered
<i>Triteleia howellii</i>	Howell's triteleia	Red	Endangered	Endangered
<i>Typha latifolia</i> Marsh	common cattail Marsh	Blue		
<i>Tyto alba</i>	Barn Owl	Red	Threatened	Threatened
<i>Uria aalge</i>	Common Murre	Red		
<i>Urile penicillatus</i>	Brandt's Cormorant	Red		
<i>Uropappus lindleyi</i>	Lindley's microseris	Red	Endangered	Endangered
<i>Utricularia ochroleuca</i>	ochroleucous bladderwort	Blue		
<i>Viola howellii</i>	Howell's violet	Red		
<i>Viola praemorsa</i> var. <i>praemorsa</i>	yellow montane violet	Red	Endangered	Endangered
<i>Woodwardia fimbriata</i>	giant chain fern	Blue		
<i>Zeltnera muehlenbergii</i>	Muhlenberg's centaury	Red	Endangered	Endangered



Warning: Secured CDC data in this area: provide project details to cdcdata@gov.bc.ca

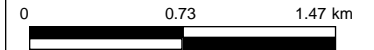
CDC Occurrence Map

Legend

Species and Ecosystems at Available Occurrences - CD

FEATURE_CODE

- Animal - Vertebrate
- Animal - Invertebrate
- Plant - Vascular
- Plant - Non-vascular
- Ecological Community



1: 36,112

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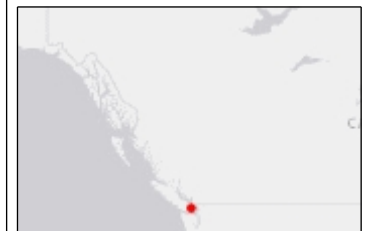
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Datum: NAD83

Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia





BC Conservation Data Centre: Ecosystem Occurrence Report

Shape ID: 80021

Scientific Name: *Populus trichocarpa* - *Alnus rubra* / *Rubus spectabilis*
English Name: black cottonwood - red alder / salmonberry

Identifiers

Occurrence ID: 10783
Shape ID: 80021
Element Group: Ecological Community

Status

Provincial Rank: S3
BC List: Blue
Global Rank: GNR

Locators

Survey Site: REAY CREEK, SIDNEY
Directions:
Biogeoclimatic Unit: CDF mm
Ecosection: SGI

Occurrence Information

First Observation Date: 2007 **Last Observation Date:** 2015-10-06

Occurrence Data:

This middle bench floodplain forest occurrence is based on Terrestrial Ecosystem Mapping (TEM) and has been verified by a field visit. It is comprised of a young forest. This ecological community occupies approximately 4.0 ha or 44 % of the area shown.

General Description:

This occurrence is located on the floodplain of Reay Creek between Victoria Airport and the highway. The surrounding area is mostly urban, with the occurrence being a narrow strip between urban housing.

Environmental Summary:

Field data indicates the occurrence is on level, fluvial materials.

Occurrence Rank and Occurrence Rank Factors

Rank*: E : Verified extant (viability not assessed)

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date:

Rank Comments:

Condition of Occurrence:

Size of Occurrence:

4.02 ha

Landscape Context:

Version

Version Date: 2013-01-29

Version Author: de Groot, A.

Mapping Information

Estimated Representation Accuracy: Medium

Estimated Representation Accuracy Comments: The ecological community occupies 44.4% (4.02 ha) of the mapped occurrence.

Confident that full extent is represented by Occurrence: ?

Confidence extent Definition: Uncertain whether full extent of EO is known

Additional Inventory Needed: Y

Inventory Comments: The field data is from a visit to verify the element occurrence.

This element occurrence is based on available ecosystem mapping. Many factors influence the reliability of an ecosystem map. Depending on the scale of aerial images used to capture the ecosystems, very small ecosystems and some types of disturbance may not be visible and will not be mapped. If the air photos are not current, new disturbance may have occurred since the time of mapping and the inventory may not accurately represent the current state of the landscape. Other factors, such as the skill and experience of the mapper within the study area, and the field survey intensity level will also influence the reliability of the map.

Documentation

References:

- Madrone Environmental Services Ltd. 2008. Terrestrial Ecosystem Mapping of the Coastal Douglas-Fir Biogeoclimatic Zone. Unpublished report prepared for Integrated Land Management Bureau (ILMB), Duncan, B.C. 123pp.
- Terrestrial Ecosystem Mapping [TEM] of the Coastal Douglas-fir Biogeoclimatic Zone. 2008. Prepared for B. Zinovich, Integrated Land Management Bureau, B.C. Minist. of Agric. and Lands, Nanaimo B.C. by Madrone Environmental Services, Duncan B.C. 1:20,000 spatial data.
- de Groot, A., and C.M. Cadrin. 2013. Element occurrence and element occurrence rank specifications for riparian deciduous forests and shrublands of coastal British Columbia. Unpublished document. Version January, 2013. B.C. Minist. Environ., Conservation Data Centre, Victoria, B.C. 5 pp.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 80021, black cottonwood - red alder / salmonberry. B.C. Ministry of Environment. Available: <http://maps.gov.bc.ca/ess/hm/cdc>, (accessed Mar 16, 2022).

APPENDIX D

ProUCL Output

General Statistics on Uncensored Data - Soil Results

Date/Time of Computation ProUCL 5.12022-03-03 4:19:20 PM
 User Selected Options
 From File KELSET_ProUCL.xls
 Full Precision OFF

From File: KELSET_ProUCL.xls

General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV
Arsenic	26	0	26	0	0.00%	N/A	N/A	4.473	1.82	1.349	0.302
Cadmium	26	0	26	0	0.00%	N/A	N/A	4.313	20.46	4.524	1.049
Chromium	26	0	26	0	0.00%	N/A	N/A	51.38	480.7	21.93	0.427
Iron	26	0	26	0	0.00%	N/A	N/A	27512	15319462	3914	0.142
Lead	26	0	26	0	0.00%	N/A	N/A	29.01	333.1	18.25	0.629
Zinc	26	0	26	0	0.00%	N/A	N/A	155.5	8783	93.72	0.603
Sodium	20	0	20	0	0.00%	N/A	N/A	303.7	11358	106.6	0.351

General Statistics for Raw Data Sets using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV
Arsenic	26	0	1.7	8	4.473	4.3	1.82	1.349	1.038	0.245	0.302
Cadmium	26	0	0.23	14.8	4.313	2.565	20.46	4.524	3.128	0.986	1.049
Chromium	26	0	17	100	51.38	45.5	480.7	21.93	15.57	0.677	0.427
Iron	26	0	18100	34900	27512	27550	15319462	3914	2595	-0.582	0.142
Lead	26	0	9.1	84.8	29.01	26.05	333.1	18.25	17.12	1.387	0.629
Zinc	26	0	71	464	155.5	116	8783	93.72	60.79	1.911	0.603
Sodium	20	0	163	618	303.7	302.5	11358	106.6	104.5	1.397	0.351

Percentiles using all Detects (Ds) and Non-Detects (NDs)

Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
Arsenic	26	0	2.8	4	4	4.3	5	5	6	6	7.5
Cadmium	26	0	0.42	0.5	0.748	2.565	8.508	9.59	10.25	12.55	14.4
Chromium	26	0	29	36	37	45.5	66.25	78	80	89	98
Iron	26	0	23850	25300	26275	27550	29350	29400	31650	33750	34775
Lead	26	0	10.75	11.9	14.73	26.05	36.25	38	51.25	60.78	79.28
Zinc	26	0	78.5	85	94.5	116	180.5	200	241.5	337.5	439.3

Arsenic

Data appear Approximate Normal at 5% Significance Level

95% Student's-t UCL	4.925	95% Adjusted-CLT UCL (Chen-1995)	4.922
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Cadmium

Assuming Normal Distribution

95% Student's-t UCL	5.828	95% Adjusted-CLT UCL (Chen-1995)	5.955
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Chromium

Data appear Normal at 5% Significance Level

95% Student's-t UCL	58.73	95% Adjusted-CLT UCL (Chen-1995)	59.07
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Iron

Data appear Normal at 5% Significance Level

95% Student's-t UCL	28823	95% Adjusted-CLT UCL (Chen-1995)	28681
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Lead

Data appear Approximate Normal at 5% Significance Level

95% Student's-t UCL	35.13	95% Adjusted-CLT UCL (Chen-1995)	35.94
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Zinc

Data Not Normal at 5% Significance Level

95% BCA Bootstrap UCL	193.1
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General Statistics on Uncensored Data - Sediment Results

Date/Time of Computation ProUCL 5.12022-03-02 2:33:56 PM
 User Selected Options
 From File ProUCL_SedKelset.xls
 Full Precision OFF
 From File: ProUCL_SedKelset.xls

General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV	
Arsenic	62	0	61	1	1.61%		1	1	5.496	8.012	2.831	0.515
Cadmium	62	0	62	0	0.00%	N/A	N/A	6.387	42.73	6.537	1.024	
Chromium	62	0	62	0	0.00%	N/A	N/A	51.48	760.3	27.57	0.536	
Chromium Trivalent (Cr(III))	35	27	35	0	0.00%	N/A	N/A	46.14	494.5	22.24	0.482	
Chromium Hexavalent (Cr(VI))	35	27	0	35	100.00%	0.3	8	N/A	N/A	N/A	N/A	
Lead	51	11	51	0	0.00%	N/A	N/A	20.14	222.8	14.93	0.741	
Zinc	62	0	62	0	0.00%	N/A	N/A	203	9561	97.78	0.482	
Iron	51	11	51	0	0.00%	N/A	N/A	26612	39033059	6248	0.235	

General Statistics for Raw Data Sets using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV
Arsenic	61	0	2	22.4	5.57	5.32	7.937	2.817	1.957	3.628	0.506
Cadmium	62	0	0.25	35	6.387	4.26	42.73	6.537	4.752	2	1.024
Chromium	62	0	14	154	51.48	42.35	760.3	27.57	23.5	1.329	0.536
Chromium Trivalent (Cr(III))	35	27	14	96	46.14	42	494.5	22.24	23.72	0.647	0.482
Chromium Hexavalent (Cr(VI))	0	27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	51	11	4.4	60.2	20.14	15.5	222.8	14.93	13.19	1.042	0.741
Zinc	62	0	71	502	203	174	9561	97.78	72.65	0.978	0.482
Iron	51	11	13100	39700	26612	27400	39033059	6248	7413	-0.12	0.235

Percentiles using all Detects (Ds) and Non-Detects (NDs)

Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
Arsenic	62	0	3	3.74	3.91	5.26	6.3	6.92	7.38	9.073	14.74
Cadmium	62	0	1.001	1.142	1.318	4.26	9.08	10.77	13.79	16.32	29.14
Chromium	62	0	24	29.2	32.4	42.35	67.05	71	85.9	103.6	133.9
Chromium Trivalent (Cr(III))	35	27	24	25.8	27.5	42	61	68.6	72.2	88	95.66
Chromium Hexavalent (Cr(VI))	35	27	0.3	0.3	0.3	4	8	8	8	8	8
Lead	51	11	5.8	6.9	7.72	15.5	28.5	31.8	43.1	49.4	58.15
Zinc	62	0	109.5	127.2	131.3	174	271	279.4	356.4	377.7	451.4
Iron	51	11	19200	20900	21700	27400	31050	31300	34200	36400	38600

Arsenic

Detected Data Not Normal at 5% Significance Level

95% BCA Bootstrap UCL	6.312	95% Bootstrap t UCL	6.364
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Cadmium

Data Not Normal at 5% Significance Level

95% BCA Bootstrap UCL	7.984
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Chromium

Data Not Normal at 5% Significance Level

95% BCA Bootstrap UCL	57.85
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Lead

Data Not Normal at 5% Significance Level

95% BCA Bootstrap UCL	23.9
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Zinc

Data Not Normal at 5% Significance Level

95% BCA Bootstrap UCL	225.3
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Iron

Data appear Normal at 5% Significance Level

95% Student's-t UCL	28078	95% Adjusted-CLT UCL (Chen-1995)	28035
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APPENDIX E

WLC Engagement Meeting



TECHNICAL MEMORANDUM

DATE 21 March 2023

Reference No. 22526061-009-TM-Rev0

TO Lizanne Meloche and Stephanie Gregory
Public Services and Procurement Canada

FROM Alexis Fast and Blair McDonald

SUMMARY OF ENGAGEMENT MEETING WITH THE W̱SÁNEĆ LEADERSHIP COUNCIL TECHNICAL ADVISORY COMMITTEE RE: RISK ASSESSMENT IN KÉLSET, DOWNGRADIANT OF KÉLSET POND, BC

1.0 INTRODUCTION

WSP Canada Inc. (WSP; formerly Golder Associates Ltd. [Golder]) was retained by Public Services and Procurement Canada (PSPC), on behalf of Transport Canada, to present the results of the draft human health and ecological risk assessment (HHERA) conducted by WSP for KÉLSET to the W̱SÁNEĆ Leadership Council (WLC), describe the uncertainties in the draft HHERA, and request input into future risk assessment activities. The engagement meeting was held virtually on 19 January 2023; this technical memorandum summarizes the information presented by WSP at the meeting, the feedback received, and recommendations for further work.

This technical memorandum was prepared for Canada in accordance with the terms and conditions of the Public Works Government Services Canada (PWGSC) Contaminated Sites Risk Assessment Contract with Task Authorizations (CTA) EZ897-191436/002/VAN, dated 9 August 2019, Task Authorization (TA) 700652230 dated 20 May 2022, Amendment #1 to Task Authorization Number 700652230 dated 24 June 2022, and the Notice to Readers in Section 5.0. The scope of work was described in the workplan “Workplan and Cost Estimate—Risk Assessment Activities and Post-Remediation Monitoring in KÉLSET, BC” dated 19 May 2022, and in the “Request for Amendment (#1) to Task Authorization 700652230—Risk Assessment Activities and Post-Remediation Monitoring in KÉLSET, BC” dated 20 June 2022.

2.0 BACKGROUND

In FY2021/22, WSP was retained by PSPC, on behalf of Transport Canada, to conduct a detailed HHERA in support of risk management for KÉLSET (also known as Reay Creek), downgradient of KÉLSET Pond, in British Columbia. KÉLSET originates at the Victoria International Airport, which is located on federal land leased to the Victoria Airport Authority. The airport has been in operation since 1939, and has included a variety of aircraft manufacturing, electroplating, and other industrial activities operations; stormwater and groundwater influences from these industrial activities drain towards KÉLSET.

KÉLSET Pond and KÉLSET have been the subject of considerable investigation. Sediment remediation and habitat restoration programs were completed by PSPC for KÉLSET (the portion within the airport property) in 2019/20 and at KÉLSET Pond in 2020/21. The draft HHERA was conducted for select portions of KÉLSET below KÉLSET Pond where intrusive remediation has not been completed. The objective of the HHERA was to assess

the potential human health and ecological risks associated with the residual concentrations of airport-related contaminants in KÉLSET; the Study Area for the HHERA included the portions of KÉLSET between KÉLSET Pond to Patricia Bay Highway, and between Lochside Drive to Bazan Bay. The portions of KÉLSET that flow through privately-owned land (i.e., between Patricia Bay Highway and Lochside Drive) were not part of the assessment.

Based on current and future use of KÉLSET as a creek located within a forested ravine that runs through municipal parks bordered predominantly by private residential housing, the results of the draft HHERA indicated there were low risks to aquatic receptors (e.g., aquatic plants, benthic invertebrates, and fish) from the metal contaminants of concern identified in the sediment and/or surface water in KÉLSET, and no risks to terrestrial wildlife or humans that might use the area as an urban park. Consistent with urban park land use, a default assumption in the draft HHERA was that KÉLSET and its riparian areas were not being used as a source of food; however, an area of uncertainty was whether there were alternative land uses that should be evaluated (e.g., harvesting of traditional foods from or along KÉLSET). An additional area of uncertainty was whether there were specific ecological receptors that stakeholders and rightsholders would like to see reflected in a food chain model.

3.0 SUMMARY OF ENGAGEMENT MEETING

As a result of the uncertainties described above, WSP presented the results of the draft HHERA to the WLC Technical Advisory Committee during a virtual meeting held on 19 January 2023. In addition to presenting the objectives, methods, and results of the draft HHERA, WSP described the uncertainties with the assessment and requested input into future risk assessment activities.

3.1 Attendees

- **WLC Technical Advisory Committee:** William Morris (Tsartlip FN), Erik Pelkey (WLC Community Engagement Coordinator), Gordon Elliott (WLC Director of Operations), Joni Olsen (WLC Policy/Negotiations Manager), Eryn Rogers (WLC Policy and Negotiation Analyst), Laurie Whitehead (WLC Referrals Manager), Peter Evans (geographer and anthropologist; advisor to the WLC)
- **Transport Canada:** Eddie Uyeda
- **PSPC:** Lizanne Meloche, Stephanie Gregory
- **WSP:** Blair McDonald, Alexis Fast

3.2 Meeting Agenda

After introductions were made, PSPC provided a brief overview of Transport Canada's work in KÉLSET, and Transport Canada provided the land acknowledgement and summary of the history of contamination and remediation work conducted by Transport Canada to date. WSP (Blair McDonald) then presented an overview of the draft HHERA and its uncertainties and opened the floor for discussion.

3.3 Summary of Feedback/Questions and WSP Responses

The following summarizes the feedback/questions received from the WLC Technical Advisory Committee during the 19 January 2023 meeting.

Joni Olsen: The WLC are concerned about pollutants that could have been transported downstream to the mouth of the creek and the potential impacts on fish/shellfish harvesting in Bazan Bay.

WSP response: Sediment samples collected from the mouth of the creek were below applicable standards. By extension, WSP considers it unlikely that the metal contaminants resulting from historical operations at the airport are having a significant impact on fish/shellfish in Bazan Bay.

Erik Pelkey: The WLC are concerned about potential effects on species that aren't stationary, which are harvested as food items by First Nations (ducks were specifically mentioned as a food item that is hunted and consumed).

WSP response: Ducks weren't specifically assessed, but based on the porewater data, it is unlikely that metals in the sediment are releasing to the porewater. This result suggests the metal contaminants resulting from historical operations at the airport are not bioaccumulating into the food chain in a significant amount.

Peter Evans: The WLC are concerned about the potential effects on shellfish at the mouth of the creek (presently closed for harvesting by DFO); has there been testing of tissues for the metal contaminants of concern?

WSP response: As described above, sediment samples collected from the mouth of the creek were below applicable standards. By extension, WSP considers it unlikely that the metal contaminants resulting from historical operations at the airport are having a significant impact on fish/shellfish in Bazan Bay. As a result, WSP did not collect tissue data as part of the risk assessment.

Joni Olsen: The WSP risk assessment is relevant in that it helps determine who is not responsible for the shellfish/fish closures in Bazan Bay. The WLC understands the line of thought that since there are no impacts in sediment at the mouth of the creek, there are likely no effects on shellfish, but would like to see tissue data.

WSP response: Acknowledged

Laurie Whitehead: Have we considered berry picking along KÉLSET?

WSP response: Soil samples collected along the length of KÉLSET, downstream of KÉLSET Pond, were below applicable standards. As a result, WSP considers it unlikely that the metal contaminants resulting from historical operations at the airport are bioaccumulating into the terrestrial food chain (including berries) in a significant amount. An evaluation of large-scale berry harvesting was not conducted in the risk assessment.

Joni Olsen: The WLC is concerned with cumulative effects on food sources/food security; appreciates the work the government is doing to clean up contamination.

WSP response: Acknowledged

4.0 CONCLUSIONS AND RECOMMENDATIONS

During the engagement meeting, the WLC expressed concerns with bioaccumulation of contaminants/pollutants into food items and with cumulative effects on food sources/food security. Based on the feedback received during the meeting, the WLC Technical Advisory Committee had no concerns with the results of the draft HHERA and it is recommended that the report be finalized with no additional work.

5.0 NOTICE TO READERS

This technical memorandum was prepared for Canada in accordance with the terms and conditions of the Public Works Government Services Canada (PWGSC) Contaminated Sites Risk Assessment Contract with Task Authorizations (CTA) EZ897-191436/002/VAN, dated 9 August 2019, Task Authorization (TA) 700652230 dated 20 May 2022, and Amendment #1 to Task Authorization Number 700652230 dated 24 June 2022. The scope of work was described in the workplan “Workplan and Cost Estimate—Risk Assessment Activities and Post-Remediation Monitoring in KÉLSET, BC” dated 19 May 2022, and in the “Request for Amendment (#1) to Task Authorization 700652230—Risk Assessment Activities and Post-Remediation Monitoring in KÉLSET, BC” dated 20 June 2022.

The inferences concerning the Site conditions contained in this letter are based on information obtained during the assessment conducted by WSP personnel and are based solely on the condition of the property at the time of the site visit, as described in this technical memorandum.

This letter was prepared, based in part, on information obtained from historic information sources. In evaluating the subject Site, WSP has relied in good faith on information provided. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings and conclusions documented in this letter have been prepared for the specific application to this project and have been developed in a manner consistent with that level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction.

With respect to regulatory compliance issues, regulatory statutes are subject to interpretation. These interpretations may change over time; these should be reviewed.

If new information is discovered during future work, the conclusions of this memorandum should be re-evaluated and the letter amended, as required, prior to any reliance upon the information presented herein.

6.0 CLOSURE

We trust the information contained in this report is sufficient for your present needs. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

WSP CANADA INC.



Alexis Fast, MEdes, RPBio, PMP
Project Manager, Lead Environmental Scientist



Blair McDonald, MET, RPBio, CSAP
Principal, Senior Environmental Scientist

[https://wsponline-my.sharepoint.com/personal/alexis_fast_wsp_com/documents/desktop/projects/2023/22526061_kelset/project work/engagement meetings/22526061-009-tm-rev0-kelset-summary of engagement meeting - 20mar_23.docx](https://wsponline-my.sharepoint.com/personal/alexis_fast_wsp_com/documents/desktop/projects/2023/22526061_kelset/project%20work/engagement%20meetings/22526061-009-tm-rev0-kelset-summary%20of%20engagement%20meeting%20-%2020mar_23.docx)

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