# ANNEX A

## Site Photographs

Photo 1: A view of the home at 2425 Glenview Avenue, Kamloops, BC, looking south/southwest. The impact area has been levelled since the date of the photograph.

Photo 2: A view of the main impact area prior to being filled in/levelled. Note the crack in the foundation on the right edge of the building. The basement window of the home is boarded up at the top left of the photograph.

Photo 3: A view of the drilling investigation, positioned over location MW20-01

Photo 4: The soil stratigraphy within MW20-01 for the interval of 4.6 m bgs to 6.1 m bgs; see the borehole log for this monitoring well location in the Annexes to the specifications.

Photo 5: A view of the west side of the home at 2425 Glenview Avenue, looking south; the severed hydro-electric and telecommunications connections are visible at the top right corner of the home; the Fortis BC gas meter is present on the west side of the home, midway along the wall. The fence shown in the photograph, and associated anchor ropes, will be removed prior to remediation.

Photo 6: A view of the front yard of the property at 2425 Glenview Avenue, looking north. The flagstone walkway is visible at the bottom right of the photograph and gravel driveway on the right of the photograph.

Photo 7: A view of the front yard of the property at 2425 Glenview Avenue, looking south. The fence shown in the photograph will be removed prior to remediation. The storage container in the driveway to the home is located outside the Work Area as defined in the drawings.

Photo 8: A view of MW20-03, in front of the entrance to the home, this monitoring well is to be protected. The flagstone walkway is visible in the left side of the photograph.

Photo 9: A view of the basement wall/foundation, looking north. The boarded-up basement window visible in Photo 2 is visible. Cracking of the foundation is evident.

Photo 10: A view of the basement with temporary bracing and a support wall installed.

# ANNEX B

## Stage II Preliminary Site Investigation

**REPORT**

# Kamloops Snowbirds Incident Clean Up,

## *Property A Stage 2 Preliminary Site Investigation Results*

Submitted to:

**Public Services and Procurement Canada**
Attention: Dave Osguthorpe
1230 Government Street, Suite 401
Victoria, BC  V8W 3X4

Submitted by:

**Golder Associates Ltd.**
Suite 200 - 2920 Virtual Way, Vancouver, British Columbia, V5M 0C4, Canada

+1 604 296 4200

20145856-011-R-Rev0

23 July 2020

# Distribution List

1 Copy (e-pdf) - Public Services and Procurement Canada

1 Copy (e-pdf) - Golder Associates Ltd.

# Executive Summary

## Introduction

Golder Associates Ltd. (Golder) was retained by Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND) to conduct a Stage 2 Preliminary Site Investigation (Stage 2 PSI) for the Snowbirds Environmental Cleanup project located at 2425 Glenview Avenue, Kamloops, BC (the Site).

The purpose of the Stage 2 PSI is to evaluate whether or not the potential contaminants of concern (PCOCs) associated with the aircraft crash and firefighting response at the Site are present at concentrations exceeding the relevant numerical regulatory standards, and to provide vertical and lateral delineation of contaminants of concern (COCs).

This report was prepared in accordance with terms and conditions of Public Works and Government Services Canada (PWGSC) Contaminated Sites Characterization Contract (reference EZ897-191444/002/VAN) dated 25 October 2019, Golder's workplan dated 20 May 2020 and the subsequent amendments, "*Request for Amendment (#2) to Task Authorization 700514134 to Undertake Additional Soil Sampling to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project*" dated 8 June 2020, and "*Request for Amendment (#3) to Task Authorization 700514134 to Undertake Supplemental Tasks to Support Remediation Planning Related to the Department of National Defence Kamloops Snowbird Environmental Clean-Up Project"* dated 24 June 2020.

One area of potential environmental concern (APEC) was identified at the Site based on the preliminary site reconnaissance; the APEC consisted of the main crash site and front yard of the home where chemicals on board the aircraft impacted and spilled to the ground surface, and areas of the Site where aqueous film-forming foam (AFFF) was deployed as part of the fire fighting response.

## Scope of Work

The scope of work for the Stage 2 PSI was as follows:

- Develop a Site-specific Health and Safety Environment Plan (HaSEP) for undertaking investigation activities at the Site.
- Conduct preliminary surficial soil sampling at the Site on an expedited basis
- Conduct a sub-surface investigation program, including clearance of proposed drilling areas by a utility locator, in the outdoor areas of the Site that included drilling eight boreholes with four locations completed as monitoring wells and two of these locations also completed with soil vapour probes.
- Conduct a sub-slab investigation within the basement of the home that included coring through the concrete foundation in two locations to advance a borehole in one location and install a temporary sub-slab vapour port in the second location.
- Collect soil samples from the borehole locations for analysis of the PCOCs.
- Develop the four groundwater monitoring wells to improve connection to the aquifer and to remove sediment introduced during drilling.

- Measure field parameters in the groundwater recovered from the monitoring wells including pH, temperature, electrical conductivity, and reduction-oxidation potential (redox), and collect groundwater samples for analysis of PCOCs.
- Purge soil vapour monitoring wells and the sub-slab soil vapour sampling port. Collect soil vapour samples for analysis of PCOCs. Review the analytical data provided by the laboratory, and compare the results to the applicable provincial standards.
- Summarize the findings of the investigation in this report, including borehole logs, analytical data tables, figures, and conclusions. This Stage 2 PSI has been prepared in accordance with the British Columbia Ministry of Environment & Climate Change Strategy (BC ENV) Technical Guidance 11 – Guidance for a Stage 2 PSI and Detailed Site Investigation.

## Summary and Recommendations

### *Soil*

Golder conducted an initial surficial sampling program on 25 and 26 May 2020 that included collecting surficial samples from 12 locations from the Site to assess the presence of contamination relating to the main crash site and front yard of the home where chemicals on board the aircraft impacted and spilled to the ground surface, and areas of the Site where AFFF was deployed as part of the fire fighting response. Hydrocarbon, VOC, and metals contamination was identified in the surficial sample collected at the impact site of the main body of the aircraft (SS20-18). Hydrocarbon contamination was also identified at the location approximately 5.5 m to the east of the impact site of the main body of the aircraft (SS20-17).

Following the initial surficial sampling program, a subsurface investigation was conducted to provide further characterization of the quality of soil, groundwater, and soil vapour and to provide soil delineation for SS20-17 and SS20-18. Between 10 and 12 June 2020, eight boreholes were advanced with two locations completed as monitoring wells and two locations completed as nested groundwater and soil vapour monitoring wells. Hydrocarbon and VOC contamination was identified in the soils at the impact site of the main body of the aircraft from ground surface in SS20-18 to a depth of 4.0 m bgs in MW20-02. Samples analyzed in MW20-02 at a depth of 4.6-4.75 m bgs met the CSR standards for COCs. Hydrocarbon contamination was also identified in the borehole located approximately 3 m north of the impact site of the main body of the aircraft (BH20-05) from surface to 2.55 m bgs and VOC contamination was identified from surface to 1.05 m bgs.

To assess the possibility for soil contamination following preferential pathways beneath the foundation of the house, an additional subsurface investigation was conducted on 26 June 2020. Soil contamination was not identified in the borehole advanced through the concrete foundation of the house.

Soil contamination identified in locations SS20-17, SS20-18, MW20-02 and BH20-05 has been delineated laterally to the north, south east and west and vertically to a depth of 4.3 m bgs at MW20-02/SS20-18 (inferred to be halfway between the deepest sample that exceeded the standards and the next sample below standards). The following parameters were retained as COCs in soil and should be remediated: LEPHs, HEPHs, 2-methylnaphthalene, naphthalene, VPHs, n-nonane, BTEX, cadmium, and chromium. Quinoline and 1,2-dibromoethane were retained as soil PCOCs based on elevated laboratory detection limits in select soil samples. The elevated detection limits observed for quinoline and 1,2-dibromoethane were in locations where there are COCs present; both parameters were laterally and vertically delineated, and the areas with elevated laboratory detection limits will be incidentally remediated for other COCs.

## Groundwater

The groundwater monitoring wells were sampled on 19 June 2020. The concentration of the PCOCs in the groundwater samples met the applicable BC CSR standards.

No PCOCs were retained as COCs for groundwater at the Site. Groundwater quality at the Site should be assessed for seasonal variations; it is expected that this requirement would be addressed following remediation of soil at the Site.

## Soil Vapour

The soil vapour probes installed in the outdoor areas of the Site were sampled on 18 June 2020. To assess soil vapour quality underneath the foundation of the house, a sub-slab soil vapour probe was installed and sampled on 26 June 2020.

The analytical results for the three soil vapour locations sampled indicated that the outdoor air exposure met the BC CSR RL standards. Indoor air exposure did not meet the BC CSR RL standards.

The PCOCs VPH, benzene, total xylenes, 1,3-butadiene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and methyl-cyclohexane were retained as COCs and should be assessed again following soil remediation and for seasonal variations. Naphthalene was retained as a soil vapour PCOC based on elevated laboratory detection limits in SV20-09.

It is expected that removal of contamination in soil will incidentally address soil vapour contamination identified above.

## Recommendations

Based on the results of the Stage 2 PSI, soil containing concentrations of LEPHs, HEPHs, VPHs, 2-methylnaphthalene, naphthalene, BTEX, cadmium, chromium, and n-nonane exceeding the CSR $RL_{LD}$ standards is present in the area of SS20-18/MW20-02, SS20-17, and BH20-05. Soil exceeding the BC HWR Leachate Quality Standard for leachable ethylbenzene was also identified in one borehole location.

The following recommendation is provided to address the soil contamination identified at the Site:

- Conduct a remedial excavation to remove the contaminated soil in the area of the impact site of the main body of the aircraft and backfill the area with clean soil to return the Site back to the landowners.
- If monitoring wells must be decommissioned during remediation, install post-remediation groundwater monitoring wells to assess post-remediation groundwater quality, and undertake seasonal groundwater monitoring in the dry season (i.e. August/September) and wet season (i.e. December/January) to assess for seasonal variability.
- If soil vapour probes must be decommissioned during remediation, install post-remediation soil vapour monitoring probes to assess post-remediation soil vapour quality, and undertake seasonal soil vapour monitoring in the dry and wet seasons to assess for seasonal variability.

A remedial action plan is currently being developed by Golder and a draft plan has been issued to PSPC/DND for review (Golder reference number 20145856-005-R-RevA).

A summary of the COCs and recommendations is provided below.

| Media | PCOC | COC | Recommendations |
|---|---|---|---|
| Soil PCOC | LEPHs, HEPHs, PAH, VPHs | 2-methylnapthalene, naphthalene, LEPH, HEPH, VPH | Remediation |
| | Benzene, ethylbenzene, toluene, xylene | Benzene, ethylbenzene, toluene, xylene | Remediation |
| | aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc | cadmium, chromium | Remediation |
| | PFBS, PFOS | - | |
| | ethylene glycol | - | |
| | isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, butylbenzenes, 1,2-dichloroethane | - | |
| | MTBE, styrene, N-nonane | n-nonane | Remediation |
| | 1,2 dibromoethane | - | |
| Groundwater | LEPHw, EPHw10-19, PAHs, VPHw, VHw6-10 | - | Assess post remediation and for seasonal variations |
| | benzene, toluene, ethylbenzene, xylene | - | |
| | aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc | - | |
| | PFBS, PFOS, PFOA | - | |
| | 1,2-dibromoethane, n-nonane | - | |
| Soil Vapour | benzene, toluene, ethylbenzene, xylene | Benzene and total xylenes | Assess post remediation and for seasonal variations |
| | styrene, MTBE, naphthalene, VPH, 1,2-dibromoethane, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and isopropylbenzene,1,3-butadiene, methyl-cyclohexane, n-decane and n-hexane | VPH, 1,3-butadiene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and methyl-cyclohexane | |

*quinoline and 1,2-dibromoethane are retained as soil PCOC based on elevated laboratory detection limits in select soil samples.

**naphthalene is retained as a soil vapour PCOC based on elevated laboratory detection limits at SV20-09.

# Notice to Readers

This report was prepared in accordance with terms and conditions of the Public Works and Government Services Canada (PWGSC) Contaminated Sites Characterization Contract (reference EZ897-191444/002/VAN) dated 25 October 2019 and Golder's workplan dated 20 May 2020, amendment titled "Request for Amendment (#2) to Task Authorization 700514134 to Undertake Additional Soil Sampling to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project" dated 8 June 2020 and amendment titled, "Request for Amendment (#3) to Task Authorization 700514134 to Undertake Supplemental Tasks to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project" dated 24 June 2020.

The inferences concerning Site conditions contained in this report are based on information obtained during the assessment conducted by Golder personnel, and are based solely on the condition of the properties at the time of the Site reconnaissance, supplemented by historical and interview information obtained by Golder, as described in this report.

This report was prepared, based in part, on information obtained from historic information sources. In evaluating the subject Site, Golder 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 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 and geotechnical 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.

# Table of Contents

**TABLES**

**FIGURES**

**APPENDICES**

# List of Acronyms

| | |
|---|---|
| α | vertical vapour attenuation factor |
| Allnorth | Allnorth Consultants Ltd. |
| ALS | ALS Environmental |
| AFFF | aqueous film-forming foam |
| AW | aquatic life |
| AW-F | aquatic life (freshwater) |
| BC ENV | British Columbia Ministry of Environment and Climate Change Strategy |
| BTEX | benzene, toluene, ethylbenzene, xylenes |
| $C_{air}$ | estimated air concentration |
| $C_{vapour}$ | measured soil or sub-slab vapour concentration |
| CSR | Contaminated Sites Regulation |
| COC | contaminant of concern |
| CSAP | Contaminated Sites Approved Professional |
| DF | difference factor |
| DND | Department of National Defence |
| DQO | data quality objectives |
| DW | drinking water |
| EMA | *Environmental Management Act* |
| EMBC | Emergency Management BC |
| EPH | extractable petroleum hydrocarbons |
| Golder | Golder Associates Ltd. |
| HaSEP | Health and Safety Environment Plan |
| HDPE | high-density polyethylene |
| HEPH | heavy extractable petroleum hydrocarbons |
| HWR | Hazardous Waste Regulation |
| KFR | Kamloops Fire Rescue |
| LEPH | light extractable petroleum hydrocarbons |
| Lynx Creek | Lynx Creek Industrial and Hydrovac Ltd. |
| m asl | metres above sea level |
| m bgs | metres below ground surface |

| | |
|---|---|
| m btoc | metres below top of casing |
| MTBE | methyl tert-butyl ether |
| OTM | On the Mark Locates Ltd. |
| PAH | polycyclic aromatic hydrocarbons |
| PCOC | potential contaminant of concern |
| PFAS | per- and polyfluoroalkyl substances |
| PFOA | perfluorooctanoic acid |
| PFBS | perfluorobutane sulfonate |
| PFHpA | perfluoroheptanoic acid |
| PFOS | perfluorooctane sulfonate |
| PFNA | perfluorononanoic acid |
| PHC | petroleum hydrocarbon |
| PID | photoionization detector |
| ppm | parts per million |
| PSI | Preliminary Site Investigation |
| PSPC | Public Services and Procurement Canada |
| PVC | polyvinyl chloride |
| PWGSC | Public Works and Government Services Canada |
| QA/QC | Quality Assurance and Quality Control |
| RCAF | Royal Canadian Air Force |
| Rocky Mountain | Rocky Mountain Soil Sampling Inc |
| RPD | Relative Percent Difference |
| SOP | Standard Operating Procedure |
| Stage 2 PSI | Stage 2 Preliminary Site Investigation |
| Sumas | Sumas Environmental Services Inc. |
| VOC | volatile organic compounds |

# 1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND) to conduct a Stage 2 Preliminary Site Investigation (Stage 2 PSI) for the Snowbirds Environmental Cleanup project located at 2425 Glenview Avenue, Kamloops, BC (the Site).

The purpose of the Stage 2 PSI is to evaluate whether or not the potential contaminants of concern (PCOCs) associated with the aircraft crash and firefighting response at the Site are present at concentrations exceeding the relevant numerical regulatory standards, and to provide vertical and lateral delineation of contaminants of concern (COCs).

This report was prepared in accordance with terms and conditions of Public Works and Government Services Canada (PWGSC) Contaminated Sites Characterization Contract (reference EZ897-191444/002/VAN) dated 25 October 2019, Golder's workplan dated 20 May 2020 and the subsequent amendments, "*Request for Amendment (#2) to Task Authorization 700514134 to Undertake Additional Soil Sampling to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project*" dated 8 June 2020, and "*Request for Amendment (#3) to Task Authorization 700514134 to Undertake Supplemental Tasks to Support Remediation Planning Related to the Department of National Defence Kamloops Snowbird Environmental Clean-Up Project"* dated 24 June 2020.

## 1.1 Scope of Work

The scope of work for the Stage 2 PSI was as follows:

- Develop a Site-specific Health and Safety Environment Plan (HaSEP) for undertaking investigation activities at the Site.
- Conduct preliminary surficial soil sampling at the Site on an expedited basis.
- Conduct a sub-surface investigation program, including clearance of proposed drilling areas by a utility locator, in the outdoor areas of the Site that included drilling eight boreholes with four locations completed as monitoring wells and two of these locations also completed with soil vapour probes.
- Conduct a sub-slab investigation within the basement of the home that included coring through the concrete foundation in two locations to advance a borehole in one location and install a temporary sub-slab vapour port in the second location.
- Collect soil samples from the borehole locations for analysis of the PCOCs described in Section 1.3.5.
- Develop the four groundwater monitoring wells to improve connection to the aquifer and to remove sediment introduced during drilling.
- Measure field parameters in the groundwater recovered from the monitoring wells including pH, temperature, electrical conductivity, and reduction-oxidation potential (redox), and collect groundwater samples for analysis of PCOCs.
- Purge soil vapour monitoring wells and the sub-slab soil vapour sampling port. Collect soil vapour samples for analysis of PCOCs. Review the analytical data provided by the laboratory, and compare the results to the applicable provincial standards.

- Summarize the findings of the investigation in this report, including borehole logs, analytical data tables, figures, and conclusions. This Stage 2 PSI has been prepared in accordance with the British Columbia Ministry of Environment & Climate Change Strategy (BC ENV) Technical Guidance 11 – Guidance for a Stage 2 PSI and Detailed Site Investigation.

## 1.2 Professional Statement

Pursuant to Section 63 of the Contaminated Sites Regulation, Golder confirms that this Stage 2 PSI report has been prepared in accordance with the applicable sections of the Contaminated Sites Regulation (Part 5, 6, 9, and 14).

The senior reviewer for this report, Erik von Krogh, has demonstrated experience in the assessment described in this report, and is familiar with the assessment work carried out at the Site. This report was prepared by professionals familiar with the *Environmental Management Act* (EMA) and the Contaminated Sites Regulation (CSR). Primary project participants and report authors were Alison Verde (PEng), Alanna Umphrey (AScT), and Erik von Krogh (RPBio, PMP). The services performed as described in this report were conducted in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits, financial and physical constraints applicable to the services.

## 1.3 Background Information

### 1.3.1 Background on the Crash

On 17 May 2020, shortly after takeoff from the Kamloops Airport, a Royal Canadian Air Force (RCAF) CT114 Tutor Snowbird aircraft crashed immediately adjacent the home on the Site, a privately-owned residential property located near the intersection of Glenview Avenue and Schreiner Street in Kamloops, BC. The aircraft is understood to have been destroyed on impact, and was reportedly carrying “JP8/F34” jet fuel, which ignited and caused damage to the adjacent residential structure at 2425 Glenview Avenue. As a result of the crash and explosion, the tail section of the aircraft was thrown across the street, coming to rest near a power pole on the City of Kamloops boulevard, on the north side of Glenview Avenue. A resident of a home on the north side of Glenview Avenue showed DND a video recording of a fireball project from the crash site northwards across the street. The front of the home at the Site was severely damaged by fire, and it appears the fire caused substantial damage to the western portion of the roof of the home. It is inferred the crash caused cracking of the basement wall/foundation of the home immediately adjacent the crash location. The crash severed the overhead power and telecommunication lines, which were removed from the Site during the emergency response.

An aerial photograph of the crash site following extinguishment of the fire is included in Appendix A.

The Site is located approximately 900 metres east of the Kamloops Airport, in the Brocklehurst neighbourhood of Kamloops, BC. Further to a Site visit and discussions with PSPC/DND, the extent of the impact area was observed to include the Site and adjoining private residential properties and municipal roadway (Glenview Avenue) which are under provincial jurisdiction and regulated under the BC ENV Contaminated Sites Regulation (CSR); the CSR is the primary regulation applicable at the Site, and the applicable land use is Residential low density ($RL_{LD}$).

### 1.3.2 Initial Emergency and Spill Response Efforts

Kamloops Fire Rescue (KFR) and emergency responders from the Kamloops Airport attended the scene to extinguish the fire. The fire was reported to be extinguished using Ansulite 3% (DC-3 formulation) aqueous film-forming foam (AFFF), intended for use on Class B hydrocarbon fuel fires. This AFFF product is reported to contain per- and poly-fluorinated substances (PFAS), and specifically perfluorooctanoic acid (PFOA), though it is reported to not contain high concentrations of perfluorooctanesulfonic acid (PFOS)[1]. Based on verbal reports from first responders and images/video captured by news media, the AFFF was observed to be deployed over the front lawn and roof of the home at the Site; it is inferred the AFFF may have flowed over the roof and down the southwest drain onto the lawn downgradient from the drainpipe. AFFF was observed on Glenview Avenue, and was reported to have accumulated in low gravel areas adjacent to the paved roadway of Glenview Avenue.

A DND Hazmat Incident/Spill Report form was prepared by DND on 17 May 2020 and is included as Appendix B. The form documented that the crash caused the release of 4.2 L of engine oil, 5.9 L of hydraulic oil, 1552 L of JP8/F34 fuel, and 168.2 L of diesel. In addition to the DND Hazmat Incident/Spill Report form, DND indicated that an Emergency Management BC (EMBC) incident report was submitted to BC ENV; EMBC incident report number 200560. EMBC documented the incident in their weekly incident report for the period of 11 to 17 May 2020; it was noted that the BC ENV Response Officer raised the incident to urgent status due to heightened media/public interest.

The aircraft and debris were removed by DND, and a backhoe was used to remove fragments of the aircraft from the main impact site. Based on observations during drilling, noted below, it appeared that a depth of soil approximately 2 m deep was disturbed by the crash and subsequent excavation. Following retrieval of aircraft fragments, the soil was replaced in the excavation hole.

Following the emergency response, contractors, acting on behalf of the homeowners, erected temporary modular fencing to secure the Site and limit access to the home and yard.

### 1.3.3 Preliminary Site Reconnaissance

On 20 May 2020, Mr. Erik von Krogh and Mr. Aaron Keryluke of Golder participated in a preliminary reconnaissance of the Site to assist with developing a scope of work for the Stage 2 PSI. The Golder representatives met personnel from PSPC (Mr. Dave Osguthorpe), DND (Ms. Marie Goulden; Major Al Jacula), and BC ENV Emergency Response Officer (Mr. Rick Wagner) to perform a reconnaissance of the Site, review the emergency response efforts undertaken between 17 May and 20 May 2020, and assess visible impacts to exterior areas of the home and yard.

Subsequent to the preliminary site reconnaissance, on 25 May 2020, DND established a land use agreement with the homeowners at the Site permitting access to the Site for site characterization purposes.

---

[1] https://www.ansul.com/en/us/DocMedia/F-2017100.pdf

### 1.3.4 Area of Potential Environmental Concern

Based on the preliminary site reconnaissance, one area of potential environmental concern (APEC) was identified at the Site based on the preliminary site reconnaissance; the APEC consisted of the main crash site and front yard of the home where chemicals on board the aircraft impacted and spilled to the ground surface, and areas of the Site where AFFF was deployed as part of the fire fighting response. It is noted that a formal Stage 1 Preliminary Site Investigation was not undertaken to evaluate historical or current uses of the Site, and to evaluate whether there may be other APECs related to the historic or current use of the Site. The scope of this Stage 2 PSI is limited to the assessment of the APEC related to the crash of the Snowbird aircraft and the subsequent firefighting response.

### 1.3.5 Potential Contaminants of Concern

The crash of the aircraft and the resulting fire-fighting effort were considered to have the potential to cause contamination to soil, groundwater, and soil vapour in the vicinity of the crash. Based on information provided by DND (see Appendix C) regarding potential chemicals stored on the aircraft, as well as reference to the material safety data sheet for Ansulite 3%, potential contaminants of concern (PCOC) were selected. PCOCs are chemical substances that are regulated under the BC ENV CSR and which may pose a potential unacceptable risk to human or ecological health.

PCOCs were considered to be as follows:

***Soil***

- PCOCs related to fuels and lubricants understood to be carried by the aircraft: light and heavy extractable petroleum hydrocarbons (LEPHs/HEPHs), polycyclic aromatic hydrocarbons (PAHs), volatile petroleum hydrocarbons (VPHs), benzene, toluene, ethylbenzene and xylenes (BTEX)
- PCOCs related to the aircraft paint, batteries, etc.: aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc.
- PCOCs related to AFFF firefighting agents deployed following the crash: perfluorobutane sulfonate (PFBS) and perfluorooctane sulfonate (PFOS).
- PCOC related to fuel additives, methyl carbitol fuel additive grade: ethylene glycol.
- Further to the list of primary PCOCs above, it is noted that the Contaminated Sites Approved Professional Society (CSAP) have developed a document titled, “PCOC Selection and Guidance” to inform PCOC selection. CSAP considers there to be a potential for secondary PCOCs to be present when elevated concentrations of primary contaminants are measured. To address this uncertainty, the soil sample exhibiting the highest concentrations of primary hydrocarbon-related contaminants was analysed for secondary PCOCs as follows: N-nonane, isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, butylbenzenes, barium, methyl tert-butyl ether (MTBE), styrene, 1,2 dibromoethane, and 1,2-dichloroethane.

In addition, petroleum hydrocarbon fractions defined by the Canadian Council for Ministers of the Environment as part of the Canada-wide Standards for Petroleum Hydrocarbons were analysed in a subset of samples for information purposes.

### *Groundwater*

- The primary PCOCs for groundwater were: LEPHw, EPHw10-19, PAHs, VPHw, VHw6-10, benzene, toluene, ethylbenzene, xylene, dissolved metals (aluminum, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc), PFBS, PFOS, and perfluorooctanoic acid (PFOA).
- Secondary PCOCs identified in soil were only included as PCOCs in groundwater if the concentration in soil samples exceeded the applicable CSR standards. Laboratory detection limits for 1,2-dibromoethane in soil were elevated above the applicable CSR standards, therefore 1,2-dibromoethane was retained as a PCOC in groundwater. Concentrations of n-nonane in soil were above applicable CSR standards and n-nonane was retained as a PCOC in groundwater.

### *Soil Vapour*

- Soil vapour PCOCs were selected based on primary and secondary PCOCs above and based on regulated substances in soil vapour and include: BTEX, styrene, MTBE, naphthalene, VPH, 1,2-dibromoethane, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and isopropylbenzene. Additional soil vapour parameters selected for analysis include: 1,3-butadiene, methyl cyclohexane, n-decane and n-hexane based on the laboratory fuel and diesel package.

## 1.3.6 Site Description

The Site is zoned RT-1 (Two Family Residential; City of Kamloops 2020) and is 21 m wide in the west-east direction, and approximately 55 m long in the north-south direction, with a total approximate area of 1,185 $m^2$ as reported by the City of Kamloops (2020). The Site is occupied by a single-story residential home with a basement, which occupies approximately 180 $m^2$, which is approximately 15% of the property land area.

Based on review of orthophotographs available on the Kamloops CityMap[2], it appears the home was built before 1974. Golder contacted the City of Kamloops to request building plans for the home. The City of Kamloops informed Golder that building plans for the home were not available and they were not able to provide further property information related to the age of the home or construction details; therefore plans for the home were not available from the homeowner. The basement floor of the home is estimated to be approximately 1.7 m below ground surface, and the floor was observed to be approximately 100 mm thick. In an email dated 23 May 2020 to DND, the homeowner indicated they had lived in the home since 1990 and they reported that the home did not have perimeter drains or sumps in the basement. The home was reported to be heated using natural gas, and the homeowner was not aware that other heat sources, such as heating oil stored in aboveground- or underground-storage tanks, had been used at the home prior to 1990. Based on an email from the homeowner’s insurance company on 16 June 2020, it is understood that the interior of the home contained asbestos-products and that an abatement has been undertaken by Thomson Valley Restorations in the crash- and fire-damaged portions of the home.

On 17 June 2020, a structural engineer from Apple Consulting Engineering Services, of Kamloops, BC, acting on behalf of the homeowner, performed a reconnaissance of the basement of the home and developed a plan for temporary bracing to support the northern basement wall/foundation that was directly impacted by the crash.

---

[2] https://www.kamloops.ca/city-services/maps-apps

On 25 June 2020, the homeowner’s structural engineer inspected the bracing that had been installed, as well as a support wall constructed to provide additional support the first floor of the home.

The front yard of the Site is predominantly grass (residential lawn). There is a flagstone walkway leading from the gravel driveway to the entrance of the home; the flagstone pathway forms a small triangular-shaped landscaped area adjacent the driveway. Based on publicly available street-level images, there appeared to be landscaping shrubs and vegetation on the northwest area in front of the home, in the area where the aircraft crashed. The back of the home is developed with a flagstone patio, a deck and grass (residential lawn). A garden is present in the far south area of the property.

Relevant property information regarding the Site is presented in the following Table 1.

**Table 1: Property Information**

| | |
|---|---|
| **Civic Address** | 2425 Glenview Avenue, Kamloops, BC |
| **Legal Description** | PL 13661, LT 4, DL 251 |
| **Parcel Identifier** | 002-859-068 |
| **Latitude/Longitude** | 50°42'9.37"N 120°25'0.60"W |

### 1.3.7 Topography

The Site is located at an elevation of approximately 345 to 346 m (City of Kamloops 2020) and topography in the surrounding area was observed to be fairly flat. Locally, there appears to be a topographic low point north of the property on municipal land, adjacent Glenview Avenue. There did not appear to be a surface water flow pathway from the Site to the storm drain rock pits located at the intersection of Glenview Avenue and Schreiner Street.

### 1.3.8 Surficial Geology

The Geological Survey of Canada Map 9-1963 describes geology on-site as Alluvial stream channel and flood-plain, deposits: gravel, sand, and mucky peat.

The soils encountered as part of this investigation were observed to consist of silt and sand from surface to approximately 3.4 metres below ground surface (m bgs), underlain by fine sand and grading to coarse sand at approximately 5.2 m bgs.

### 1.3.9 Hydrogeological Setting

Groundwater was observed during this investigation at approximately 5.1 m bgs. Groundwater flow is expected to be influenced by regional topography and is inferred to flowing in a south to southwest direction toward the Thompson River approximately 180 m south of the Site.

The impacts from the recent release of fuel to the ground surface are expected to be limited to near surface groundwater systems, and therefore consideration to deeper or regional aquifers and/or hydro-stratigraphic units was not considered relevant to this investigation.

### 1.3.10 Groundwater and Surface Water Use

A search of the BC Water Resource Atlas was undertaken in June 2020 for an area within 500 m of the approximate centre of the Site, located in the areas considered to be up-gradient or cross-gradient with respect to inferred regional groundwater flow. No water wells were identified. The Site is located approximately 180 m north of the Thompson River and 4.5 km west of the North Thompson River. The Thompson River flows to the West towards Kamloops Lake located approximately 10 km west of the Site.

### 1.3.11 Climatic Conditions

Climate information is inferred to be similar to that recorded at the ‘Kamloops A’ weather station, approximately 1.7 km southwest of the Site. According to the 29-year average from 1981 to 2010 inclusive, the average annual mean temperature at ‘Kamloops A’ is approximately 9.3°C and the average annual precipitation is 277.6 millimetres (Environment Canada 2019). Mean precipitation ranges from 12.4 millimetres in February, to 31.4 millimetres in July. An average of approximately 63.5 centimetres of snow falls per year.

### 1.3.12 Utilities

Based on information obtained from BC One Call, the City of Kamloops and private utility locates performed on-site, the following utilities are understood to be located at the Site:

- BC Hydro electrical overhead lines; the power lines are understood to have been severed and were pulled back to the power pole due to the aircraft incident.
- Cable and telecommunication lines understood to have been overhead; the cable and telecommunication lines are understood to have been severed and were pulled back to the power pole due to the aircraft incident.
- Municipal sanitary and water utility lines run underground from Glenview Avenue to the northwest area of the house. The City of Kamloops (2020) reports that the water line is located “5.79 m from NW & 0.3 m O/S [off-set]”.
- Fortis BC natural gas utility line runs underground from Glenview Avenue to a meter on the west side of the home, near the northwest corner of the house. The utility line was identified by a private utility locater and noted to be present at a depth of approximately 1.2 m bgs.
- Stormwater in the area drains along the roadway into rockpit sumps that are located on the north and south sides of Glenview Avenue, west of the intersection with Schreiner Street. There are no defined drainage channels or swales directing surface water long Glenview Avenue, and it is not expected that surface water would have flowed from the Site to the rock drains, as the front yard of the home constitutes a local topographic low point. The rock pits were observed during the preliminary site reconnaissance and appeared to contain standing water; there was no sheen observed on the water.

### 1.3.13 Contaminant Fate and Transport

Based on our visual observations, the PCOCs related to the aircraft paint, batteries, and other solid aircraft components were expected to be localized to the crash area.

PCOCs related to fuels and liquid petroleum hydrocarbons were expected to be potentially present in a wider area, from the main crash area northward towards the street and the location of the tail section. This is because it was considered possible for liquid PCOCs to be released northwards in the direction of the fireball observed by a resident of a home on the north side of Glenview Avenue.

PCOCs related to AFFF and the firefighting efforts were expected to be potentially present across the front lawn of the Site, as well as in a localized area to the south of the home where liquids sprayed onto the roof of the home may have drained to the ground surface.

Contaminant fate and transport in the subsurface was expected to be somewhat limited by the presence of the silt and sand soils, which may have reduced infiltration into the subsurface. PCOCs related to AFFF were considered likely to bind preferentially to organic soils present in the near-surface topsoil. It was therefore considered possible for light non-aqueous phase liquids (LNAPL) to be present in the shallow soils, particularly in the main crash site where soils were disturbed during removal of the wreckage. LNAPL has the potential to migrate downwards by gravity through the soil column, and if enough mass was present, LNAPL could come to rest at the water table. Possible preferential flow pathways present in the vicinity of the crash site include:

- Possible higher permeability fill adjacent the foundation and below the slab of the basement floor.
- Utilities crossing through the crash area which may have more permeable backfill materials than the surrounding soils.
- There are cracks in the foundation wall and basement floor which constitute preferential flow pathways for soil vapour.

It was also considered possible that the PCOCs could migrate towards the groundwater table as a result of precipitation infiltrating into the soils.

PCOCs related to the fuels on the aircraft are considered volatile, and volatile contaminants are expected to be present in soil gas in the main crash area. The volatile substances were released immediately adjacent to the home, and the crash is inferred to have caused cracking to the foundation. Therefore, vapour intrusion into the home was considered possible.

### 1.3.14 Pathways for Exposure and Potential Receptors

Pathways for exposure include possible ingestion of, inhalation of (i.e. dust), or skin contact with, contaminated soil and surface water (i.e., puddles accumulating in the area of contamination) and possible inhalation of volatile contamination in ambient air (both outdoors and indoors). Exposure to contaminated groundwater is not expected due to the depth of groundwater (>5 m) and groundwater is not expected to be used for drinking water at the Site or immediately downgradient.

Human and ecological receptors that may be exposed to contamination at the Site include the homeowners, contractors involved in the remediation of the Site and restoration of the home, small wildlife (birds and small mammals) that may enter the Site to consume plants or contaminated soil/water, soil invertebrates and insects in the shallow soil, and plants.

# 2.0 REGULATORY FRAMEWORK

In British Columbia, environmental matters pertaining to contaminated sites generally fall under the jurisdiction of the BC Ministry of Environment and Climate Change (BC ENV), pursuant to the Environmental Management Act (EMA, SBC 2003, Chapter 53 assented to 23 October 2003, updated to 17 June 2020). The key regulation under the EMA that relates to the assessment and remediation of contaminated sites is the Contaminated Sites Regulation (BC Reg. 375/96, O.C. 1480/96 and M271/2004, as updated [includes amendments up to BC Reg. 13/2019, 24 January 2019]). The standards listed in the CSR provide numerical concentrations for the evaluation of soil, sediment, vapour, and groundwater quality and remedial requirements, and identify soil disposal criteria for soil that is subject to provincial laws and regulations.

In addition, the BC Hazardous Waste Regulation (HWR 2017) under the EMA provides requirements for the off-site handling, transportation and disposal of materials classified as “hazardous waste” in BC, as well as facility requirements. The federal Transportation of Dangerous Goods also governs transportation of hazardous waste.

A summary of the BC CSR and HWR relevant to the Site are presented below.

## 2.1 Land Use Definition

The Site is zoned RT-1, residential, by the City of Kamloops. Based on the current and future use of the Site and the zoning at the Site, land use at the Site is considered residential low density.

## 2.2 CSR Standards

### 2.2.1 Soil Standards

The CSR provides both matrix and generic numerical soil standards for use in the assessment of soil quality at properties subject to investigation. The CSR soil standards are divided into eight categories based on land use and include standards for wildlands that are natural ($WL_N$) and reverted ($WL_R$), agricultural (AL), urban park (PL), residential that is low density ($RL_{LD}$) and high density ($RL_{HD}$), commercial land use (CL) and industrial land use (IL). As indicated in Section 2.1, the land use at the Site is considered to be $RL_{LD}$.

Matrix numerical soil standards are provided in CSR Schedule 3.1 – Part 1: *Matrix – Numerical Soil Standards*, based on site-specific factors of human health protection and environmental protection. When parameter concentrations were compared with Schedule 3.1 matrix standards, the most conservative standards of the following human health site-specific factors were applied:

- <u>Human Health Protection</u>
  - intake of contaminated soil
  - groundwater used for drinking water
- <u>Environmental Protection</u>
  - toxicity to soil invertebrates and plants
  - groundwater flow to surface water used by freshwater aquatic life

Generic numerical soil standards are also provided in the CSR Schedule 3.1 – Part 2: *Generic Numerical Soil Standards to Protect Human Health*, and CSR Schedule 3.1 – Part 3: *Generic Numerical Soil Standards to Protect Ecological Health*.

The Site is not used for agricultural purposes; therefore, the Schedule 3.1 – Part 1 site-specific pathways for the protection of livestock (i.e., livestock ingesting soil and fodder, and groundwater used for livestock watering) and irrigation were not considered applicable to the Site.

### 2.2.2 Water Quality Standards

The CSR provides Generic Numerical Water Standards for the assessment of groundwater quality (CSR Schedule 3.2). Based on guidance provided in BC ENV Protocol 21 *Water Use Determination* (ENV 2017a), the CSR groundwater standards for the protection of aquatic life in freshwater bodies (AW-FW) and drinking water (DW) were considered applicable to the Site.

### 2.2.3 Soil Vapour

The CSR provides Generic Numerical Vapour Standards (Schedule 3.3), for four categories based on land use: agricultural/urban park/residential, commercial, industrial and parkade land uses. As stated in Section 2.1, the land use is considered to be residential and the CSR residential land use soil vapour standards were applied to the Site.

#### Vapour Attenuation Factor

The BC ENV Protocol 22 *Application of Vapour Attenuation Factors to Characterize Vapour Contamination* (BC ENV 2017b) allows for the application of vertical vapour attenuation factor to predict indoor and outdoor vapour concentrations when transitioning from the subsurface soil vapour concentrations to indoor or outdoor concentrations, as follows:

$$C_{air} = C_{vapour} \text{ x } \alpha$$

> where $C_{air}$ is the estimated air concentration of the substance, $C_{vapour}$ is the measured soil or sub-slab vapour concentration of the substance, and α is the vertical vapour attenuation factor chosen from Table 2 in Protocol 22.

Specific depth-dependant attenuation factors are applied, based on distance between the potential vapour source and site users, the land use and buildings at the site, exposure type (i.e., indoor or outdoor), vapour probe type (sub-slab versus sub-surface) and final screened depth of soil vapour probe sampled during the investigation. For conservative purposes, attenuation factors were applied to soil vapour data collected from the Site to estimate both indoor and outdoor soil vapour concentrations.

Based on the depth to the top of the sand pack at each outdoor soil vapour location, the appropriate outdoor vapour attenuation factor was applied in accordance with Protocol 22. None of the conditions in Protocol 22 that preclude applying the attenuation factor were applicable to the Site, including i) groundwater in contact with buildings or there is active pumping or drawdown of groundwater, or ii) vapour under pressure (i.e., landfill).

Based on the cracks within the basement wall there is a preferential pathway for vapour. According to Protocol 22, when there is a preferential pathway, attenuation factors can not be applied to assess indoor exposure.

## 2.3 BC Hazardous Waste Regulation

The BC Hazardous Waste Regulation (HWR) specifies requirements for the siting, construction, operation, performance, management, maintenance and closure of facilities for the storage, use, treatment and disposal of hazardous waste. Of importance to this project, the HWR outlines testing protocols for hazardous waste and provides standards to identify hazardous waste. The HWR includes a standard for waste oil that is defined by a total concentration of petroleum hydrocarbons by weight of 3% or higher.

Furthermore, the HWR provides Leachate Quality Standards for comparison to leachate results in Schedule 4, Part 3 of the regulation. For comparison purposes, standards listed in Table 1 of Schedule 4 of the HWR were used for screening leachate results from toxicity characteristic leaching procedure (TCLP) testing. The TCLP test is commonly requested by landfill operators/waste disposal contractors to assess whether or not the leachate from a contaminated material is potentially hazardous and would trigger additional handling and documentation procedures.

# 3.0 FIELD METHODS

Sampling and analysis plans were developed in an iterative manner, and the investigations were undertaken in phases. The first phase of the investigation involved a grid-based surficial soil sampling program including characterization of near-surface soils in the main crash area. The second phase of the investigation involved borehole drilling to provide vertical delineation of observed surficial contamination. A third phase of investigation was undertaken within the building to evaluate soil conditions and soil vapour concentrations below the floor of the basement (approximately 2 m from the northern basement wall).

Field investigation methods carried out as part of this Stage 2 PSI program were conducted in general accordance with Golder's Standard Procedures for the following activities:

- Utility clearance, surficial soil sampling, daylighting, drilling and soil sampling
- Soil headspace screening
- Installing groundwater and soil vapour monitoring wells
- Groundwater monitoring well development, purging and sampling
- Soil vapour purging and sampling
- Waste management
- Quality Assurance / Quality Control (QA/QC) sample collection and analysis

The following sections outline and summarize the methods utilized for the field investigation program conducted as part of this Stage 2 PSI.

## 3.1 Health and Safety and Utility Locates

Prior to undertaking the field investigation program, a health and safety plan was developed. The plan addressed potential health and safety issues that had been identified on the Site and provided mitigation measures to address those potential risks. A BC One Call was placed prior to the intrusive investigations to assess the potential presence of on-site utilities. The health and safety plan was updated and implemented throughout the duration of the investigation.

Proposed outdoor borehole locations were assessed for the presence of underground utilities and/or obstructions by Quadra Utility Locating Ltd. of Vancouver, BC on 10 June 2020. Indoor sampling locations were assessed for the presence of underground utilities, obstructions, and potential rebar in the concrete floor by Lynx Creek Industrial and Hydrovac Ltd. (Lynx Creek) of Kamloops, BC on 12 June 2020.

On 12 June 2020, intrusive investigation work was conducted inside the house at the Site. The homeowner's insurance company subcontracted Apple Engineering Services (Apple Engineering) of Kamloops, BC to inspect the condition of the foundation of the house and provide recommendations regarding the safety of working within the basement. A temporary bracing system was designed and reviewed by Apple Engineering prior to Golder entering the house.

Due to the potential for elevated vapour concentrations related to the aircraft fuel, Golder field personnel wore a portable gas detector during intrusive investigations with sensors to measure the lower explosive limit (LEL), and concentrations of oxygen, hydrogen sulfide, and carbon monoxide with alarms set to sound when concentrations were outside of the limits for safe working conditions.

## 3.2 PFAS Sampling Procedures

Golder has developed a specialized sampling protocol for soil, and groundwater when analyzing samples for PFAS to reduce the potential for cross-contamination. Due to the very low detection limits for PFAS (parts per trillion), the potential for cross-contamination between samples and other sources is considered high.

Golder field personnel adhered to standard operating procedures (SOPs) for sampling for PFAS as follows:

- SOP-0 Planning and Sample Submission
- SOP-1 General Field Methods for PFAS Sampling
- SOP-2 Quality Assurance/Quality Control Protocols for PFAS Sampling
- SOP-3 PFAS Program Monitoring Well Development, Purging and Sampling
- SOP-4 PFAS Soil Sampling

The following sampling methods were used when collecting samples for analysis of PFAS:

- Field personnel avoided the use of shampoo, moisturizer, sunscreen, insect repellant, or other scented personal hygiene products for a 12-hour period prior to field activities.
- Field personnel wore natural fibre clothing such as cotton. During wet conditions, the use of a PVC rain suit was permitted. Field personnel did not wear any other synthetic, water resistant, waterproof, stain-resistant, or coated Tyvek clothing on sampling days (i.e., GoreTex™).
- Field personnel avoided the use of paper bags and other paper packaging, aluminum foil, wax paper or coated textiles to transport food to site as historically food packages have been treated with PFAS to resist wetting.

During the sampling of the various media, the following procedures were followed:

- Only non-waterproof, loose leaf paper was used with a pencil and aluminum clip boards to record field notes.
- Field personnel avoided use of non-dedicated field equipment, with dedicated sampling equipment used where possible.
- Non-essential personnel were not allowed within 10 m of sampling.
- Ice cubes were used in the coolers, with no gel-filled ice packs used.
- Non-dedicated sampling equipment was decontaminated prior to use by cleaning with a solution of Liquinox™ soap and deionized, laboratory certified PFAS-free water. The equipment was then rinsed with PFAS-free water and allowed to air dry.

The following procedure was followed for hydro-excavation and drilling, in addition to regular soil sampling procedures discussed in Section 3.3:

- A sample of the water used for hydro-excavation was collected prior to use of the water supply and equipment, and analyzed for PFAS to be certain that the supplied water did not contain PFAS.
- Equipment operators were instructed to only touch soil when wearing clean nitrile gloves.
- Prior to approaching the samples, nitrile gloves were donned. Sample bottles were marked with a pencil prior to sampling. Sample bottles were filled with soil and stored in ice filled coolers.
- When drilling, augers were rinsed with Liquinox™ soap and water prior to use.

The following procedures were followed during groundwater sampling for PFAS, in addition to regular groundwater sampling procedures discussed in Section 3.4:

- Field personnel collected depth to bottom of the well measurements at the groundwater monitoring wells only prior to development, and following sampling.
- Samples for PFAS were collected in HDPE bottles and stored in ice-filled coolers.

Additional QA/QC protocols were added to the standard QA/QC procedures outlined in Section 3.9:

- Equipment blanks were collected from soil sampling equipment (laboratory certified PFAS-free water run over shovel) and groundwater water sampling equipment (laboratory certified PFAS-free water run through peristaltic pump) on days PFAS sampling was conducted.
- One trip blank sample (laboratory pre-filled sample) was submitted with the groundwater samples to the laboratory.

Samples were packed securely in ice-filled coolers and delivered directly to sample reception at ALS Environmental Ltd (ALS) in Kamloops, BC on the day of sampling or the following morning. The samples were shipped by ALS in Kamloops to ALS in Burnaby, BC for analysis. Completed Golder Chain-of-Custody forms were submitted with each shipment.

## 3.3 Soil Sampling

### 3.3.1 Surficial Soil Sampling

Soil sampling procedures were consistent with generally accepted industry standards and with the ENV guidance document titled, “Technical Guidance #1, Technical Guidance on Contaminated Sites – Site Characterization and Confirmation Testing” (BC ENV TG #1) (2009a).

An initial surficial soil sampling program was conducted on 25 and 26 May 2020 to assess the potential for surficial soil contamination at the Site. Nine surficial soil samples were collected on-site (SS20-09 through SS20-18; See Figure 2). The surficial soil samples were collected by digging with a hand shovel to a depth of 0.15 m bgs. An additional surficial soil sample was collected on 2 June 2020 (SS20-19) to provide further soil characterization and at the outflow of a downspout on the south side of the home, where it was inferred that figure fighting foam could have flowed off the roof of the home.

The location of surficial soil samples were recorded using a handheld GPS unit. Soil sampling was conducted as described in Section 3.3.3 and soil samples collected for PFAS also followed the sampling procedures as described in Section 3.2.

## 3.3.2 Subsurface Investigations

### *3.3.2.1 Outdoor Daylighting and Drilling*

A drilling program was undertaken between 10 and 12 June 2020 to attempt to achieve lateral and vertical soil delineation and to support remediation planning. Based on proximity to known utilities, eight boreholes were hydro-excavated by Lynx Creek of Kamloops, BC on 10 June 2020. Lynx Creek advanced boreholes by hydro-excavation to depths ranging from 3.0 to 3.4 m bgs. Location BH20-07 was only hydro-excavated to 0.6 m bgs as that was the target depth for the borehole. The following borehole locations were advanced at the location of surficial soil sample exceedances to provide further soil characterization with depth:

- BH20-06 was advanced at the location of SS20-17
- BH20-07 was advanced at the location of SS20-10
- MW20-02 was advanced at the location of SS20-18

Slurry generated from the hydro-excavating was transported by Lynx Creek to the Sumas Environmental Services Inc. (Sumas) facility in Kamloops BC as hazardous waste as described in Section 3.7.

Following completion of hydro-excavation, five borehole locations (MW20-01, MW20-02, MW20-03, MW20-04, and BH20-08) were advanced to a maximum depth of 6.1 m bgs on 11 and 12 June 2020 by On the Mark Locates Ltd. (OTM) of Kelowna, BC. Drilling was undertaken using a truck-mounted solid stem auger drill rig at MW20-01, MW20-02, MW20-03, and BH20-08. Based on access limitations, drilling was undertaken using a portable mini track auger drill rig at MW20-04. Boreholes MW20-02, and MW20-04 were completed as groundwater monitoring wells as described in Section 3.3.2.3. MW20-01(SV20-01) and MW20-03(SV20-03) were installed as nested groundwater and soil vapour monitoring wells as described in Section 3.5.1. When drilling, augers were rinsed with Liquinox™ and water prior to use.

Boreholes BH20-05, BH20-06, BH20-07, and BH20-08 were backfilled in accordance with the BC ENV Groundwater Protection Regulation (BC ENV 2016) with hydrated bentonite chips from the bottom of the borehole to 0.6 m bgs and 10/20 silica sand from 0.6 m bgs to 0.1 m bgs and the ground surface was restored with topsoil that was removed prior to drilling.

Soil cuttings generated from the drilling program were classified as hazardous waste based on results from the preliminary soil sampling which indicated the total petroleum hydrocarbon content in the soil exceeded 3% by weight. The soil cuttings were stored in 205 L drum(s) at the Site and were removed under hazardous waste manifest by Sumas on 13 June 2020 to a licensed off-site facility (see Section 3.7).

Soils were observed in the field for colour, potential staining, soil type, and measured for headspace vapours as described in Section 3.3.3. Borehole logs are presented in Appendix D and borehole locations are presented on Figure 2.

#### 3.3.2.2 Indoor Sub-Slab Drilling

In order to assess the sub-slab soil quality and potential requirements for remedial excavation beneath the footing of the home, a sub-slab intrusive investigation was conducted on 26 June 2020.

As noted in Section 1.3.6, bracing and a temporary supporting wall was constructed by contractors performing work on behalf of the homeowner; the edge of the temporary supporting wall was estimated to be approximately 2 m from the north wall of the basement. One borehole location (BH20-10; Figure 2) was advanced adjacent the temporary supporting wall and approximately 1.5 m from the west wall in the basement of the home at the Site by Rocky Mountain Soil Sampling Inc. (Rocky Mountain) of Vancouver, BC. Prior to characterizing the soils below the slab, the concrete foundation at the borehole location was cored by drilling an anchor bolt to which a coring machine was affixed, then coring a 15 cm diameter round hole through the thickness of the concrete floor. The anchor bolt was removed following coring.

The subsurface soils were characterized using a “pionjar” drill equipped with a split spoon soil sampling device. BH20-10 was advanced to a depth of 2.7 m below the basement floor (approximately 4.4 m below the ground surface outside the home). BH20-10 was backfilled in accordance with the Groundwater Protection Regulation (BC ENV 2016) using a combination of hydrated bentonite chips and sand. A layer of sand was placed above the bentonite to mitigate the risk of bentonite heave. The concrete was then restored to establish a flush surface.

One temporary sub-slab vapor port (SV20-09; Figure 2) was also installed in the basement of the house on 26 June 2020 as described in Section 3.5.1.

Due to the limited volume of soil cuttings generated from the sub-slab investigations, cuttings were stored on-site in a 205-L drum with the groundwater purge water. The drum will be transported off-site to a licensed facility (see Section 3.7) at the conclusion of the investigation, or as part of remediation activities.

#### 3.3.2.3 Monitoring Well Installation

Four monitoring wells were installed during the drilling program including MW20-04 on 11 June 2020 and MW20-01, MW20-02, and MW20-03 on 12 June 2020. The selected depths of the screen interval for the monitoring wells were based on observed depths to water, the soil stratigraphy observed in the borehole, and based on groundwater flow. The screen interval for the four monitoring wells installed was from 4.7 to 6.2 m bgs. The monitoring well screens were installed in a sand layer overlain by silty sand.

The monitoring wells were constructed without the use of glues or solvents. The well risers were constructed of 51 millimetre (mm) diameter, pre-washed, wrapped and threaded Schedule 40, threaded polyvinyl chloride (PVC) pipe. The well screens were constructed of 1.5 metre length sections of No. 10 size slotted PVC pipe. A clean 10/20 size filter sand pack was placed around the screened portion of the wells to approximately 0.3 m above the top of the screen and 0.3 m below the bottom of the screen. A bentonite seal was used to fill the annular space between the sand pack to 0.9 m bgs. The annular space from 0.9 m bgs to ground surface was filled with sand to reduce heaving of the ground surface related to expansion of the bentonite as it is hydrated. The monitoring wells were completed with flush mount casings, set in concrete.

Monitoring well construction details are provided in the borehole logs in Appendix D. Monitoring well locations are shown in Figure 2.

### 3.3.3 Soil Sampling

Soil sampling procedures were consistent with generally accepted industry standards and with the ENV guidance document titled, “Technical Guidance #1, Technical Guidance on Contaminated Sites – Site Characterization and Confirmation Testing” (BC ENV TG #1) (2009a).

Samples were observed in the field for colour, sheen, staining, and soil type. Soil samples were collected for field headspace screening of organic vapour using an RKI Instruments RKI Eagle 2 gas monitor equipped with a photoionization detector (PID), and sensors for carbon dioxide ($CO_2$), carbon monoxide (CO), and methane ($CH_4$). Prior to use at the Site, the RKI Eagle was calibrated with a calibration gas containing 100 parts per million (ppm) isobutylene gas, 30% $CO_2$, 50% CO, and 2.5% $CH_4$ as per operating instructions, and was re-checked for calibration on a regular basis during the investigation program.

Soil samples were selected for analysis based on several factors including: when field observations such as visual signs of contamination or elevated headspace readings were identified, within each unit of soil stratigraphy, and at specific depths to achieve vertical and lateral delineation.

Select soil samples were submitted to ALS for analysis based on PCOCs/COCs identified in Section 1.3.5, including: LEPHs, HEPHs, PAHs, VPHs, BTEX, aluminum, antimony, barium, cadmium, chromium, cobalt, lead, titanium, zinc, PFBS, PFOS, ethylene glycol, 1,2,4-trimethylbenzene, n-nonane, isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, butylbenzenes, MTBE, styrene, 1,2 dibromoethane, and/or 1,2-dichloroethane.

Soil samples collected for the analysis of PFAS were collected in a 250 mL pre-cleaned HDPE jar supplied by the laboratory, ALS Environmental (ALS). Soil samples collected for the analysis of non-volatile parameters were collected in pre-cleaned 125 mL glass jars supplied by ALS. Soil samples collected for the analysis of potential volatile hydrocarbon parameters were collected using methanol field preservation in accordance with the laboratory and BC ENV procedures. Soil samples collected from the Site were appropriately-labelled and stored in coolers filled with ice for transport to the analytical laboratory, accompanied by appropriately-completed, Chain-of-Custody forms.

Any tool(s) used to collect the samples were washed with laboratory-grade detergent (Liquinox™) and rinsed with distilled water. Nitrile gloves were worn when handling sampling equipment and samples and were changed between each sample and sample location.

## 3.4 Groundwater Sampling

### 3.4.1 Groundwater Development

The groundwater monitoring wells were developed on 12 June 2020 following installation and prior to sampling. The purpose of groundwater monitoring well development was to remove drilling-related sediment and silt that had settled in the monitoring well since the time of well installation, and to improve the hydraulic connection of the monitoring well with the surrounding soil.

The water level was measured prior to development using a water level tape and the volume of water within the monitoring well was calculated. During development, water was removed from the monitoring well using dedicated high-density polyethylene (HDPE) tubing and Waterra™ inertial foot valves. While purging the well, *in-situ* water quality parameters (pH, temperature, dissolved oxygen, redox potential, and specific conductivity) were recorded. The wells were purged until the water quality parameters stabilized. The water quality parameters of the drill water were also measured, and it was confirmed that the water quality parameters of the groundwater at the end of development were different than the drill water parameters.

Development groundwater was collected and stored in a 205-L drum on-site prior to disposal at a licensed off-site facility (see Section 3.7).

### 3.4.2 Groundwater Purging and Sampling

Following groundwater monitoring well development, the monitoring wells were allowed seven days for the groundwater to equilibrate prior to sampling. The newly installed monitoring wells were sampled on 19 June 2020. Groundwater sampling procedures were consistent with generally accepted industry standards and with the ENV guidance document titled, “Technical Guidance #8, Technical Guidance on Contaminated Sites – Groundwater Investigation and Characterization” (2017d).

The groundwater level was measured prior to sampling using a water level tape and the volume of water within the monitoring well was calculated. The monitoring wells were purged and sampled using low-flow sampling techniques using a peristaltic pump with dedicated 6 mm diameter HDPE tubing. When sampling with the peristaltic pump, the inlet tubing was placed at the midpoint of the well screen. During purging, a YSI Pro Plus™ multi-meter was used to monitor *in-situ* water quality parameters (pH, temperature, dissolved oxygen, redox potential, and specific conductivity), with the measurements recorded on Groundwater Sampling Sheets. When consecutive parameter measurements were within approximately 10%, purging was terminated and groundwater samples were collected. During purging, care was taken to avoid excessive agitation of the well water so that re-suspension of finer particulate in the water column would be minimized.

Groundwater samples were collected in clean, laboratory-supplied sample bottles. Water samples for dissolved metals were field-filtered using a 0.45 micrometre (µm) in-line filter. At least 1 litre of water was purged through the filter prior to sampling to reduce the risk of cross-contamination if metals were present in the filter. As necessary, samples were preserved in the field using chemicals supplied by the laboratory. Standard Golder protocols were followed during groundwater sampling to minimize the possibility of cross-contaminating the wells and the samples, including decontamination of any non-dedicated equipment used to collect the samples and nitrile gloves worn and changed when handling sampling equipment.

Purge water from the monitoring wells sampled was collected and stored in a 205-L drum on-site prior to disposal at a licensed off-site facility (see Section 3.7).

Groundwater samples were submitted to ALS for analysis based on PCOCs identified in Section 1.3.5 including LEPHw, EPHw10-19, PAHs, VPHw, VHw6-10, BTEX, dissolved metals (aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc), PFBS, PFOS, PFOA, 1,2-dibromoethane and n-nonane.

## 3.5 Soil Vapour Sampling

### 3.5.1 Soil Vapour Probe Installation and Leak Tracer Testing

Two soil vapour probes were installed in the annulus of groundwater monitoring wells at the Site on 12 June 2020 during the drilling program at locations MW20-01 (SV20-01) and MW20-03 (SV20-03). The locations of the soil vapour probes were chosen to assess the soil vapour quality and potential for vapour migration in relation to indoor and outdoor exposure to the home and off-site properties.

The probes were installed by OTM using pre-constructed 25mm PVC pipe with a 0.15 m in length slotted screen. A solid PVC cap was fitted to the top of the PVC pipe following installation and was replaced with a PVC cap with a brass fitting to connect tubing prior to sampling. The soil vapour probe screens were installed at a depths of approximately 3.4 m to 3.55 m bgs (SV20-01) and 3.85 to 4.0 m bgs (SV20-03). Clean 10/20 silica sand was placed in the annulus adjacent to the screen, approximately 0.15 m above and below the screen. Hydrated granular bentonite was placed in the annulus approximately 0.30 m below and above the sand pack and hydrated bentonite chips were placed above the bentonite powder up to 0.3 m bgs. The soil vapour monitoring wells were assembled without the use of glues or solvents that might compromise the quality of soil vapour samples.

One sub-slab soil vapour probe was installed on 26 June 2020 by Rocky Mountain using a hammer drill to drill a hole (approximately 15 mm in width) through the concrete floor in the basement of the house. A temporary vapour port (injection packer) was then installed in the drill hole in order to assess soil vapour quality beneath the house foundation. Following sampling, the temporary port was removed and the hole was filled with concrete to re-establish the grade of the floor.

Soil vapour probe construction logs are presented in Appendix D. The location of the soil vapour probes are shown on Figure 2.

Following completion of the soil vapour probe installation (permanent and temporary locations) and prior to the collection of the soil vapour samples, helium leak tracer tests were undertaken at each of the soil vapour probe locations. Leak tracer testing was undertaken to measure the integrity of the soil vapour probe installation. Helium detected during the collection of field parameters from the probe may be indicative of a faulty installation or a loose connection within the probe components. The leak test was undertaken by placing a rigid plastic shroud over the soil vapour probe, filling the shroud with pure helium (~99.9 %) gas. A Dielectric MGD-2002 helium detector was used to measure the concentration of helium under the shroud and in the screening sample from the Tedlar® bag. The concentrations measured were recorded on Soil Vapour Sampling forms. The helium leak tracer test was successful at each of the three soil vapour probe locations at the Site.

### 3.5.2 Soil Vapour Sample Collection

Soil vapour sampling procedures were consistent with generally accepted industry standards and with the ENV guidance document titled, “Technical Guidance #4, Vapour Investigation and Remediation” (2017c).

Following installation, the outdoor soil vapour probes were allowed six days to equilibrate prior to sampling. The ground conditions at the time of vapour sampling were dry; it had not rained for several days prior to sampling. The indoor temporary sampling location was sampled approximately 15 minutes after installing the sampling port. Prior to sampling, soil vapour probes were purged using an SKC® pump set to a flow rate of approximately 200 to 300 mL/minute. Approximately three probe volumes of air were purged from the outdoor soil vapour probes and 3 litres of soil vapour were purged from the temporary indoor location. During purging, measurements of oxygen, carbon dioxide, hydrogen sulphide ($H_2S$) and methane were recorded using a Landtec GEM 2000 and organic vapours were measured using a Mini-RAE 3000 PID equipped with a 10.6 eV lamp calibrated with 100 ppm isobutylene. Field measurements were recorded on Soil Vapour Sampling forms.

Following the purging process, the soil vapour probes were allowed to equilibrate for a period of approximately 10 minutes. Soil vapour samples were subsequently collected using laboratory-provided 1.4 L Summa canisters with dedicated laboratory-provided 20-minute flow control regulators.

Duplicate soil vapour samples were collected by using a t-splitter connection to fill both Summa canisters concurrently. One flow regulator was connected to the t-splitter to control the flow rate to both the sample and the duplicate.

Soil vapour samples were submitted to ALS for analysis based on PCOCs identified in 1.3.5 including BTEX, styrene, MTBE, naphthalene, VPH, 1,2-dibromoethane, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, isopropylbenzene, 1,3-butadiene, methyl-cyclohexane, n-decane, and n-hexane based on the laboratory fuel and diesel package.

## 3.6 Sample Handling and Laboratory Analyses

Soil and water samples were packed securely in ice-filled coolers and delivered at the end of the field day to the ALS depot in Kamloops or driven by Golder to the ALS depot in Burnaby, BC on the day following sampling. Summa canisters were packed securely in a cooler and delivered to the ALS depot in Kamloops. Completed Golder Chain-of-Custody forms were submitted with each shipment. Once samples were received by ALS in Kamloops, samples were logged, repacked as needed, and shipped via ground to the ALS laboratory in Burnaby, BC. ALS is CALA certified for analytical methods used for this program.

## 3.7 Waste Management and Disposal

Slurry generated from the hydro-excavating was transported by Lynx Creek to the Sumas facility in Kamloops BC. Soil cuttings generated during the outdoor drilling program and purged water generated during groundwater well development was collected and stored in steel, 205-litre (L) drums and transported off-site on 13 June 2020 by Sumas.

Based on the results of the initial surficial soil sampling, the soil was expected to contain greater than 3% of petroleum hydrocarbons by weight and therefore was classified as hazardous waste under the BC HWR. Material was transported to Sumas under a transportation of dangerous goods (TDG) manifest (BCG 00321) where the material was treated as hazardous waste and was stabilized prior to transport to Secure Energy Pembina Class 1 and Class 2 Landfill.

Purge water generated during monitoring well sampling and a limited amount of soil produced during the indoor sub-slab drilling program remain on-site in a 205-L drum. Following completion of the field program, the drum will be picked up and transported to the Sumas Kamloops facility for disposal.

The soil disposal manifests, disposal certificate, a letter documenting hazardous waste disposal methods, and the Secure Energy Pembina operating permit are provided in Appendix E.

## 3.8 Survey

The locations and elevations of investigation points, including the surficial soil sampling locations, boreholes, groundwater monitoring wells, soil vapour monitoring wells, and the temporary soil vapour sub-slab port, were surveyed by Allnorth Consultants Ltd. (Allnorth) of Kamloops, BC on 10 June and 26 June 2020.

## 3.9 Quality Assurance and Quality Control (QA/QC)

To assess and document that the sampling and analytical data were interpretable, meaningful and reproducible, conformance to a Golder QA/QC program was followed.

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

1) Sampling methods were consistent with established Golder protocols, industry standards and provincial/federal requirements.
2) Field notes were recorded during all stages of the investigation.
3) Chain-of-Custody procedures were used for the shipment of samples to the laboratories. Samples included in a shipment were identified on a Golder Chain-of-Custody form, with one copy retained by Golder personnel, after sign-off.
4) The analysis of approximately one duplicate sample for every 10 samples analysed per analytical parameter was targeted for each media.
5) Samples were stored in coolers and chilled with ice (soil and groundwater), during transport and prior to submission to the analytical laboratory and analysed within recommended holding times.

The quality control (QC) measures established for the field program included the following technical aspects:

- Submission of blind field duplicate samples (i.e., paired sample analyses). A blind field duplicate sample is a second sample of a certain media (e.g., soil or water) from the same location that is submitted to the analytical laboratory under a separate label such that the laboratory has no prior knowledge that it is a duplicate.

- 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:

  $$RPD\ (\%) = \frac{(X_1 - X_2)}{average(X_1, X_2)} x100$$

  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 method detection limit (MDL), the laboratory results are considered to be less precise, and the RPD is not calculated. For parameters with concentrations less than five times the MDL, but still above the MDL, the difference factor (DF) between paired analyses results is calculated by:

  $$DF = \frac{(X_1 - X_2)}{MDL}$$

  where $X_1$ is the original sample result and $X_2$ is the paired analysis result.

Golder’s internal data quality objectives (DQOs) for samples were as follows:

- an RPD less than or equal to 35% for soil and less than 50% for PAH parameters in soil
- an RPD less than or equal to 20% for groundwater
- an RPD less than or equal to 50% for soil vapour
- a DF less than or equal to 2.0 (for soil, groundwater, or soil vapour)

# 4.0 RESULTS

The following sections present the field observations recorded and the laboratory analytical results from the samples submitted for analysis during the Stage 2 PSI.

## 4.1 Soil

Soil sampling procedures were consistent with generally accepted industry standards and with the BC ENV guidance document titled, “Technical Guidance #1, Technical Guidance on Contaminated Sites – Site Characterization and Confirmation Testing” (BC ENV TG1; BC ENV 2009). The table below indicates the primary PCOC, secondary PCOC, sample locations and sample density.

**Table 2: SOIL PCOC and SAMPLE COUNT**

| | Analytes - PCOC | Sample Locations | Number of Samples analyzed (including duplicates) |
|---|---|---|---|
| Primary PCOC | LEPHs/HEPHs, PAH, VPHs | SS20-09 to SS20-18, MW20-01 to MW20-04, BH20-05, BH20-06, BH20-08, BH20-10 | 46 (6) |
| | BTEX | | 44 (6) |
| | aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc. | SS20-14, SS20-15, SS20-16, SS20-17, SS20-18 | 7 (2) |
| | cadmium, chromium - only | MW20-01, MW20-02, MW20-3, MW20-04, BH20-05, BH20-08, BH20-10 | 24 (3) |
| | PFBS, PFOS | SS20-10, SS20-18, SS20-19, BH20-07 | 8 (2) |
| | ethylene glycol | MW20-02 | 1 |
| Secondary PCOC | isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, butylbenzenes, 1,2-dichloroethane | MW20-02 | 1 |
| | MTBE, styrene, N-nonane | SS20-09 to SS20-18, MW20-01 to MW20-04, BH20-05, BH20-06, BH20-08, BH20-10 | 44 (6) |
| | 1,2 dibromoethane | SS20-09 to SS20-18, MW20-01 to MW20-04, BH20-05, BH20-08, BH20-10 | 41 (6) |

### 4.1.1 Soil – Field Observations

Soil conditions were observed at surficial soil sample locations SS20-09 to SS20-19 and boreholes MW20-01, MW20-02, MW20-03, MW20-04, BH20-05 to BH20-08, and BH20-10, and are documented in the borehole logs that are provided in Appendix D. The soil stratigraphy at the Site was generally described as silt and sand from ground surface to approximately 3.4 m bgs underlain by fine sand and grading to coarse sand at approximately 5.2 m bgs.

Visual evidence of contamination such as sheen or staining were not observed in the boreholes, however recorded headspace vapour levels were measured to a maximum concentration of 2,002 parts per million (ppm) in borehole BH20-05 at 0.9 to 1.05 m bgs; headspace measurements for samples analysed by the laboratory are presented in Tables 1a and 1b following the report. Headspace vapour level versus depth profiles are provided on the borehole logs in Appendix D.

### 4.1.2 Soil – Analytical Results

Soil analytical results are presented in the Tables 1A through 1D Series and summarized in Figures 2 to 6. Laboratory analytical reports are provided in Appendix F. Individual parameter groups are discussed below and soil analytical results are summarized in Section 4.1.3.

#### *4.1.2.1 Hydrocarbons*

During the initial surficial soil sampling program, 12 samples, including two field duplicates, were analyzed for soil primary PCOCs: LEPHs, HEPHs, PAH, and VPHs. The following exceedances were identified during the initial surficial soil sampling program:

- SS20-17 from 0.05 to 0.15 m bgs: contained concentrations of naphthalene and LEPHs exceeding the CSR $RL_{LD}$ standards.
- SS20-18 from 0.05 to 0.15 m bgs: contained concentrations of LEPHs, HEPHs, VPHs and 2-methylnaphthalene exceeding the CSR $RL_{LD}$ standards.
- Due to high concentrations of test parameters, laboratory detection limits for naphthalene and quinoline in the sample and duplicate collected at SS20-18 from 0.05 to 0.15 m bgs were elevated above the CSR $RL_{LD}$ standards.

During the subsurface investigations, an additional 34 soil samples, including four field duplicates, were analyzed for LEPHs, HEPHs, PAH, and VPHs. The following exceedances were identified during the subsurface investigations:

- MW20-02 from 1.8 to 1.95 m bgs: contained concentrations of LEPHs and VPHs exceeding the CSR $RL_{LD}$ standards. Laboratory detection limits of naphthalene were elevated above CSR $RL_{LD}$ standards due to high concentrations in other analyzed parameters.
- MW20-02 from 3.7 to 4.0 m bgs: contained concentrations of LEPHs and VPHs exceeding the CSR $RL_{LD}$ standards. Laboratory detection limits of naphthalene were elevated above CSR $RL_{LD}$ standards due to high concentrations in other analyzed parameters.
- BH20-05 from 0.05 to 0.15 m bgs: contained concentrations of LEPHs and VPHs exceeding the CSR $RL_{LD}$ standards. Laboratory detection limits of naphthalene were elevated above CSR $RL_{LD}$ standards due to high concentrations in other analyzed parameters.

- BH20-05 from 0.9 to 1.05 m bgs: contained concentrations of LEPHs and VPHs exceeding the CSR $RL_{LD}$ standards. Laboratory detection limits of naphthalene and quinoline were elevated above CSR $RL_{LD}$ standards due to high concentrations in other analyzed parameters.
- BH20-05 from 2.4 to 2.55 m bgs: contained concentrations of LEPHs exceeding the CSR $RL_{LD}$ standard. Laboratory detection limits of naphthalene was elevated above CSR $RL_{LD}$ standards due to high concentrations in other analyzed parameters.

Based on soil analytical results, 2-methylnapthalene, naphthalene, LEPHs, HEPHs, and VPHs were retained as COCs in soil. Based on the elevated concentration of quinoline in select samples, quinoline was retained as a PCOC.

#### 4.1.2.2 Volatile Organic Compounds

During the initial surficial soil sampling program, 12 samples (including two field duplicates) were analyzed for soil primary PCOCs including: BTEX. The surficial soil sample collected at the main aircraft impact site (SS20-18) was also analyzed soil secondary PCOCs including: for styrene, 1,2-dibromoethane, MTBE, n-nonane, butylbenzene, 1.2-dichloroethane, 1,3,5-trimethylbenzene, isopropylbenzene, and 1-propylbenzene. The following exceedances were identified during the initial surficial soil sampling program:

- SS20-17 from 0.05 to 0.15 m bgs: contained a concentration of n-nonane of exceeding the CSR $RL_{LD}$ standard.
- SS20-18 from 0.05 to 0.15 m bgs: contained concentrations of n-nonane, benzene, toluene, ethylbenzene, and xylenes exceeding the CSR $RL_{LD}$ standards. Laboratory detection limit of 1,2-dibromoethane was elevated above CSR $RL_{LD}$ standards due to high concentrations in other analyzed parameters.

Given that the secondary PCOCs butylbenzene, 1,2-dichloroethane, 1,3,5-trimethylbenzene, isopropylbenzene, and 1-propylbenzene did not exceed the CSR $RL_{LD}$ standards, they were not retained as COCs and no further analysis was considered necessary. During the subsurface investigations, an additional 32 soil samples (including four field duplicates) were analyzed for n-nonane, BTEX, styrene, and MTBE and 29 of those samples were also analyzed for 1,2-dibromoethane to determine if it should be retained as a COC. The following exceedances were identified during the subsurface investigations:

- MW20-02 at 1.8 to 1.95 m bgs: contained concentrations of benzene, toluene, ethylbenzene, and xylene exceeding the applicable CSR $RL_{LD}$ standards.
- MW20-02 at 3.7 to 4.0 m bgs: contained concentrations of n-nonane, benzene, toluene, and xylene exceeding the applicable CSR $RL_{LD}$ standards
- BH20-05 at 0.05 to 0.15 m bgs and 0.9 to 1.05 m bgs: contained concentrations of n-nonane, benzene, toluene, ethylbenzene, and xylene exceeding the applicable CSR $RL_{LD}$ standards.

Based on soil analytical results, benzene, toluene, ethylbenzene, and xylenes were retained as COCs in soil. Based on the elevated concentration of 1,2-dibromoethane in select samples, 1,2-dibromoethane was retained as a PCOC.

### 4.1.2.3 Glycols

During the initial surficial soil sampling program, the sample collected at SS20-18 at the crash site of the main body of the aircraft was analyzed for ethylene glycol. The concentrations of analyzed ethylene glycol was less than the applicable CSR $RL_{LD}$ standards and therefore, is not retained as a COC in soil and no further analysis was completed.

### 4.1.2.4 Metals

Seven soil samples (including two field duplicates) were collected in the upper 0.15 m of five surficial sampling locations across the Site and analyzed for the metals PCOCs including aluminum, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc. The following exceedances were identified:

- SS20-18 from 0.05 to 0.15 m bgs: contained concentrations of cadmium and total chromium exceeding the CSR $RL_{LD}$ standard.

Given that cadmium and chromium were the only metals with concentrations above the CSR $RL_{LD}$ standard during the surficial soil sampling program, the following metals were not retained as PCOCs for the subsurface investigation: aluminum, antimony, barium, cobalt, lead, titanium, and zinc. An additional 24 samples (including three field duplicates) at seven locations were collected and analyzed for cadmium and chromium during the subsurface investigations at Site to provide lateral and vertical delineation. The concentration of cadmium and chromium in the 24 samples collected during the subsurface investigations were less than the applicable CSR $RL_{LD}$ standards.

Based on soil analytical results, cadmium and chromium are retained as COCs in soil.

### 4.1.2.5 PFAS

Eight soil samples, including two field duplicates, were collected within the top 0.45 m bgs across the Site and analyzed for PFAS parameters. Concentrations of PFAS parameters were detectable above the laboratory reporting limit but concentrations of PFBS and PFOS were well below the CSR $RL_{LD}$ standards.

Therefore, PFBS and PFOS were not retained as COCs in soil.

### 4.1.2.6 Leachable BTEX

Due to high concentrations of BTEX reported in the samples collected at MW20-02 from 3.7 to 4.0 m bgs and BH20-05 from 0.9 to 1.05 m bgs, the samples were also analyzed for leachable BTEX and compared to the BC HWR Leachate Quality Standards to permit decision making regarding off-site transportation and disposal requirements. The sample collected at BH20-05 exceeded the leachate quality standard for ethylbenzene and soil at this location is therefore considered hazardous waste.

### 4.1.3 Summary of Soil Analytical Results

The following Table 3 presents a summary of the soil samples which contained concentrations of COCs greater than the applicable CSR $RL_{LD}$ and/or BC HWR standards identified at the Site.

**Table 3: Summary of Soil Samples Exceeding CSR and BC HWR Standards**

| Location | Depth (m bgs) | Parameter Exceeding CSR $RL_{LD}$ Standards | Parameter Exceeding BC HWR |
|---|---|---|---|
| SS20-17 | 0.05 to 0.15 | n-nonane, naphthalene, LEPHs | |
| SS20-18[1] | 0.05 to 0.15 | Cadmium, chromium, n-nonane, benzene, toluene, ethylbenzene, xylenes, 2-methylnaphthalene, LEPHs, HEPHs, and VPHs | Sum of LEPH, HEPH, and VPH greater than 3% by weight |
| MW20-02 | 1.8 to 1.95 | Benzene, toluene, ethylbenzene, xylenes, LEPHs, and VPHs | |
| | 3.7 to 4.0 | n-nonane, benzene, toluene, xylenes, LEPHs, and VPHs | |
| BH20-05 | 0.05 to 0.15 | n-nonane, benzene, toluene, ethylbenzene, xylenes, LEPHs, and VPHs | |
| | 0.9 to 1.05 | n-nonane, benzene, toluene, ethylbenzene, xylenes, LEPHs, and VPHs | Leachable ethylbenzene |
| | 2.4 to 2.55 | LEPHs | |

[1] Surficial soil sample SS20-18 was collected at the same location as MW20-02.

### 4.1.4 Soil – Discussion and Recommendation

In order for the Site to meet the CSR numerical $RL_{LD}$ standards, the following parameters in soil should be remediated: LEPHs, HEPHs, 2-methylnaphthalene, naphthalene, VPHs, n-nonane, BTEX, cadmium, and chromium.

Quinoline and 1,2-dibromoethane were retained as soil PCOC based on elevated laboratory detection limits in select soil samples. The elevated detection limits observed for quinoline and 1,2-dibromoethane were in locations where there are COCs present; both parameters were laterally and vertically delineated, and the areas with elevated laboratory detection limits will be incidentally remediated for other COCs.

The soil contamination exceeding the BC CSR $RL_{LD}$ standards has been delineated as follows:

- Soil contamination identified in locations SS20-17, SS20-18, MW20-02 and BH20-05, has been delineated laterally to the north, south east and west (see Figures 2 through 5) and vertically to a depth of 4.3 m bgs (see Figure 6).

## 4.2 Groundwater

### 4.2.1 Groundwater – Field Observations

The depth to the groundwater in the monitoring wells at the time of groundwater sampling ranged from approximately 4.79 to 4.85 metres below top of casing (m btoc) during the 19 June 2020 sampling event. The depth to groundwater and groundwater elevations are presented in the following Table 4. Groundwater in the area of the Site is generally expected to flow south to southwest. The groundwater elevation in the four monitoring wells at the Site was measured between 340.62 to 340.67 metres above sea level (m asl).

**Table 4: Summary of Groundwater Elevation**

| Monitoring Well Location | Depth to Groundwater (m btoc) | Elevation of Top of Casing (m asl) | Ground Elevation (m asl) | Groundwater Elevation (m asl) |
|---|---|---|---|---|
| MW20-01 | 4.84 | 345.47 | 345.71 | 340.63 |
| MW20-02 | 4.79 | 345.41 | 345.59 | 340.62 |
| MW20-03 | 4.85 | 345.48 | 345.68 | 340.63 |
| MW20-04 | 4.84 | 345.54 | 345.78 | 340.67 |

Stabilized field parameters recorded prior to collection of groundwater samples are presented in Table 5 below.

**Table 5: Stabilized Groundwater Field Parameters**

| Monitoring Well Location | Temperature (°C) | pH (pH units) | Specific Conductivity (µS/cm) | Reduction-Oxidation Potential (mV) | Dissolved Oxygen (mg/L) |
|---|---|---|---|---|---|
| MW20-01 | 13.6 | 6.48 | 667 | 110.1 | 4.16 |
| MW20-02 | 13.5 | 6.52 | 586.6 | 117.5 | 4.29 |
| MW20-03 | 13.4 | 6.60 | 630.5 | 111.9 | 4.70 |
| MW20-04 | 12.1 | 6.60 | 562.4 | 116.8 | 4.86 |

### 4.2.2 Groundwater – Analytical Results

Groundwater analytical results are presented in the Tables 2 series and summarized on Figure 7. The laboratory analytical report is provided in Appendix F. Groundwater samples were collected from monitoring wells MW20-01, MW20-02, MW20-03, and MW20-04 on 19 June 2020. The samples were analyzed for PCOCs as described in Section 1.3.5, LEPHw, EPHw10-19, PAHs, VPHw, VHw6-10, BTEX, dissolved metals (aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc), PFBS, PFOS, PFOA, 1,2-dibromoethane and n-nonane.

The laboratory analytical results indicated that the concentrations of PCOCs in the four samples, and one field duplicate sample, were less than the applicable CSR standards.

### 4.2.3 Groundwater – Discussion

No PCOCs have been retained as COCs for groundwater at the Site. Groundwater quality at the Site should be assessed for seasonal variations.

As groundwater contamination was not measured at the Site, a formal assessment of groundwater flow direction and contour mapping was not performed.

## 4.3 Soil Vapour

### 4.3.1 Soil Vapour – Field Observations

Stabilized field parameters recorded prior to collection of soil vapour samples on 18 and 26 June 2020 are presented in the following Table 6.

**Table 6: Stabilized Soil Vapour Field Parameters**

| Soil Vapour Probe Location | Sample Date | PID (ppm) | Methane (%) | Carbon Dioxide (%) | Oxygen (%) |
|---|---|---|---|---|---|
| SV20-01 | 18 June 2020 | 16.7 | 0 | 1.3 | 17.6 |
| SV20-03 | 18 June 2020 | 6.4 | 0 | 1.0 | 17.4 |
| SV20-09 (subslab) | 26 June 2020 | 0.1 | 0.1 | 1.3 | 17.9 |

### 4.3.2 Soil Vapour – Analytical Results

Soil vapour analytical results are presented in Table 3 following the report and summarized on Figure 8. The laboratory analytical reports are provided in Appendix F. Soil Vapour samples were collected from locations SV20-01 and SV20-03 on 18 June 2020 and from SV20-09 (sub-slab sample from the basement of the home) on 26 June 2020. The samples were analyzed for PCOCs as described in Section 1.3.5; BTEX, styrene, MTBE, naphthalene, VPH, 1,2-dibromoethane, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, isopropylbenzene, 1,3-butadiene, methyl-cyclohexane, n-decane, and n-hexane.

As discussed in Section 2.2.3, the analytical results were compared to the CSR RL standards without an attenuation factor to assess indoor air exposure. The analytical results for the outdoor soil vapour monitoring wells, SV20-01 and SV20-03, were also compared to the CSR RL standards with an attenuation factor to assesses outdoor air exposure.

The soil vapour analytical results indicated:

- Outdoor air exposure met the BC CSR RL standards.
- Indoor air exposure did not meet the BC CSR RL standards for VPH, benzene, xylenes, 1,3-butadiene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and/or methyl-cyclohexane in the soil vapour samples collected from SV20-01, SV20-03, and SV20-09.
- The laboratory detection limit for naphthalene in the sample collected from SV20-09 was greater than the CSR RL standard due to high concentration of other analytes.

Soil vapour concentrations were highest at SV20-01, which is located within approximately 2 m of the main crash site where soil concentrations were highest. SV20-03 is located approximately 2.5 m of the main crash site, while SV20-09 was located inside the home approximately 2 m south from the foundation wall. Concentrations of volatile and semi-volatile contaminants were generally highest at SV20-01, and it is inferred there is a gradient of decreasing soil vapour concentration with increasing distance from the areas of highest soil contamination. Consideration was given to off-site properties and off-site receptors with respect to soil vapour exposure and based on application of appropriate attenuation factors for the current and inferred future off-site property uses (a residential home with a basement extending to approximately 1.5 m bgs free of preferential pathways), migration of soil vapour contamination is not occurring from the Site to off-site properties.

### 4.3.3 Soil Vapour – Discussion

The PCOCs VPH, benzene, total xylenes, 1,3-butadiene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and methyl-cyclohexane have been retained as COCs and should be assessed again after soil remediation and for seasonal variations. Naphthalene was retained as a soil vapour PCOC based on elevated laboratory detection limits in SV20-09.

It is expected that the removal of volatile and semi volatile contamination in soil will incidentally address soil vapour contamination identified above.

# 5.0 QUALITY ASSURANCE AND QUALITY CONTROL

## 5.1 Equipment Blanks and Trip Blanks

The results of the laboratory analysis of equipment blanks, trip blanks, and the sample collected of the water used for hydro-excavation are presented in Table 4 following the report. The laboratory analytical results indicated that the concentration of analyzed parameters were less than laboratory detection limits in the three equipment blanks, one trip blank and one sample of water collected from the water source used for hydro-excavation.

## 5.2 Field Duplicate Samples

The RPDs and DFs that were calculated for the Stage 2 PSI soil, groundwater, and soil vapour samples and were evaluated against the project targets for the media type (as described in Section 3.9) are presented in Table 5 (soil), Table 6 (groundwater) and Table 7 (soil vapour) following the report.

### 5.2.1 Soil

- Seven duplicate soil pairs were analyzed during the investigations. DFs values ranged from up to 2.7 which met the project targets with the exception of MW20-02 (3.7 to 4.0 m bgs) with a DF of 2.7.
- RPD values ranged from 1.0% to 197%. A summary of the RPDs that exceeded the project targets is listed below:
    - SS20-18 (0.05 to 0.15 m bgs): 8:2 fluorotelemer sulfonic acid (8:2 FTS); perfluroheptanoic acid (PFHpA); perfluorononanoic acid (PFNA); 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; 1-propylbenzene; benzene; ethylbenzene; isopropylbenzne; m-p-xylenes; o-xylenes; sec-butylbenzene; toluene; VPH; and xylenes
    - SS20-17 (0.05 to 0.15 m bgs): 1-methylnaphthalene, 2-methylnaphthalene, fluorene, LEPHs, and phenanthrene
    - MW20-02 (3.7 to 4.0 m bgs): 1-propylbenzene, benzene, toluene, xylene

These elevated RPDs are inferred to be related to heterogeneity in the soil samples. The elevated RPDs are not expected to affect classification as to whether or not these samples exceeded the BC CSR $RL_{LD}$ standards as the samples which had elevated RPDs contained concentrations of COCs greater than two times the CSR $RL_{LD}$ standards. Samples SS20-17, SS20-18, and MW20-02 from 3.7 to 4.0 m bgs contained concentrations of one or more parameters that exceeded the CSR $RL_{LD}$ standards in only one sample in the duplicate pair. As a conservative measure, the parameter was considered to exceed the CSR $RL_{LD}$ standards.

### 5.2.2 Groundwater

One duplicate groundwater pair was analyzed during the groundwater investigations at MW20-02.

- The RPDs were calculated and ranged up to 18 % which met the project targets.
- DFs were calculated and ranged up to 0.8 which met the project targets.

### 5.2.3 Soil Vapour

One duplicate soil vapour pair was analyzed during the soil vapour investigation at SV20-03. The following DFs and RPDs were calculated:

- The RPDs for all parameters ranged up to 9% which met the project targets.
- DFs were calculated and ranged up to 0.125 which met the project targets.

## 5.3 Laboratory QA/QC Program

The laboratory QA/QC program consisted of one or more of the following analysis: analysis of method blank, laboratory duplicate, matrix spike, laboratory control samples. The laboratory QA/QC results are presented in the laboratory certificates of analysis provided in Appendix F.

### 5.3.1 Soil

The results of the laboratory QA/QC program for the soil samples collected during the Stage 2 PSI indicated:

- The reported concentration of laboratory duplicates were outside ALS DQO due to sample heterogeneity for several samples during the initial surficial soil sampling program and subsurface investigations.
- Laboratory control sample recovery was above the ALS DQO for PFAS for several samples during the initial surficial soil sampling program and subsurface investigations. The lab reported that non-detected sample results were considered reliable and results above the detection limit have been qualified.
- Method blanks exceeded the ALS DQO for PFBA for several samples during the initial surficial soil sampling program and subsurface investigations. The laboratory reported detection limits have been adjusted for samples with measured concentrations below five times the method blank concentration.
- Matrix spike recovery could not be accurately calculated for several PFAS due to high analyte background in sample during the initial surficial soil sampling program and subsurface investigations.
- Relative percent difference could not be calculated in several samples due to the result being less than the detection limit.

### 5.3.2 Groundwater

The results of the laboratory QA/QC program for the surface water and groundwater samples collected during the Stage 2 PSI indicated:

- Method blank exceeds ALS DQO for PFBA for several samples. PFBA was not detected in the groundwater samples analysed during the investigation.
- Detection level raised for acenaphthene, fluorene, naphthalene, quinoline due to chromatographic interference due to co-elution.

### 5.3.3 Soil Vapour

The results of the laboratory QA/QC program for the soil vapour samples collected during the PSI indicated:

- Laboratory Method Blanks were below detection.
- Laboratory control sample duplicates were within internal ALS QAQC standards.
- Detection limit adjusted for required dilution for several VOC parameters (methyl-cyclohexane, n-Hexane).
- Analytical interference of parameter 1,2- Dichloroethane may be present, results may be biased high.
- Detection limit raised because of dilution required due to high concentration of test analytes for VH(C6-C13) and VPH(C6-C13) hydrocarbons and all VOC parameters analyzed except methyl-cyclohexane, n-Hexane, 1,2 Dichloroethane.

## 5.4 Summary of QA/QC Results

Based on the results of the blank samples, field duplicates, and laboratory QA/QC program, the analytical results are considered to be acceptable for the purposes of this investigation.

Blank samples contained concentrations of PFAS less than the detection limit. This indicates that cross-contamination of samples with PFAS from sampling equipment, atmosphere, or sample handling procedures at levels that could impact the interpretation of the results was unlikely to have occurred. Water used during hydro-excavation was also unlikely to have introduced PFAS contamination to the boreholes.

Duplicate soil, groundwater, and soil vapour samples with calculated RPDs and DFs above the Golder internal targets were concluded to be due to sample heterogeneity. Samples that contained concentrations of one or more parameters that exceeded the CSR $RL_{LD}$ standards in only one sample in the duplicate pair were considered to exceed the CSR $RL_{LD}$ standards as a conservative measure. Also, at least one other parameter exceeded the CSR $RL_{LD}$ standards in the samples where only one parameter exceeded in a duplicate pair.

The laboratory QA/QC program indicated that there were qualifiers noted in the laboratory analytical data. The qualifiers generally resulted in adjustment of reported detection limits and the laboratory results were considered acceptable for the purposes of this investigation.

# 6.0 SUMMARY AND RECOMMENDATIONS

## 6.1 Soil

Golder conducted an initial surficial sampling program on 25 and 26 May 2020 that included collecting surficial samples from 12 locations from the Site to assess the presence of contamination relating to the main crash site and front yard of the home where chemicals on board the aircraft impacted and spilled to the ground surface, and areas of the Site where AFFF was deployed as part of the fire fighting response. Hydrocarbon, VOC, and metals contamination was identified in the surficial sample collected at the impact site of the main body of the aircraft (SS20-18). Hydrocarbon contamination was also identified at the location approximately 5.5 m to the east of the impact site of the main body of the aircraft (SS20-17).

Following the initial surficial sampling program, a subsurface investigation was conducted to provide further characterization of the quality of soil, groundwater, and soil vapour and to provide soil delineation for SS20-17 and SS20-18. Between 10 and 12 June 2020, eight boreholes were advanced with two locations completed as monitoring wells and two locations completed as nested groundwater and soil vapour monitoring wells. Hydrocarbon and VOC contamination was identified in the soils at the impact site of the main body of the aircraft from ground surface in SS20-18 to a depth of 4.0 m bgs in MW20-02. A sample analyzed in MW20-02 at a depth of 4.6-4.75 m bgs met the CSR $RL_{LD}$ standards for COCs. Hydrocarbon contamination was also identified in the borehole located approximately 3 m north of the impact site of the main body of the aircraft (BH20-05) from surface to 2.55 m bgs and VOC contamination was identified from surface to 1.05 m bgs at this location.

To assess the possibility for soil contamination following preferential pathways beneath the foundation of the house, an additional indoor subsurface investigation was conducted on 26 June 2020. Soil contamination was not identified in the borehole advanced through the concrete foundation of the house.

Soil contamination identified in locations SS20-17, SS20-18, MW20-02 and BH20-05 has been delineated laterally to the north, south east and west and vertically to a depth of 4.3 m bgs at MW20-02/SS20-18 (inferred to be halfway between the deepest sample that exceeded the standards and the next sample below standards, except to the south where it is assumed the lateral extent of contamination was constrained by the presence of the building foundation and footing). As the contamination source is surficial and concentrations decrease with elevation, BH20-05 is inferred to decrease to concentrations meeting CSR standards at a depth of approximately 3.0 m bgs, based on review of a similar concentration profile in MW20-02. The following parameters were retained as COCs in soil and should be remediated: LEPHs, HEPHs, 2-methylnaphthalene, naphthalene, VPHs, n-nonane, BTEX, cadmium, and chromium. Quinoline and 1,2-dibromoethane were retained as soil PCOC based on elevated laboratory detection limits in select soil samples. The elevated detection limits observed for quinoline and 1,2-dibromoethane were in locations where there are COCs present; both parameters were laterally and vertically delineated, and the areas with elevated laboratory detection limits will be incidentally remediated for other COCs.

## 6.2 Groundwater

The groundwater monitoring wells were sampled on 19 June 2020. The concentration of the PCOCs in the groundwater samples met the applicable BC CSR standards.

No PCOCs were retained as COCs for groundwater at the Site. Groundwater quality at the Site should be assessed for seasonal variations; it is expected that this requirement would be addressed following remediation of soil at the Site.

## 6.3 Soil Vapour

The soil vapour probes installed in the outdoor areas of the Site were sampled on 18 June 2020. To assess soil vapour quality underneath the foundation of the house, a sub-slab soil vapour probe was installed and sampled on 26 June 2020.

The analytical results for the three soil vapour locations sampled indicated that the outdoor air exposure met the BC CSR RL standards. Indoor air exposure did not meet the BC CSR RL standards.

The PCOCs VPH, benzene, total xylenes, 1,3-butadiene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and methyl-cyclohexane were retained as COCs and should be assessed again for indoor air following soil remediation and taking into account for seasonal variations. Naphthalene was retained as a soil vapour PCOC based on elevated laboratory detection limits in SV20-09.

It is expected that removal of contamination in soil will incidentally address soil vapour contamination identified above.

## 6.4 Recommendations

Based on the results of the Stage 2 PSI, soil containing concentrations of LEPHs, HEPHs, VPHs, 2-methylnaphthalene, naphthalene, BTEX, cadmium, chromium, and n-nonane exceeding the CSR $RL_{LD}$ standards are present in the area of SS20-18/MW20-02, SS20-17, and BH20-05. Soil exceeding the BC HWR Leachate Quality Standard for leachable ethylbenzene was also identified in one borehole location at BH20-05, and the total concentration of petroleum hydrocarbons in SS20-18 exceeded 3% by weight, and soil at this location is considered to be hazardous waste.

The following recommendation is provided to address the soil contamination identified at the Site:

- Conduct a remedial excavation to meet numerical standards to remove the contaminated soil in the area of the impacted site associated with the main body of the aircraft and backfill the area with clean soil in order to return the Site back to the landowners.
- If monitoring wells must be decommissioned during remediation, install post-remediation groundwater monitoring wells to assess post-remediation groundwater quality, and undertake a round of post-remediation groundwater monitoring. If the post-remediation groundwater monitoring event indicates that groundwater concentrations of PCOCs are not present above the CSR standards, no further work will be required and the monitoring wells can be decommissioned.
- If soil vapour probes must be decommissioned during remediation, install post-remediation soil vapour monitoring probes to assess post-remediation soil vapour quality, and undertake seasonal soil vapour monitoring in the dry and wet seasons to assess for seasonal variability and stability.

It is recommended that remediation be undertaken to remove contaminated soil and incidentally address soil vapour contamination. A remedial action plan (RAP) has been prepared under separate cover (Golder reference number 20145856-005-R-RevB). The RAP reviews the results from the Stage 2 PSI and provides recommendations in terms of remedial extents, volumes, and remediation activities required to perform remediation.

A summary of the COCs and recommendations is provided below.

**Table 7: Summary of COCs and Recommendations**

| Media | PCOC | COC | Recommendations |
|---|---|---|---|
| Soil PCOC | LEPHs, HEPHs, PAH, VPHs | 2-methylnapthalene, naphthalene, LEPH, HEPH, VPH | Remediation |
| | Benzene, ethylbenzene, toluene, xylene | Benzene, ethylbenzene, toluene, xylene | Remediation |
| | aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc | cadmium, chromium | Remediation |
| | PFBS, PFOS | - | - |
| | ethylene glycol | - | - |
| | isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, butylbenzenes, 1,2-dichloroethane | - | - |
| | MTBE, styrene, N-nonane | n-nonane | Remediation |
| | 1,2 dibromoethane | - | - |
| Groundwater | LEPHw, EPHw10-19, PAHs, VPHw, VHw6-10 | - | Assess post-remediation and for seasonal variations |
| | benzene, toluene, ethylbenzene, xylene | - | |
| | aluminium, antimony, barium, cadmium, chromium, cobalt, lead, titanium, and zinc | - | |
| | PFBS, PFOS, PFOA | - | |
| | 1,2-dibromoethane, n-nonane | - | |
| Soil Vapour | benzene, toluene, ethylbenzene, xylene | Benzene and total xylenes | Assess post-remediation and for seasonal variations |
| | styrene, MTBE, naphthalene, VPH, 1,2-dibromoethane, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and isopropylbenzene,1,3-butadiene, methyl-cyclohexane, n-decane and n-hexane | VPH, 1,3-butadiene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and methyl-cyclohexane | |

*quinoline and 1,2-dibromoethane are retained as soil PCOC based on elevated laboratory detection limits in select soil samples.

** Naphthalene was retained as a soil vapour PCOC based on elevated laboratory detection limits in SV20-09.

## 7.0 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 at 604-296-4200.

**Golder Associates Ltd.**

Alanna Umphrey, AScT
*Environmental Technician*

Alison Verde, PEng
*Environmental Engineer*

COLLEGE OF APPLIED BIOLOGY
Erik
von Krogh
R.P. Bio
2604
CAB

23 July 2020

Erik von Krogh, RPBio, PMP
*Associate, Senior Environmental Scientist*

AU/AV/EvK/syd

https://golderassociates.sharepoint.com/sites/128990/project files/6 deliverables/issued to client_for wp/20145856-011-r-rev0/20145856-011-r-rev0-kamloops stage 2 psi-23jul_20.docx

# 8.0 REFERENCES

BC ENV (BC Ministry of Environment and Climate Change Strategy). 1988. Hazardous Waste Regulation. (OC 268/88, as updated [includes amendments up to BC Reg 243/2016, 1 November 2017]).

BC ENV. 1996a. *Environmental Management Act*. SBC 2003 Chapter 53. Current to 30 January 2019. Victoria BC: http://www.bclaws.ca/civix/document/id/complete/statreg/03053_01#part1

BC ENV. 1996b. Contaminated Sites Regulation. (BC Reg. 375/96, O.C. 1480/96 and M040/2019, as updated [includes amendments up to BC Reg. 11/2019 and 13/2019, updated to 24 January 2019]). Victoria, BC.

BC ENV. 2009. *Technical Guidance 1 on Contaminated Sites: Site Characterization and Confirmation Testing*. Available at [http://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/technical-guidance].

BC ENV. 2016. Groundwater Protection Regulation. (BC Reg. 39/2016, O.C. 113/2016, as updated [includes amendments up to BC Reg 152/2016, 10 June 2016]). Victoria, BC.

BC ENV. 2017a. *Protocol 21 on Contaminated Sites: Water Use Determination*. Version 2.0. Available at [https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/protocols].

BC ENV. 2017b. *Protocol 22 on Contaminated Sites: Application of Vapour Attenuation Factors to Characterize Vapour Contamination*. Version 2.0. Available at [https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/protocols].

BC ENV. 2017c. Technical Guidance #4, Vapour Investigation and Remediation. Version 2.0. Available at [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/technical-guidance/tg04.pdf].

BC ENV. 2017d. Technical Guidance #8, Technical Guidance on Contaminated Sites – Groundwater Investigation and Characterization. Version 2.0. Available at [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/technical-guidance/tg08.pdf].

City of Kamloops. (2020). Kamloops CityMap. Accessed 16 June 2020. Available at [https://www.kamloops.ca/homes-business/community-planning-zoning/zoning-property-information].

Geological Survey of Canada (1963). Map 9-1963 Surficial Geology, Kamloops Lake, British Columbia.

Province of British Columbia. iMapBC. Accessed 16 June 2020. Available at: [https://www2.gov.bc.ca/gov/content/data/geographic-data-services/web-based-mapping/imapbc?keyword=imapbc].

# Table 1A: SOIL ANALYTICAL RESULTS
# METALS, BTEX, VOCs, GLYCOLs
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

| | | | Location | SS20-09 | SS20-10 | SS20-11 | SS20-12 | SS20-13 | SS20-14 | SS20-15 | SS20-16 | SS20-17 | SS20-17 | SS20-18 | SS20-18 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-02 | MW20-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Name | 02905-01 | 02905-03 | 02905-05 | 02905-07 | 02905-09 | 02905-11 | 02906-01 | 02906-03 | 02906-05 | 02906-07 | 02903-03 | 02903-07 | 02926-04 | 02926-05 | 02926-06 | 02926-07 | 02927-03 | 02931-01 | 02927-04 | 02931-02 | 02926-02 | 02928-01 |
| | | | Sample Date | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 25-May-20 | 25-May-20 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 |
| | | | Sample Depth | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.9-1.05 m | 2.4 - 2.55 m | 4.0 - 4.15 m | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m | 1.8-1.95 m | 3.7-4.0 m |
| | | | Laboratory ID | L2451986-1 | L2451986-3 | L2451986-5 | L2451986-7 | L2451986-9 | L2451986-11 | L2451986-13 | L2451986-15 | L2451986-17 | L2451986-19 | L2451374-15 | L2451374-19 | L2460211-4 | L2460211-5 | L2460211-6 | L2460211-7 | L2460211-15 | L2460211-20 | L2460211-16 | L2460211-21 | L2460211-2 | VA20A8304-001 |
| | | | QAQC Related Sample | | | | | | | | | | L2451986-17 | | L2451374-15 | L2460211-5 | L2460211-4 | | | | | | | | VA20A8304-002 |
| | | | QAQC | | | | | | | | | FDA | FD | FDA | FD | FDA | FD | | | | | | | | FDA |
| **Parameter** | CSR RLLD[1] | **CSR MCS** | **Unit** | | | | | | | | | | | | | | | | | | | | | | |
| **Field + Physical** | | | | | | | | | | | | | | | | | | | | | | | | | |
| PID | | | ppm | <0.1 | <0.1 | 9 | <0.1 | 1 | 1 | 3 | 1 | 426 | 426 | 878 | 878 | 4 | 4 | 2 | 2 | 2 | - | <0.1 | - | 944 | 1742 |
| Moisture, Percent | | | % | 13.8 | 17.7 | 14.2 | 9.02 | 29.2 | 21.4 | 15.0 | 15.8 | 18.9 | 20.9 | 24.5 | 24.8 | 17.9 | 17.4 | 20.0 | - | - | - | - | - | 25.3 | 11.3 |
| pH | | | pH units | - | - | - | - | - | 6.96 | 6.61 | 6.71 | 6.11 | 5.86 | 6.81 | 6.93 | 8.05 | 8.14 | 8.06 | 8.16 | 7.72 | 6.79 | 7.38 | 7.39 | - | 7.19 |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 40000 | HH | mg/kg | - | - | - | - | - | 26800 | 20100 | 23400 | 18400 | 21500 | 19500 | 18500 | - | - | - | - | - | - | - | - | - | - |
| Antimony | 20 | EH | mg/kg | - | - | - | - | - | 0.16 | 0.22 | 0.18 | 0.26 | 0.28 | 3.43 | 2.47 | - | - | - | - | - | - | - | - | - | - |
| Barium | 350 | DW | mg/kg | - | - | - | - | - | 193 | 132 | 150 | 128 | 147 | 159 | 149 | - | - | - | - | - | - | - | - | - | - |
| Cadmium | 1-20 | AWF, I, pH | mg/kg | - | - | - | - | - | 0.266 | 0.202 | 0.147 | 0.169 | 0.173 | 32.8 | 26.6 | 0.139 | 0.166 | 0.118 | 0.080 | 0.035 | 0.065 | 0.063 | 0.090 | - | 0.118 |
| Chromium | 60 | AWF, DW | mg/kg | - | - | - | - | - | 58.9 | 45.4 | 50.2 | 45.1 | 49.5 | 75.8 | 79.8 | 45.9 | 43.2 | 39.8 | 41.2 | 20.0 | 27.7 | 15.8 | 16.9 | - | 21.6 |
| Cobalt | 25 | AWF,DW,I | mg/kg | - | - | - | - | - | 15.5 | 13.6 | 15.4 | 14.1 | 15.0 | 14.8 | 14.5 | - | - | - | - | - | - | - | - | - | - |
| Lead | 120 | I | mg/kg | - | - | - | - | - | 14.2 | 12.5 | 12.1 | 13.3 | 13.7 | 11.2 | 11.6 | - | - | - | - | - | - | - | - | - | - |
| Titanium | | | mg/kg | - | - | - | - | - | 1930 | 1530 | 1630 | 1550 | 1650 | 1550 | 1530 | - | - | - | - | - | - | - | - | - | - |
| Zinc | 450 | T | mg/kg | - | - | - | - | - | 119 | 82.8 | 85.3 | 75.4 | 81.7 | 138 | 134 | - | - | - | - | - | - | - | - | - | - |
| **Other Analytes** | | | | | | | | | | | | | | | | | | | | | | | | | |
| n-Butylbenzene | 800 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | < 69 | < 150 | - | - | - | - | - | - | - | - | - | - |
| n-Nonane | 4.5 | HH | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 4.29 | 5.25 | 194 | 557 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | - | 80.5 |
| sec-Butylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | 29.5 | 56.3 | - | - | - | - | - | - | - | - | - | - |
| tert-Butylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | < 2.5 | < 2.5 | - | - | - | - | - | - | - | - | - | - |
| **Glycols** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diethylene Glycol | | | mg/kg | - | - | - | - | - | - | - | - | - | - | <10 | - | - | - | - | - | - | - | - | - | - | - |
| Ethylene Glycol | 10 | DW | mg/kg | - | - | - | - | - | - | - | - | - | - | <10 | - | - | - | - | - | - | - | - | - | - | - |
| 1,2-Propylene Glycol | | | mg/kg | - | - | - | - | - | - | - | - | - | - | <10 | - | - | - | - | - | - | - | - | - | - | - |
| Triethylene Glycol | 30000 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | <10 | - | - | - | - | - | - | - | - | - | - | - |
| **VOCs + BTEX** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1,2-dibromoethane | 3.5 | HH | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.15 | <0.20 | *< 8.5* | *< 13* | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | - | <0.400 |
| 1,2-dichloroethane | 5 | EH | mg/kg | - | - | - | - | - | - | - | - | - | - | < 0.050 | < 0.050 | - | - | - | - | - | - | - | - | - | - |
| Benzene | 0.035 | DW | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0091 | 0.0089 | 1.65 | 3.43 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.399 | 0.345 |
| Toluene | 0.5 | AWF | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 0.126 | 0.135 | 22.1 | 40.8 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 7.03 | 8.12 |
| Ethylbenzene | 15 | DW | mg/kg | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | 0.838 | 0.828 | 57.7 | 97.1 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | 15.2 | 12.8 |
| Xylenes, Total | 6.5 | DW | mg/kg | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | 6.34 | 5.93 | 369 | 603 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | 91.1 | 72.1 |
| o-Xylene | | | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 2.89 | 2.18 | 112 | 187 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 29.9 | 20.2 |
| Styrene | 5 | EH | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | < 2.5 | < 2.5 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Methyl tert-Butyl Ether | 4000 | HH | mg/kg | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | < 0.20 | < 0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.200 |
| m,p-Xylenes | | | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 3.45 | 3.75 | 257 | 416 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 61.3 | 51.9 |
| 1,2,4-Trimethylbenzene | | | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 4.51 | 4.15 | 248 | 473 | - | - | - | - | - | - | - | - | - | - |
| 1,3,5-Trimethylbenzene | 150 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | 70.7 | 137 | - | - | - | - | - | - | - | - | - | - |
| Isopropylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | 29.8 | 50.3 | - | - | - | - | - | - | - | - | - | - |
| 1-Propylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | 75.5 | 128 | - | - | - | - | - | - | - | - | - | - |

**Notes**

[1] Standards shown are from the *Contaminated Sites Regulation* ("CSR"; BC Reg. 375/96, O.C. 1480/96 including amendments up to BC Reg. 13/2019, 24 January 2019

Land Use abbreviations: $RL_{LD}$ (low density residential)

The most conservative standard (MCS) is applied of the following site specific factors: AWF - freshwater aquatic life; DW - drinking water; EH - ecological health; HH - human health; I - intake of contaminated soil; T - toxicity to soil invertebrates and plants

* The depth of samples collected at BH20-10 are expressed as depth below outdoor ground surface

< Indicates parameter was below laboratory equipment detection limit.
- Chemical not analyzed or criteria not defined.
CAS RN = Chemical Abstracts Service Registry Number
FDA = field duplicate available; FD = field duplicate
mg/kg = milligrams/kilogram
pH = standard is pH dependent
QAQC = Quality Assurance/Quality Control

| | |
|---|---|
| 100 | values highlighted yellow exceed the CSR $RL_{LD}$ standard |

Output generated by GalReport.

# Table 1A: SOIL ANALYTICAL RESULTS
## METALS, BTEX, VOCs, GLYCOLs
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| Location | | | | MW20-02 | MW20-02 | MW20-02 | MW20-03 | MW20-03 | MW20-03 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | BH20-05 | BH20-05 | BH20-05 | BH20-06 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-10 | BH20-10 | BH20-10 | BH20-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Name | | | | 02928-02 | 02928-03 | 02928-04 | 02925-04 | 02925-05 | 02926-12 | 02925-08 | 02925-09 | 02927-05 | 02927-06 | 02927-07 | 02925-10 | 02925-11 | 02925-12 | 02925-02 | 02926-08 | 02926-09 | 02926-10 | 02928-05 | 02945-01 | 02945-02 | 02945-03 | 02945-04 |
| Sample Date | | | | 12-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 |
| Sample Depth | | | | 3.7-4.0 m | 4.6-4.75 m | 5.8-5.95 m | 0.05-0.15 m | 0.9-1.05 m | 3.96-4.11 m | 0.9-1.05 m | 2.4-2.55 m | 3.4 - 3.7 m | 4.0 - 4.6 m | 5.5 - 5.65 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 0.9-1.05 m | 0.05-0.15 m | 0.9-1.05 m | 0.9-1.05 m | 4.0-4.3 m | 2.3-2.45 m* | 3.2-3.35 m* | 4.25-4.4 m* | 4.25-4.4 m* |
| Laboratory ID | | | | VA20A8304-002 | VA20A8304-003 | VA20A8304-004 | L2459618-4 | L2459618-5 | L2460211-12 | L2459618-8 | L2459618-9 | L2460211-17 | L2460211-18 | L2460211-19 | L2459618-10 | L2459618-11 | L2459618-12 | L2459618-2 | L2460211-8 | L2460211-9 | L2460211-10 | VA20A8304-005 | L2466948-1 | L2466948-2 | L2466948-3 | L2466948-4 |
| QAQC Related Sample | | | | VA20A8304-001 | | | | | | | | | | | | | | | | L2460211-10 | L2460211-9 | | | | L2466948-4 | L2466948-3 |
| QAQC | | | | FD | | | | | | | | | | | | | | | | FDA | FD | | | | FDA | FD |
| **Parameter** | CSR RLLD[1] | **CSR MCS** | **Unit** | | | | | | | | | | | | | | | | | | | | | | | |
| **Field + Physical** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PID | | | ppm | 1742 | 38 | 22 | 122 | 14 | 442 | 86 | 4 | 20 | 98 | 2 | 1122 | 2002 | 104 | 8 | 6 | 4 | 4 | 2 | <0.1 | <0.1 | <0.1 | <0.1 |
| Moisture, Percent | | | % | 14.3 | 13.0 | 11.7 | 15.5 | 16.3 | 9.55 | 15.9 | 18.7 | - | - | - | 25.2 | 21.8 | 21.8 | 23.5 | 21.0 | 13.8 | 12.0 | 4.80 | 4.66 | 2.01 | 2.91 | 2.36 |
| pH | | | pH units | 7.29 | 7.39 | - | 6.51 | 6.93 | - | - | - | 7.70 | 7.56 | 6.93 | 7.13 | 7.20 | 7.50 | - | - | - | - | 8.31 | 7.35 | 7.55 | 7.37 | 7.43 |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 40000 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Antimony | 20 | EH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Barium | 350 | DW | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Cadmium | 1-20 | AWF, I, pH | mg/kg | 0.097 | 0.039 | - | 0.203 | 0.116 | - | - | - | 0.046 | 0.034 | 0.142 | 0.227 | 0.121 | 0.218 | - | - | - | - | 0.032 | 0.042 | 0.048 | 0.037 | 0.035 |
| Chromium | 60 | AWF, DW | mg/kg | 23.0 | 20.2 | - | 45.6 | 52.6 | - | - | - | 17.7 | 18.9 | 26.0 | 58.2 | 53.8 | 45.0 | - | - | - | - | 11.3 | 17.5 | 18.6 | 19.7 | 16.3 |
| Cobalt | 25 | AWF,DW,I | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Lead | 120 | I | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Titanium | | | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Zinc | 450 | T | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Other Analytes** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| n-Butylbenzene | 800 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| n-Nonane | 4.5 | HH | mg/kg | 2.30 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 233 | 304 | 1.25 | <0.050 | <0.060 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| sec-Butylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| tert-Butylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Glycols** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diethylene Glycol | | | mg/kg | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ethylene Glycol | 10 | DW | mg/kg | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1,2-Propylene Glycol | | | mg/kg | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Triethylene Glycol | 30000 | HH | mg/kg | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **VOCs + BTEX** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1,2-dibromoethane | 3.5 | HH | mg/kg | <0.050 | <0.050 | - | <0.050 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.60 | <0.90 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| 1,2-dichloroethane | 5 | EH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Benzene | 0.035 | DW | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0074 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.818 | 1.93 | 0.0115 | - | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Toluene | 0.5 | AWF | mg/kg | 0.053 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 15.1 | 28.3 | 0.145 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Ethylbenzene | 15 | DW | mg/kg | 0.114 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | 25.5 | 49.5 | 0.270 | - | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Xylenes, Total | 6.5 | DW | mg/kg | 0.884 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | 154 | 298 | 1.78 | - | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |
| o-Xylene | | | mg/kg | 0.330 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 50.9 | 97.3 | 0.615 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Styrene | 5 | EH | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 0.057 | 0.173 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Methyl tert-Butyl Ether | 4000 | HH | mg/kg | <0.200 | <0.200 | <0.050 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | - | <0.20 | <0.20 | <0.20 | <0.200 | <0.20 | <0.20 | <0.20 | <0.20 |
| m,p-Xylenes | | | mg/kg | 0.554 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 103 | 200 | 1.16 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| 1,2,4-Trimethylbenzene | | | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1,3,5-Trimethylbenzene | 150 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Isopropylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1-Propylbenzene | 1500 | HH | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Notes**

[1] Standards shown are from the *Contaminated Sites Regulation* ("CSR"; BC Reg. 375/96, O.C. 1480/96 including amendments up to BC Reg. 13/2019, 24 January 2019

Land Use abbreviations: $RL_{LD}$ (low density residential)

The most conservative standard (MCS) is applied of the following site specific factors: AWF - freshwater aquatic life; DW - drinking water; EH - ecological health; HH - human health; I - intake of contaminated soil; T - toxicity to soil invertebrates and plants

* The depth of samples collected at BH20-10 are expressed as depth below outdoor ground surface

< Indicates parameter was below laboratory equipment detection limit.
- Chemical not analyzed or criteria not defined.
CAS RN = Chemical Abstracts Service Registry Number
FDA = field duplicate available; FD = field duplicate
mg/kg = milligrams/kilogram
pH = standard is pH dependent
QAQC = Quality Assurance/Quality Control

| | |
|---|---|
| 100 | values highlighted yellow exceed the CSR $RL_{LD}$ standard |

Output generated by GalReport.

# Table 1B: SOIL ANALYTICAL RESULTS
# HYDROCARBONS
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

| | | | Location | SS20-09 | SS20-10 | SS20-11 | SS20-12 | SS20-13 | SS20-14 | SS20-15 | SS20-16 | SS20-17 | SS20-17 | SS20-18 | SS20-18 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-02 | MW20-02 | MW20-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Name | 02905-01 | 02905-03 | 02905-05 | 02905-07 | 02905-09 | 02905-11 | 02906-01 | 02906-03 | 02906-05 | 02906-07 | 02903-03 | 02903-07 | 02926-04 | 02926-05 | 02926-06 | 02926-07 | 02927-03 | 02931-01 | 02927-04 | 02931-02 | 02926-02 | 02928-01 | 02928-02 |
| | | | Sample Date | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 26-May-20 | 25-May-20 | 25-May-20 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 |
| | | | Sample Depth | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.9-1.05 m | 2.4 - 2.55 m | 4.0 - 4.15 m | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m | 1.8-1.95 m | 3.7-4.0 m | 3.7-4.0 m |
| | | | Laboratory ID | L2451986-1 | L2451986-3 | L2451986-5 | L2451986-7 | L2451986-9 | L2451986-11 | L2451986-13 | L2451986-15 | L2451986-17 | L2451986-19 | L2451374-15 | L2451374-19 | L2460211-4 | L2460211-5 | L2460211-6 | L2460211-7 | L2460211-15 | L2460211-20 | L2460211-16 | L2460211-21 | L2460211-2 | VA20A8304-001 | VA20A8304-002 |
| | | | QAQC Related Sample | | | | | | | | | | L2451986-17 | | L2451374-15 | L2460211-5 | L2460211-4 | | | | | | | | VA20A8304-002 | VA20A8304-001 |
| | | | QAQC | | | | | | | | | FDA | FD | FDA | FD | FDA | FD | | | | | | | | FDA | FD |
| Parameter | CSR RLLD[1] | CSR MCS | Unit | | | | | | | | | | | | | | | | | | | | | | | |
| **Field + Physical** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PID | | | ppm | <0.1 | <0.1 | 9 | <0.1 | 1 | 1 | 3 | 1 | 426 | 426 | 878 | 878 | 4 | 4 | 2 | 2 | 2 | - | <0.1 | - | 944 | 1742 | 1742 |
| pH | | | pH units | - | - | - | - | - | 6.96 | 6.61 | 6.71 | 6.11 | 5.86 | 6.81 | 6.93 | 8.05 | 8.14 | 8.06 | 8.16 | 7.72 | 6.79 | 7.38 | 7.39 | - | 7.19 | 7.29 |
| **Hydrocarbons** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 950 | HH | mg/kg | <0.0050 | <0.0050 | <0.040 | <0.0050 | <0.0050 | <0.0050 | <0.040 | <0.0050 | <0.30 | <0.20 | < 4.0 | < 3.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.70 | <0.200 | <0.200 |
| Acenaphthylene | | | mg/kg | <0.0050 | <0.0050 | <0.010 | <0.0050 | <0.0050 | <0.0050 | <0.010 | <0.0050 | <0.20 | <0.070 | < 2.0 | < 1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.16 | <0.0300 | <0.0400 |
| Anthracene | 2.5 | T | mg/kg | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.020 | <0.0080 | < 0.20 | < 0.20 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.040 | <0.0100 | <0.0100 |
| Benz(a)anthracene | 1 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.020 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | < 0.20 | < 0.20 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(a)pyrene | 5 | I | mg/kg | <0.020 | <0.010 | <0.010 | <0.010 | 0.017 | <0.010 | <0.020 | <0.010 | <0.020 | 0.012 | 0.024 | 0.02 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(b,j) fluoranthene | 1 | EH | mg/kg | 0.016 | <0.010 | 0.014 | <0.010 | 0.031 | <0.010 | 0.013 | <0.010 | 0.015 | 0.016 | < 0.020 | < 0.030 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo[b,j,k]fluoranthene | | | mg/kg | 0.016 | <0.015 | <0.015 | <0.015 | 0.031 | <0.015 | <0.015 | <0.015 | <0.015 | 0.016 | < 0.022 | < 0.032 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Benzo(g,h,i)perylene | | | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | 0.021 | <0.010 | <0.010 | <0.010 | 0.011 | 0.010 | 0.017 | 0.016 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(k)fluoranthene | 1 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | < 0.010 | < 0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Chrysene | 200 | HH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.030 | <0.010 | 0.010 | <0.010 | <0.020 | 0.012 | < 0.020 | < 0.020 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Dibenz(a,h)anthracene | 1 | EH | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | < 0.0050 | < 0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Fluoranthene | 50 | T | mg/kg | 0.019 | <0.010 | 0.016 | <0.010 | 0.031 | 0.011 | 0.016 | <0.010 | 0.026 | 0.024 | 0.113 | 0.087 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Fluorene | 600 | HH | mg/kg | <0.010 | <0.010 | 0.044 | <0.010 | <0.010 | <0.010 | 0.067 | <0.010 | 0.261 | 0.167 | 4.52 | 4.06 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 0.812 | <0.300 | 0.240 |
| Indeno(1,2,3-c,d)pyrene | 1 | EH | mg/kg | 0.010 | <0.010 | <0.010 | <0.010 | 0.018 | <0.010 | <0.010 | <0.010 | 0.010 | <0.010 | 0.014 | 0.013 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 1-Methylnaphthalene | 250 | HH | mg/kg | 0.024 | <0.010 | 0.314 | <0.010 | <0.010 | <0.010 | 0.206 | <0.010 | 3.17 | 2.07 | 49.3 | 42.3 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 8.21 | 2.24 | 2.50 |
| 2-methylnaphthalene | 60 | HH | mg/kg | 0.029 | <0.010 | 0.340 | <0.010 | <0.010 | <0.010 | 0.221 | <0.010 | 4.52 | 2.95 | 68.9 | 59.2 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 11.7 | 3.22 | 3.57 |
| Naphthalene | 0.6 | T | mg/kg | <0.010 | <0.010 | <0.080 | <0.010 | <0.010 | <0.010 | <0.040 | <0.010 | 2.30 | 1.61 | *< 41* | *< 35* | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | *<6.5* | *<2.00* | *<2.00* |
| Phenanthrene | 5 | EH | mg/kg | <0.010 | <0.010 | 0.026 | <0.010 | 0.011 | <0.010 | 0.045 | <0.010 | 0.144 | 0.096 | < 2.0 | < 2.0 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.40 | <0.090 | <0.100 |
| Pyrene | 10 | EH | mg/kg | 0.016 | <0.010 | 0.014 | <0.010 | 0.025 | <0.010 | 0.016 | <0.010 | 0.033 | 0.028 | 0.231 | 0.221 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 0.054 | 0.014 | 0.018 |
| Quinoline | 2.5 | HH | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.40 | <0.30 | *< 4.0* | *< 4.0* | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <1.5 | <0.300 | <0.400 |
| Benzo(a)pyrene Total Potency Equivalence (TPE) | | | mg/kg | <0.020 | <0.020 | <0.020 | <0.020 | 0.026 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | 0.04 | 0.036 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.010 | <0.010 |
| Index of Additive Cancer Risk (IACR) | | | none | 0.19 | <0.15 | 0.16 | <0.15 | 0.33 | <0.15 | 0.17 | <0.15 | 0.19 | 0.20 | 0.49 | 0.51 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.11 | <0.11 |
| EPH (C10-C19) | | | mg/kg | <200 | <200 | 300 | <200 | <200 | <200 | 310 | <200 | 2150 | 1490 | 46000 | 41000 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 8920 | 2300 | 2780 |
| LEPH (C10-C19) Less PAHs | 1000 | EH/HH | mg/kg | <200 | <200 | 300 | <200 | <200 | <200 | 310 | <200 | 2150 | 1490 | 46000 | 41000 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 8920 | 2300 | 2780 |
| EPH (C19-C32) | | | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 1760 | 1450 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 240 | <200 | <200 |
| HEPH (C19-C32) Less PAHs | 1000 | EH/HH | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 1760 | 1450 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 240 | <200 | <200 |
| VPH (C6-C10) | 200 | EH/HH | mg/kg | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 4630 | 8200 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 860 | 1510 | 36 |
| VHC (C6-C10) | | | mg/kg | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 5080 | 8900 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 980 | 1600 | 37 |
| Petroleum Hydrocarbons - F1 (C6-C10) | | | mg/kg | - | - | - | - | - | - | - | - | 86 | 90 | 5470 | 9580 | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum Hydrocarbons - F2 (C10-C16) | | | mg/kg | - | - | - | - | - | - | - | - | 653 | 82 | 38800 | 36100 | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum Hydrocarbons - F3 (C16-C34) | | | mg/kg | - | - | - | - | - | - | - | - | 77 | <50 | 5360 | 4900 | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum Hydrocarbons - F4 (C34-C50) | | | mg/kg | - | - | - | - | - | - | - | - | <50 | <50 | < 250 | < 250 | - | - | - | - | - | - | - | - | - | - | - |

**Notes**

[1] Standards shown are from the *Contaminated Sites Regulation* ("CSR"; BC Reg. 375/96, O.C. 1480/96 including amendments up to BC Reg. 13/2019, 24 January 2019

Land Use abbreviations: $RL_{LD}$ (low density residential)

The most conservative standard (MCS) is applied of the following site specific factors: AWF - freshwater aquatic life; DW - drinking water; EH - ecological health; HH - human health; I - intake of contaminated soil; T - toxicity to soil invertebrates and plants

* The depth of samples collected at BH20-10 are expressed as depth below outdoor ground surface

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

CAS RN = Chemical Abstracts Service Registry Number

FDA = field duplicate available; FD = field duplicate

mg/kg = milligram/kilogram

QAQC = Quality Assurance/Quality Control

| | |
|---|---|
| 100 | values highlighted yellow exceed the CSR $RL_{LD}$ standard |

Output generated by GalReport.

# Table 1B: SOIL ANALYTICAL RESULTS
## HYDROCARBONS
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| | | | **Location** | MW20-02 | MW20-02 | MW20-03 | MW20-03 | MW20-03 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | BH20-05 | BH20-05 | BH20-05 | BH20-06 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-10 | BH20-10 | BH20-10 | BH20-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | 02928-03 | 02928-04 | 02925-04 | 02925-05 | 02926-12 | 02925-08 | 02925-09 | 02927-05 | 02927-06 | 02927-07 | 02925-10 | 02925-11 | 02925-12 | 02925-02 | 02926-08 | 02926-09 | 02926-10 | 02926-11 | 02928-05 | 02945-01 | 02945-02 | 02945-03 | 02945-04 |
| | | | **Sample Date** | 12-Jun-2020 | 12-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 |
| | | | **Sample Depth** | 4.6-4.75 m | 5.8-5.95 m | 0.05-0.15 m | 0.9-1.05 m | 3.96-4.11 m | 0.9-1.05 m | 2.4-2.55 m | 3.4 - 3.7 m | 4.0 - 4.6 m | 5.5 - 5.65 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 0.9-1.05 m | 0.05-0.15 m | 0.9-1.05 m | 0.9-1.05 m | 2.4-2.55 m | 4.0-4.3 m | 2.3-2.45 m* | 3.2-3.35 m* | 4.25-4.4 m* | 4.25-4.4 m* |
| | | | **Laboratory ID** | VA20A8304-003 | VA20A8304-004 | L2459618-4 | L2459618-5 | L2460211-12 | L2459618-8 | L2459618-9 | L2460211-17 | L2460211-18 | L2460211-19 | L2459618-10 | L2459618-11 | L2459618-12 | L2459618-2 | L2460211-8 | L2460211-9 | L2460211-10 | L2460211-11 | VA20A8304-005 | L2466948-1 | L2466948-2 | L2466948-3 | L2466948-4 |
| | | | **QAQC Related Sample** | | | | | | | | | | | | | | | | L2460211-10 | L2460211-9 | | | | | L2466948-4 | L2466948-3 |
| | | | **QAQC** | | | | | | | | | | | | | | | | FDA | FD | | | | | FDA | FD |
| **Parameter** | CSR RLLD[1] | **CSR MCS** | **Unit** | | | | | | | | | | | | | | | | | | | | | | | |
| **Field + Physical** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PID | | | ppm | 38 | 22 | 122 | 14 | 442 | 86 | 4 | 20 | 98 | 2 | 1122 | 2002 | 104 | 8 | 6 | 4 | 4 | 4 | 2 | <0.1 | <0.1 | <0.1 | <0.1 |
| pH | | | pH units | 7.39 | - | 6.51 | 6.93 | - | - | - | 7.70 | 7.56 | 6.93 | 7.13 | 7.20 | 7.50 | - | - | - | - | - | 8.31 | 7.35 | 7.55 | 7.37 | 7.43 |
| **Hydrocarbons** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 950 | HH | mg/kg | <0.0060 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.60 | <2.0 | <0.20 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Acenaphthylene | | | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.20 | <0.40 | <0.030 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Anthracene | 2.5 | T | mg/kg | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.030 | <0.090 | <0.0070 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| Benz(a)anthracene | 1 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.040 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(a)pyrene | 5 | I | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(b,j) fluoranthene | 1 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo[b,j,k]fluoranthene | | | mg/kg | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Benzo(g,h,i)perylene | | | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(k)fluoranthene | 1 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Chrysene | 200 | HH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Dibenz(a,h)anthracene | 1 | EH | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Fluoranthene | 50 | T | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.020 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Fluorene | 600 | HH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 1.00 | 2.65 | 0.169 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Indeno(1,2,3-c,d)pyrene | 1 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 1-Methylnaphthalene | 250 | HH | mg/kg | 0.050 | 0.014 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 9.46 | 23.9 | 1.66 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 2-methylnaphthalene | 60 | HH | mg/kg | 0.064 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 13.6 | 34.3 | 2.44 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Naphthalene | 0.6 | T | mg/kg | <0.020 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | *<9.0* | *<30* | *<2.0* | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Phenanthrene | 5 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 0.328 | 0.862 | 0.061 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Pyrene | 10 | EH | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 0.023 | 0.044 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Quinoline | 2.5 | HH | mg/kg | <0.010 | <0.010 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <2.0 | *<4.0* | <0.30 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.010 | <0.050 | <0.050 | <0.050 | <0.050 |
| Benzo(a)pyrene Total Potency Equivalence (TPE) | | | mg/kg | <0.010 | <0.010 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.010 | <0.020 | <0.020 | <0.020 | <0.020 |
| Index of Additive Cancer Risk (IACR) | | | none | <0.11 | <0.11 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 | <0.11 | <0.15 | <0.15 | <0.15 | <0.15 |
| EPH (C10-C19) | | | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 11300 | 24000 | 1510 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| LEPH (C10-C19) Less PAHs | 1000 | EH/HH | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 11300 | 24000 | 1510 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| EPH (C19-C32) | | | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 270 | 310 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| HEPH (C19-C32) Less PAHs | 1000 | EH/HH | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 270 | 310 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| VPH (C6-C10) | 200 | EH/HH | mg/kg | <10 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 2240 | 3530 | <100 | - | <100 | <100 | <100 | - | <10 | <100 | <100 | <100 | <100 |
| VHC (C6-C10) | | | mg/kg | <10 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 2440 | 3910 | <100 | - | <100 | <100 | <100 | - | <10 | <100 | <100 | <100 | <100 |
| Petroleum Hydrocarbons - F1 (C6-C10) | | | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum Hydrocarbons - F2 (C10-C16) | | | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum Hydrocarbons - F3 (C16-C34) | | | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum Hydrocarbons - F4 (C34-C50) | | | mg/kg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Notes**

[1] Standards shown are from the *Contaminated Sites Regulation* ("CSR"; BC Reg. 375/96, O.C. 1480/96 including amendments up to BC Reg. 13/2019, 24 January 2019

Land Use abbreviations: $RL_{LD}$ (low density residential)

The most conservative standard (MCS) is applied of the following site specific factors: AWF - freshwater aquatic life; DW - drinking water; EH - ecological health; HH - human health; I - intake of contaminated soil; T - toxicity to soil invertebrates and plants

* The depth of samples collected at BH20-10 are expressed as depth below outdoor ground surface

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

CAS RN = Chemical Abstracts Service Registry Number

FDA = field duplicate available; FD = field duplicate

mg/kg = milligram/kilogram

QAQC = Quality Assurance/Quality Control

| | |
|---|---|
| 100 | values highlighted yellow exceed the CSR $RL_{LD}$ standard |

Output generated by GalReport.

# Table 1C: SOIL ANALYTICAL RESULTS
# PER- AND POLYFLUORINATED ALKYL SUBSTANCES
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

| | | | **Location** | SS20-10 | SS20-18 | SS20-18 | SS20-19 | BH20-07 | BH20-07 | BH20-07 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | 02905-03 | 02903-03 | 02903-07 | 02910-01 | 02929-01 | 02929-02 | 02929-03 |
| | | | **Sample Date** | 26-May-20 | 25-May-20 | 25-May-20 | 2-Jun-20 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 |
| | | | **Sample Depth** | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.15-0.30 | 0.15-0.30 | 0.30-0.45 |
| | | | **Laboratory ID** | L2451986-3 | L2451374-15 | L2451374-19 | L2455146-01 | L2459618-13 | L2459618-14 | L2459618-15 |
| | | | **QAQC Related Sample** | | | L2451374-15 | | | L2459618-13 | |
| | | | **QAQC** | | FDA | FD | | FDA | FD | |
| **Parameter** | CSR RLLD[1] | **CSR MCS** | **Unit** | | | | | | | |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | mg/kg | 0.00626 | 1.04 | 1.57 | 0.00056 | <0.00010 | <0.00010 | <0.00010 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | mg/kg | 0.117 | 8.70 | 10.7 | 0.00094 | <0.00015 | 0.00035 | <0.00010 |
| Perfluorobutane sulfonate (PFBS) | 300 | HH | mg/kg | <0.00010 | 0.00012 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Perfluorohexane sulfonate (PFHXS) | | | mg/kg | <0.00010 | 0.00028 | 0.00038 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| perfluorooctane sulfonate (PFOS) | **0.35** | DW | mg/kg | <0.00050 | 0.00086 | 0.00125 | 0.00168 | <0.00035 | <0.00035 | <0.00035 |
| Perfluorobutanoic acid (PFBA) | | | mg/kg | <0.13 | <0.24 | <0.13 | <0.30 | <0.30 | <0.30 | <0.30 |
| Perfluoroheptanoic Acid (PFHpA) | | | mg/kg | 0.00020 | 0.00201 | 0.00291 | 0.00040 | <0.00010 | <0.00010 | <0.00010 |
| Perfluorohexanoic Acid (PFHxA) | | | mg/kg | 0.0228 | 0.183 | 0.154 | 0.00150 | 0.00017 | 0.00016 | <0.00010 |
| Perfluorononanoic Acid (PFNA) | | | mg/kg | <0.00010 | 0.00070 | 0.00108 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Perfluorooctanoic acid (PFOA) | | | mg/kg | 0.00055 | 0.0154 | 0.0205 | 0.00028 | <0.00010 | <0.00010 | <0.00010 |
| Perfluoropentanoic Acid (PFPeA) | | | mg/kg | 0.00137 | 0.0103 | 0.0077 | 0.00108 | 0.00017 | 0.00011 | <0.00010 |

[1] Standards shown are from the *Contaminated Sites Regulation* ("CSR"; BC Reg. 375/96, O.C. 1480/96 including amendments up to BC Reg. 13/2019, 24 January 2019

Land Use abbreviations: $RL_{LD}$ (low density residential)

The most conservative standard (MCS) is applied of the following site specific factors: AWF - freshwater aquatic life; DW - drinking water; EH - ecological health; HH - human health; I - intake of contaminated soil;
T - toxicity to soil invertebrates and plants

FDA = field duplicate available; FD = field duplicate

mg/kg = milligram/kilogram

QAQC = Quality Assurance/Quality Control

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

Output generated by GalReport.

| | |
|---|---|
| 100 | values highlighted yellow exceed the CSR RLLD standard |

# Table 1D: SOIL ANALYTICAL RESULTS
## BTEX TCLP
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| | | **Location** | MW20-02 | BH20-05 |
|---|---|---|---|---|
| | | **Sample Name** | 02928-01 | 02925-11 |
| | | **Sample Date** | 12-Jun-2020 | 10-Jun-2020 |
| | | **Sample Depth (mbgs)** | 3.7-4.0 | 0.9-1.05 |
| | | **Laboratory Number** | VA20A8304-001 | L2459618-11 |
| **Parameter** | Haz Waste[1] | **Unit** | | |
| benzene, TCLP | 0.5 | mg/L | <0.0050 | 0.0242 |
| ethylbenzene, TCLP | 0.24 | mg/L | 0.0816 | 0.305 |
| toluene, TCLP | 2.4 | mg/L | 0.0428 | 0.406 |
| xylene, m+p-, TCLP | | mg/L | 0.363 | 1.36 |
| xylene, o-, TCLP | | mg/L | 0.216 | 0.742 |
| xylenes, total, TCLP | 30 | mg/L | 0.580 | 2.10 |

[1] Standards shown are from the BC Hazardous Waste Regulation BC Reg 63/88 O.C. 268/88 includes amendments up to BC Reg 243/2016, 1 November 2017.

mbgs = metres below ground surface

mg/L = milligrams per litre

TCLP = toxicity characteristic leaching procedure

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

# Table 2A: GROUNDWATER ANALYTICAL RESULTS
# DISSOLVED METALS
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

| **Location** | | | MW20-01 | MW20-02 | MW20-02 | MW20-03 | MW20-04 |
|---|---|---|---|---|---|---|---|
| **Sample Name** | CSR AW-F(1) | CSR DW(1) | 02934-03 | 02934-04 | 02934-05 | 02934-02 | 02934-01 |
| **Sample Date** | | | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 |
| **Laboratory ID** | | | VA20A8760-003 | VA20A8760-004 | VA20A8760-005 | VA20A8760-002 | VA20A8760-001 |
| **QAQC** | | | | FDA | FD | | |
| **Parameter** | | | | | | | |
| **Field + Physical** | | | | | | | |
| Dissolved Oxygen, field measured (mg/L) | | | 4.16 | 4.29 | 4.29 | 4.70 | 5.22 |
| Conductivity, field measured (µS/cm) | | | 667 | 586.6 | 586.6 | 630.5 | 562.4 |
| Oxidation Reduction Potential, field measured (mV) | | | 110.1 | 117.5 | 117.5 | 111.9 | 116.8 |
| pH, field measured (unitless) | | | 6.48 | 6.52 | 6.52 | 6.60 | 6.60 |
| Temperature, field measured (°C) | | | 13.6 | 13.5 | 13.5 | 13.4 | 12.1 |
| **Metals, Dissolved** | | | | | | | |
| Aluminum | | 9500 | 3.4 | 2.2 | 2.6 | 2.2 | 1.9 |
| Antimony | 90 | 6 | 0.10 | <0.1 | <0.1 | 0.10 | <0.1 |
| Cadmium | 0.5 - 4[H] | 5 | 0.133 | 0.111 | 0.118 | 0.082 | 0.0236 |
| Chromium(2) | 10 | 50 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Cobalt | 40 | 20(3) | 3.64 | 1.64 | 1.56 | 1.51 | 0.77 |
| Lead | 40 - 160 | 10 | <0.05 | <0.05 | <0.05 | <0.05 | 0.25 |
| Titanium | 1000 | | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 |
| Zinc | 75 - 2400 | 3000 | 3.60 | 3.20 | 3.10 | 1.70 | 1.70 |

**Notes:**

All concentrations in micrograms per litre (ug/L), unless otherwise noted.

(1) Standards shown are from the Contaminated Sites Regulation ("CSR", BC Reg. 375/96 and O.C. 1480/96. Includes amendments up to BC Reg 13/2019, 24 January 2019)

(2) The standard for Hexavalent Chromium has been applied for dissolved Chromium.

(3) Interim background concentration for Cobalt as detailed in Technical Bulletin 3 is applied to replace CSR DW Standard.

Site-specific pathways include: AW-F = Protection of Freshwater Aquatic Life, DW = Protection of Drinking Water

FDA = Field Duplicate Available, FD = Field Duplicate, QA/QC = Quality Assurance/Quality Control

H = standard is Hardness dependent.

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

*Italics* indicate detection limit exceeds applicable standard.

# Table 2B: GROUNDWATER ANALYTICAL RESULTS
# HYDROCARBONS
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

| **Location** | CSR AW-F(1) | CSR DW(1) | MW20-01 | MW20-02 | MW20-02 | MW20-03 | MW20-04 |
|---|---|---|---|---|---|---|---|
| **Sample Name** | | | 02934-03 | 02934-04 | 02934-05 | 02934-02 | 02934-01 |
| **Sample Date** | | | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 |
| **Laboratory ID** | | | VA20A8760-003 | VA20A8760-004 | VA20A8760-005 | VA20A8760-002 | VA20A8760-001 |
| **QAQC** | | | | FDA | FD | | |
| **Parameter** | | | | | | | |
| **Hydrocarbons** | | | | | | | |
| Acenaphthene | 60 | 250 | <0.010 | <0.020 | <0.020 | <0.010 | <0.010 |
| Acenaphthylene | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Acridine | 0.5 | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Anthracene | 1 | 1000 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benz(a)anthracene | 1 | 0.07 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(a)pyrene | 0.1 | 0.01 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Benzo(g,h,i)perylene | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(k)fluoranthene | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Benzo(b,j) fluoranthene | | 0.07 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| benzo(b+j+k)fluoranthene | | | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Chrysene | 1 | 7 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Dibenz(a,h)anthracene | | 0.01 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Fluoranthene | 2 | 150 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Fluorene | 120 | 150 | <0.010 | <0.020 | <0.020 | <0.010 | <0.010 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 1-Methylnaphthalene | | 5.5 | <0.010 | 0.113 | 0.135 | <0.010 | <0.010 |
| 2-Methylnaphthalene | | 15 | <0.010 | 0.072 | 0.081 | <0.010 | <0.010 |
| Naphthalene | 10 | 80 | <0.050 | <0.080 | <0.090 | <0.050 | <0.050 |
| Phenanthrene | 3 | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Pyrene | 0.2 | 100 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Quinoline | 34 | 0.05 | <0.050 | *<0.080* | *<0.100* | <0.050 | <0.050 |
| Extractable Petroleum Hydrocarbons (C10-C19) | 5000 | 5000 | <250 | <250 | <250 | <250 | <250 |
| Light Extractable Petroleum Hydrocarbons (C10-C19) | 500 | | <250 | <250 | <250 | <250 | <250 |
| Extractable Petroleum Hydrocarbons (C19-C32) | | | <250 | <250 | <250 | <250 | <250 |
| Heavy Extractable Petroleum Hydrocarbons (C19-C32) | | | <250 | <250 | <250 | <250 | <250 |
| Volatile Hydrocarbons (C6-C10) | 15000 | 15000 | <100 | <100 | <100 | <100 | <100 |
| Volatile Petroleum Hydrocarbons (C6-C10) | 1500 | | <100 | <100 | <100 | <100 | <100 |

**Notes:**

All concentrations in micrograms per litre (ug/L), unless otherwise noted.

(1) Standards shown are from the Contaminated Sites Regulation ("CSR", BC Reg. 375/96 and O.C. 1480/96. Includes amendments up to BC Reg 13/2019, 24 January 2019)

Site-specific pathways include: AW-F = Protection of Freshwater Aquatic Life, DW = Protection of Drinking Water

FDA = Field Duplicate Available, FD = Field Duplicate, QA/QC = Quality Assurance/Quality Control

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

*Italics* indicate detection limit exceeds applicable standard.

# Table 2C: GROUNDWATER ANALYTICAL RESULTS
## BTEX and VOLATILES
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| Location | | | MW20-01 | MW20-02 | MW20-02 | MW20-03 | MW20-04 |
|---|---|---|---|---|---|---|---|
| Sample Name | CSR AW-F$^{(1)}$ | CSR DW$^{(1)}$ | 02934-03 | 02934-04 | 02934-05 | 02934-02 | 02934-01 |
| Sample Date | | | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 |
| Laboratory ID | | | VA20A8760-003 | VA20A8760-004 | VA20A8760-005 | VA20A8760-002 | VA20A8760-001 |
| QAQC | | | | FDA | FD | | |
| Parameter | | | | | | | |
| **VOCs + BTEX** | | | | | | | |
| dibromoethane, 1,2- | | 0.5 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| n-nonane | | 1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| trimethylbenzene, 1,2,4- | | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzene | 400 | 5 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Ethylbenzene | 2000 | 140 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Toluene | 5 | 60 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Xylenes, Total | 300 | 90 | <0.75 | 0.86 | 0.80 | <0.75 | <0.75 |
| o-Xylene | | | <0.50 | 0.86 | 0.80 | <0.50 | <0.50 |
| m,p-Xylenes | | | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Methyl tert-Butyl Ether | 34000 | 95 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Styrene | 720 | 800 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |

**Notes:**

All concentrations in micrograms per litre (ug/L), unless otherwise noted.

(1) Standards shown are from the Contaminated Sites Regulation ("CSR", BC Reg. 375/96 and O.C. 1480/96. Includes amendments up to BC Reg 13/2019, 24 January 2019)

Site-specific pathways include: AW-F = Protection of Freshwater Aquatic Life, DW = Protection of Drinking Water

FDA = Field Duplicate Available, FD = Field Duplicate, QA/QC = Quality Assurance/Quality Control

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

*Italics* indicate detection limit exceeds applicable standard.

# Table 2D: GROUNDWATER ANALYTICAL RESULTS
## Per- and Polyfluorinated Alkyl Substances
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| **Location** | | | MW20-01 | MW20-02 | MW20-02 | MW20-03 | MW20-04 |
|---|---|---|---|---|---|---|---|
| **SCN** | | | 02934-03 | 02934-04 | 02934-05 | 02934-02 | 02934-01 |
| **Laboratory ID** | CSR AW-F$^{(1)}$ | CSR DW$^{(1)}$ | VA20A8760-003 | VA20A8760-004 | VA20A8760-005 | VA20A8760-002 | VA20A8760-001 |
| **Date Sampled** | | | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 | 19-Jun-2020 |
| **QA/QC** | | | | FD | FDA | | |
| **Parameter** | | | | | | | |
| **Perfluoroalkylated Substances** | | | | | | | |
| fluorotelomer sulfonic acid, 6:2 [6:2 FTS] | | | <0.010 | 0.024 | 0.032 | <0.010 | 0.024 |
| fluorotelomer sulfonic acid, 8:2 [8:2 FTS] | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| perfluorobutane sulfonic acid [PFBS] | | **80** | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorobutanoic acid [PFBA] | | | <0.80 | <0.80 | <0.80 | <0.80 | <0.80 |
| perfluoroheptanoic acid [PFHpA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorohexane sulfonic acid [PFHxS] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorohexanoic acid [PFHxA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorononanoic acid [PFNA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorooctane sulfonic acid [PFOS] | 60 | **0.3** | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| perfluorooctanoic acid [PFOA] | | **0.2** | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| perfluoropentanoic acid [PFPeA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |

**Notes**

All concentrations in micrograms per litre (ug/L), unless otherwise noted.

(1) Standards shown are from the Contaminated Sites Regulation ("CSR", BC Reg. 375/96 and O.C. 1480/96. Includes amendments up to BC Reg 13/2019, 24 January 2019)

Site-specific pathways include: AW-F = Protection of Freshwater Aquatic Life, DW = Protection of Drinking Water

FDA = field duplicate; FD = field duplicate

QA/QC = quality assurance/quality control

SCN = sample control number

# Table 3: SOIL VAPOUR ANALYTICAL RESULTS
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | | | SV20-01 | | SV20-03 | | SV20-03 | | SV20-09 |
| **SCN** | | | 02933-03 | | 02933-01 | | 02933-02 | | 02936-01 |
| **Sample Date** | | | 2020-06-18 | | 2020-06-18 | | 2020-06-18 | | 2020-06-26 |
| **LAB Control number** | | | L2463621-3 | | L2463621-1 | | L2463621-2 | | L2466950-1 |
| **Sampling Depth (mbgs)** | | | 3.8– 4.1 | | 3.8– 4.1 | | 3.5–3.8 | | |
| **QAQC** | | | N | | N | | FD L2463621-1 | | N |
| **Laboratory COA** | | | L2463621-V2 | | L2463621-V2 | | L2463621-V2 | | L2466950 |
| **Attenuation factor (α)** | | | Indoor Air Unattenuated | Outdoor Air 0.00000061 | Indoor Air Unattenuated | Outdoor Air 0.00000061 | Indoor Air Unattenuated | Outdoor Air 0.00000061 | Indoor Air Unattenuated |
| **Parameter** | **CSR$^{1}$ (RL)** | **Units** | | | | | | | |
| **Field** | | | | | | | | | |
| Carbon Dioxide, field measured | | % | 1.3 | | 1 | | 1 | | 1.3 |
| Methane, field measured | | % | 0 | | 0 | | 0 | | 0.1 |
| Oxygen, field measured | | % | 17.6 | | 17.4 | | 17.4 | | 17.9 |
| Vacuum H2O | | In | 0 | | 0 | | 0 | | 0 |
| PID | | ppm | 16.7 | | 6.4 | | 6.4 | | 0.1 |
| Helium, field measured | | % | 0 | | 0 | | 0 | | - |
| Flow Rate | | mL/min | 292 | | 296 | | 296 | | 310 |
| Depth to Top of Sand Pack | | m | 3.4 | | 3.85 | | 3.85 | | - |
| **Hydrocarbons** | | | | | | | | | |
| Naphthalene | **3** | ug/m3 | <3.0 | 0.0000018 | <3.0 | 0.0000018 | <3.0 | 0.0000018 | **< 3.3** |
| Volatile Petroleum Hydrocarbons in Vapour (C6-C13) | **1000** | ug/m3 | **71000** | 0.043 | **26000** | 0.016 | **27300** | 0.0167 | **13600** |
| Volatile Hydrocarbons in Vapour (C6-C13) | | ug/m3 | 72100 | 0.0440 | 26300 | 0.0160 | 27600 | 0.0168 | 13900 |
| **VOCs + BTEX** | | | | | | | | | |
| 1,2-dibromoethane (Ethylene Dibromide) (EDB) | 0.5 | ug/m3 | <0.38 | 0.00000047 | <0.38 | 0.00000023 | <0.38 | 0.00000023 | < 0.19 |
| 1,2-dichloroethane | 7 | ug/m3 | 3.55 | 0.00000217 | 1.20 | 0.00000073 | 1.19 | 0.000000726 | 3.83 |
| Benzene | **1.5** | ug/m3 | **44.7** | 0.0000273 | **11.9** | 0.00000726 | **12.3** | 0.00000750 | **4.85** |
| Toluene | 5000 | ug/m3 | 165 | 0.000101 | 33.7 | 0.0000206 | 29.8 | 0.0000182 | 33.8 |
| Ethylbenzene | 1000 | ug/m3 | 106 | 0.0000647 | 14.2 | 0.00000866 | 14.0 | 0.0000085 | 8.2 |
| Xylenes, Total | **100** | ug/m3 | **261** | 0.000159 | < 20 | 0.000012 | < 20 | 0.000012 | 40.3 |
| o-Xylene | | ug/m3 | 85.1 | 0.0000519 | 10.1 | 0.00000616 | 9.6 | 0.0000059 | 10.7 |
| Styrene | 1000 | ug/m3 | < 8.5 | 0.0000052 | < 8.5 | 0.0000052 | < 8.5 | 0.0000052 | < 2.1 |
| Methyl tert-Butyl Ether | 3000 | ug/m3 | < 7.2 | 0.0000044 | < 7.2 | 0.0000044 | < 7.2 | 0.0000044 | < 1.8 |
| m,p-Xylenes | | ug/m3 | 176 | 0.000107 | < 17 | 0.000010 | < 17 | 0.000010 | 29.6 |
| 1,3-Butadiene | **2** | ug/m3 | **36.7** | 0.0000224 | **18.7** | 0.0000114 | **17.1** | 0.0000104 | < 0.55 |
| 1,2,4-Trimethylbenzene | **7** | ug/m3 | **9.25** | 0.0000002 | 2.19 | 0.0000001 | 1.89 | 0.0000005 | **9.4** |
| 1,3,5-Trimethylbenzene | **3.5** | ug/m3 | **21.1** | 0.0000129 | <0.98 | 0.0000006 | <0.98 | 0.0000006 | 2.5 |
| Isopropylbenzene | 400 | ug/m3 | 28.7 | 0.0000175 | < 9.8 | 0.0000060 | < 9.8 | 0.0000060 | < 2.5 |
| Methyl Cyclohexane | **1500** | ug/m3 | **2900** | 0.0018 | 990 | 0.000604 | 1050 | 0.000641 | **1660** |
| n-Decane | 2500 | ug/m3 | < 29 | 0.000018 | < 29 | 0.000018 | < 29 | 0.000018 | < 7.3 |
| n-Hexane | 700 | ug/m3 | 696 | 0.000425 | 223 | 0.000136 | 231 | 0.000141 | 200 |

**Notes**

All values are in μg/m$^3$ unless otherwise noted.

Standards shown are from the Contaminated Sites Regulation (CSR), B.C. Reg. 375/96, O.C. 1480/96, including amendments up to 24 January 2019 (B.C. Reg 13/2019).

Land Use abbreviations: RL (Agricultural, Urban Park, Residential)

Applied attenuation factors (α) obtained from Table 1 of BC Ministry of Environment Protocol #22 - Application of Vapour Attenuation Factors to Characterize Vapour Contamination (Effective 1 November 2017).

* Compared to vapour standards.

** Raw laboratory data (without attenuation) are shown for reference only and are not compared to the vapour standards.

mL/min = millilitres per minute

ppm - parts per million

QA/QC = Quality Assurance / Quality Control; FDA = Field Duplicate Available; FD = Field Duplicate

VPHv = Volatile petroleum hydrocarbons, carbon range 6-13

< Indicates parameter was below laboratory equipment detection limit.

- Chemical not analyzed or criteria not defined.

Output generated by GalReport.

# Table 4: Results of Quality Assurance Samples
## SNOWBIRD ENVIRONMENTAL CLEAN-UP
## KAMLOOPS, BC

| **Location** | | | 02915-01 | 02913-01 | 02930-01 | 02934-06 | 02934-07 |
|---|---|---|---|---|---|---|---|
| **Sample Name** | CSR AW-F(1) | CSR DW(1) | COK-01 (Hydrovac Water) | Equip Blank | Equip Blank | Equip Blank | Trip Blank |
| **Sample Date** | | | 2-Jun-20 | 2-Jun-20 | 10-Jun-2020 | 19-Jun-20 | 19-Jun-20 |
| **Laboratory ID** | | | L2455588-1 | L2455148-1 | L2459640-1 | VA20A8760-006 | VA20A8760-007 |
| **QAQC** | | | EB | | EB | EB | TB |
| **Parameter** | | | | | | | |
| **Metals, Dissolved** | | | | | | | |
| Aluminum | | 9500 | - | - | - | <1 | <1 |
| Antimony | 90 | 6 | - | - | - | <0.1 | <0.1 |
| Cadmium | 0.5 - 4[H] | 5 | - | - | - | <0.005 | <0.005 |
| Chromium(2) | 10 | 50 | - | - | - | <0.5 | <0.5 |
| Cobalt | 40 | 20(3) | - | - | - | <0.1 | <0.1 |
| Lead | 40 - 160 | 10 | - | - | - | <0.05 | <0.05 |
| Titanium | 1000 | | - | - | - | <0.3 | <0.3 |
| Zinc | 75 - 2400 | 3000 | - | - | - | <1 | <1 |
| **Hydrocarbons** | | | | | | | |
| Acenaphthene | 60 | 250 | - | - | - | <0.010 | <0.010 |
| Acenaphthylene | | | - | - | - | <0.010 | <0.010 |
| Acridine | 0.5 | | - | - | - | <0.010 | <0.010 |
| Anthracene | 1 | 1000 | - | - | - | <0.010 | <0.010 |
| Benz(a)anthracene | 1 | 0.07 | - | - | - | <0.010 | <0.010 |
| Benzo(a)pyrene | 0.1 | 0.01 | - | - | - | <0.0050 | <0.0050 |
| Benzo(g,h,i)perylene | | | - | - | - | <0.010 | <0.010 |
| Benzo(k)fluoranthene | | | - | - | - | <0.015 | <0.015 |
| Benzo(b,j) fluoranthene | | 0.07 | - | - | - | <0.010 | <0.010 |
| benzo(b+j+k)fluoranthene | | | - | - | - | <0.010 | <0.010 |
| Chrysene | 1 | 7 | - | - | - | <0.010 | <0.010 |
| Dibenz(a,h)anthracene | | 0.01 | - | - | - | <0.0050 | <0.0050 |
| Fluoranthene | 2 | 150 | - | - | - | <0.010 | <0.010 |
| Fluorene | 120 | 150 | - | - | - | <0.010 | <0.010 |
| Indeno(1,2,3-c,d)pyrene | | | - | - | - | <0.010 | <0.010 |
| 1-Methylnaphthalene | | 5.5 | - | - | - | <0.010 | <0.010 |
| 2-Methylnaphthalene | | 15 | - | - | - | <0.010 | <0.010 |
| Naphthalene | 10 | 80 | - | - | - | <0.050 | <0.050 |
| Phenanthrene | 3 | | - | - | - | <0.020 | <0.020 |
| Pyrene | 0.2 | 100 | - | - | - | <0.010 | <0.010 |
| Quinoline | 34 | 0.05 | - | - | - | <0.050 | <0.050 |
| Extractable Petroleum Hydrocarbons (C10-C19) | 5000 | 5000 | - | - | - | <250 | <250 |
| Light Extractable Petroleum Hydrocarbons (C10-C19) | 500 | | - | - | - | <250 | <250 |
| Extractable Petroleum Hydrocarbons (C19-C32) | | | - | - | - | <250 | <250 |
| Heavy Extractable Petroleum Hydrocarbons (C19-C32) | | | - | - | - | <250 | <250 |
| Volatile Hydrocarbons (C6-C10) | 15000 | 15000 | - | - | - | <100 | <100 |
| Volatile Petroleum Hydrocarbons (C6-C10) | 1500 | | - | - | - | <100 | <100 |
| **VOCs + BTEX** | | | | | | | |
| dibromoethane, 1,2- | | 0.5 | - | - | - | <0.2 | <0.2 |
| n-nonane | | 1 | - | - | - | <1.0 | <1.0 |
| trimethylbenzene, 1,2,4- | | | - | - | - | <1.0 | <1.0 |
| Benzene | 400 | 5 | - | - | - | <0.50 | <0.50 |
| Ethylbenzene | 2000 | 140 | - | - | - | <0.50 | <0.50 |
| Toluene | 5 | 60 | - | - | - | <0.50 | <0.50 |
| Xylenes, Total | 300 | 90 | - | - | - | <0.75 | <0.75 |
| o-Xylene | | | - | - | - | <0.50 | <0.50 |
| m,p-Xylenes | | | - | - | - | <0.50 | <0.50 |
| Methyl tert-Butyl Ether | 34000 | 95 | - | - | - | <0.50 | <0.50 |
| Styrene | 720 | 800 | - | - | - | <0.50 | <0.50 |
| **Perfluoroalkylated Substances** | | | | | | | |
| fluorotelomer sulfonic acid, 6:2 [6:2 FTS] | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| fluorotelomer sulfonic acid, 8:2 [8:2 FTS] | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| perfluorobutane sulfonic acid [PFBS] | | **80** | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorobutanoic acid [PFBA] | | | <0.80 | <0.80 | <0.80 | <0.80 | <0.80 |
| perfluoroheptanoic acid [PFHpA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorohexane sulfonic acid [PFHxS] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorohexanoic acid [PFHxA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorononanoic acid [PFNA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| perfluorooctane sulfonic acid [PFOS] | 60 | **0.3** | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| perfluorooctanoic acid [PFOA] | | **0.2** | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| perfluoropentanoic acid [PFPeA] | | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |

**Notes:**

All concentrations in micrograms per litre (ug/L), unless otherwise noted.
FDA = Field Duplicate Available, FD = Field Duplicate, QA/QC = Quality Assurance/Quality Control
< Indicates parameter was below laboratory equipment detection limit.
- Chemical not analyzed or criteria not defined.
EB= Equipment Blank
TB= Trip Blank
FB= Field Blanks

# Table 5 QAQC SOIL RESULTS
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

**Relative Percent Difference Calculations**

| Sample Location<br>Sample Name<br>Sample Collection Date<br>Sample Matrix<br>Sample Depth | Units | RPD Alert Limit | DF Alert Limit | RDL | SS20-18<br>02903-03<br>25-May-20<br>SO<br>0.05 - 0.15 m | SS20-18<br>02903-07<br>25-May-20<br>SO<br>0.05 - 0.15 m | RPD (%) | DF (unitless) | SS20-17<br>02906-05<br>26-May-20<br>SO<br>0.05 - 0.15 m | SS20-17<br>02906-07<br>26-May-20<br>SO<br>0.05 - 0.15 m | RPD (%) | DF (unitless) | BH20-07<br>02929-01<br>10-Jun-2020<br>SO<br>0.15 - 0.3 m | BH20-07<br>02929-02<br>10-Jun-2020<br>SO<br>0.15 - 0.3 m | RPD (%) | DF (unitless) | BH20-08<br>02926-09<br>11-Jun-2020<br>SO<br>0.91 - 1.07 m | BH20-08<br>02926-10<br>11-Jun-2020<br>SO<br>0.91 - 1.07 m | RPD (%) | DF (unitless) | MW20-01<br>02926-04<br>11-Jun-2020<br>SO<br>0.05 - 0.15 m | MW20-01<br>02926-05<br>11-Jun-2020<br>SO<br>0.05 - 0.15 m | RPD (%) | DF (unitless) | BH20-10<br>02945-03<br>26-Jun-2020<br>SO<br>4.25-4.4 m | BH20-10<br>02945-04<br>26-Jun-2020<br>SO<br>4.25-4.4 m | RPD (%) | DF (unitless) | MW20-02<br>02928-01<br>12-Jun-2020<br>SO<br>3.7-4.0 m | MW20-02<br>02928-02<br>12-Jun-2020<br>SO<br>3.7-4.0 m | RPD (%) | DF (unitless) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Field + Physical** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moisture, Percent | % | >35% | >2 | 0.25 | 24.5 | 24.8 | 1 | n/c | 18.9 | 20.9 | 10 | n/c | 18.6 | 21.3 | 14 | n/c | 13.8 | 12.0 | 14 | n/c | 17.9 | 17.4 | 3 | n/c | 2.91 | 2.36 | 21 | n/c | 11.3 | 14.3 | 23 | n/c |
| pH | pH units | >35% | >2 | 0.10 | 6.81 | 6.93 | 2 | n/c | 6.11 | 5.86 | 4 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | 8.05 | 8.14 | 1.00 | n/c | 7.37 | 7.43 | 1 | n/c | 7.19 | 7.29 | 1 | n/c |
| **Hydrocarbons** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | mg/kg | >50% | >2 | 0.010 | 49.3 | 42.3 | 15 | n/c | 3.17 | 2.07 | **42** | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | 2.24 | 2.50 | 11 | n/c |
| 2-methylnaphthalene | mg/kg | >50% | >2 | 0.010 | 68.9 | 59.2 | 15 | n/c | 4.52 | 2.95 | **42** | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | 3.22 | 3.57 | 10 | n/c |
| Acenaphthene | mg/kg | >50% | >2 | 0.0050 | < 4.0 | < 3.0 | n/c | n/c | < 0.30 | < 0.20 | n/c | n/c | - | - | n/c | n/c | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.200 | < 0.200 | n/c | 0 |
| Acenaphthylene | mg/kg | >50% | >2 | 2.0 | < 2.0 | < 1.0 | n/c | n/c | < 0.20 | < 0.070 | n/c | n/c | - | - | n/c | n/c | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0300 | < 0.0400 | n/c | n/c |
| Anthracene | mg/kg | >50% | >2 | 0.0040 | < 0.20 | < 0.20 | n/c | 0 | < 0.020 | < 0.0080 | n/c | n/c | - | - | n/c | n/c | < 0.0040 | < 0.0040 | n/c | 0 | < 0.0040 | < 0.0040 | n/c | 0 | < 0.0040 | < 0.0040 | n/c | 0 | < 0.0100 | < 0.0100 | n/c | 0 |
| Benz(a)anthracene | mg/kg | >50% | >2 | 0.010 | < 0.20 | < 0.20 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(a)pyrene | mg/kg | >50% | >2 | 0.010 | 0.024 | 0.020 | n/c | 0.4 | < 0.020 | 0.012 | n/c | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(a)pyrene Total Potency Equivalence (TPE) | mg/kg | >50% | >2 | 0.020 | 0.040 | 0.036 | n/c | 0.2 | < 0.020 | < 0.020 | n/c | 0 | - | - | n/c | n/c | < 0.020 | < 0.020 | n/c | 0 | < 0.020 | < 0.020 | n/c | 0 | < 0.020 | < 0.020 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(b,j) fluoranthene | mg/kg | >50% | >2 | 0.010 | < 0.020 | < 0.030 | n/c | n/c | 0.015 | 0.016 | n/c | 0.10 | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(g,h,i)perylene | mg/kg | >50% | >2 | 0.010 | 0.017 | 0.016 | n/c | 0.1 | 0.011 | 0.010 | n/c | 0.10 | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(k)fluoranthene | mg/kg | >50% | >2 | 0.010 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Benzo[b,j,k]fluoranthene | mg/kg | >50% | >2 | 0.015 | < 0.022 | < 0.032 | n/c | n/c | < 0.015 | 0.016 | n/c | 0.067 | - | - | n/c | n/c | < 0.015 | < 0.015 | n/c | 0 | < 0.015 | < 0.015 | n/c | 0 | < 0.015 | < 0.015 | n/c | 0 | < 0.015 | < 0.015 | n/c | 0 |
| Chrysene | mg/kg | >50% | >2 | 0.010 | < 0.020 | < 0.020 | n/c | 0 | < 0.020 | 0.012 | n/c | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Dibenz(a,h)anthracene | mg/kg | >50% | >2 | 0.0050 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | - | - | n/c | n/c | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 |
| EPH (C10-C19) | mg/kg | >50% | >2 | 200 | 46000 | 41000 | 11 | n/c | 2150 | 1490 | **36** | n/c | - | - | n/c | n/c | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | 2300 | 2780 | 19 | n/c |
| EPH (C19-C32) | mg/kg | >50% | >2 | 200 | 1760 | 1450 | 19 | n/c | < 200 | < 200 | n/c | 0 | - | - | n/c | n/c | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 |
| Fluoranthene | mg/kg | >50% | >2 | 0.010 | 0.113 | 0.087 | 26 | n/c | 0.026 | 0.024 | n/c | 0.20 | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Fluorene | mg/kg | >50% | >2 | 0.010 | 4.52 | 4.06 | 11 | n/c | 0.261 | 0.167 | **44** | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.300 | 0.240 | n/c | n/c |
| HEPH (C19-C32) Less PAHs | mg/kg | >50% | >2 | 200 | 1760 | 1450 | 19 | n/c | < 200 | < 200 | n/c | 0 | - | - | n/c | n/c | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 |
| Indeno(1,2,3-c,d)pyrene | mg/kg | >50% | >2 | 0.010 | 0.014 | 0.013 | n/c | 0.10 | 0.010 | < 0.010 | n/c | 0 | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 |
| Index of Additive Cancer Risk (IACR) | none | >50% | >2 | 0.15 | 0.49 | 0.51 | n/c | n/c | 0.19 | 0.20 | n/c | 0.067 | - | - | n/c | n/c | < 0.15 | < 0.15 | n/c | 0 | < 0.15 | < 0.15 | n/c | 0 | < 0.15 | < 0.15 | n/c | 0 | < 0.11 | < 0.11 | n/c | 0 |
| LEPH (C10-C19) Less PAHs | mg/kg | >50% | >2 | 200 | 46000 | 41000 | 11 | n/c | 2150 | 1490 | **36** | n/c | - | - | n/c | n/c | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | < 200 | < 200 | n/c | 0 | 2300 | 2780 | 19 | n/c |
| Naphthalene | mg/kg | >50% | >2 | 0.010 | < 41 | < 35 | n/c | n/c | 2.30 | 1.61 | 35 | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | < 2.00 | < 2.00 | n/c | 0 |
| Petroleum Hydrocarbons - F1 (C6-C10) | mg/kg | >50% | >2 | 10 | 5470 | 9580 | **55** | n/c | 86 | 90 | 5 | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Petroleum Hydrocarbons - F1 (C6-C10)-BTEX | mg/kg | >50% | >2 | 10 | 5020 | 8830 | **55** | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.010 | < 0.010 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Petroleum Hydrocarbons - F2 (C10-C16) | mg/kg | >50% | >2 | 30 | 38800 | 36100 | 7 | n/c | 653 | 82 | **155** | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Petroleum Hydrocarbons - F3 (C16-C34) | mg/kg | >50% | >2 | 50 | 5360 | 4900 | 9 | n/c | 77 | < 50 | n/c | 0.54 | - | - | n/c | n/c | < 100 | < 100 | n/c | 0 | < 100 | < 100 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Petroleum Hydrocarbons - F4 (C34-C50) | mg/kg | >50% | >2 | 50 | < 250 | < 250 | n/c | 0.0 | < 50 | < 50 | n/c | 0 | - | - | n/c | n/c | < 100 | < 100 | n/c | 0 | < 100 | < 100 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Phenanthrene | mg/kg | >50% | >2 | 0.010 | < 2.0 | < 2.0 | n/c | 0.0 | 0.144 | 0.096 | **40** | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | < 0.090 | < 0.100 | n/c | n/c |
| Pyrene | mg/kg | >50% | >2 | 0.010 | 0.231 | 0.221 | 4 | n/c | 0.033 | 0.028 | n/c | 0.50 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.010 | < 0.010 | n/c | 0 | 0.014 | 0.018 | n/c | 0.4 |
| Quinoline | mg/kg | >50% | >2 | 0.050 | < 4.0 | < 4.0 | n/c | 0.0 | < 0.40 | < 0.30 | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.300 | < 0.400 | n/c | n/c |
| VHC (C6-C10) | mg/kg | >50% | >2 | 100 | 5080 | 8900 | **55** | n/c | < 100 | < 100 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 100 | < 100 | n/c | 0 | 1600 | 37 | **191** | n/c |
| VPH (C6-C10) | mg/kg | >50% | >2 | 100 | 4630 | 8200 | **56** | n/c | < 100 | < 100 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 100 | < 100 | n/c | 0 | 1510 | 36 | n/c | **2.7** |
| **Glycols** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diethylene Glycol | mg/kg | >35% | >2 | 10 | < 10 | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Ethylene Glycol | mg/kg | >35% | >2 | 10 | < 10 | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Propylene Glycol, 1,2- | mg/kg | >35% | >2 | 10 | < 10 | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Triethylene Glycol | mg/kg | >35% | >2 | 10 | < 10 | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | mg/kg | >35% | >2 | 50 | 19500 | 18500 | 5 | n/c | 18400 | 21500 | 16 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Antimony | mg/kg | >35% | >2 | 0.10 | 3.43 | 2.47 | 33 | n/c | 0.26 | 0.28 | n/c | 0.20 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Barium | mg/kg | >35% | >2 | 0.50 | 159 | 149 | 6 | n/c | 128 | 147 | 14 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Cadmium | mg/kg | >35% | >2 | 0.020 | 32.8 | 26.6 | 21 | n/c | 0.169 | 0.173 | 2 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | 0.139 | 0.166 | 18 | n/c | 0.037 | 0.035 | n/c | 0.1 | 0.118 | 0.097 | 20 | n/c |
| Chromium | mg/kg | >35% | >2 | 0.50 | 75.8 | 79.8 | 5 | n/c | 45.1 | 49.5 | 9 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | 45.9 | 43.2 | 6 | n/c | 19.7 | 16.3 | 19 | n/c | 21.6 | 23.0 | 6 | n/c |
| Cobalt | mg/kg | >35% | >2 | 0.10 | 14.8 | 14.5 | 2 | n/c | 14.1 | 15.0 | 6 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Lead | mg/kg | >35% | >2 | 0.50 | 11.2 | 11.6 | 4 | n/c | 13.3 | 13.7 | 3 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Titanium | mg/kg | >35% | >2 | 1.0 | 1550 | 1530 | 1 | n/c | 1550 | 1650 | 6 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Zinc | mg/kg | >35% | >2 | 2.0 | 138 | 134 | 3 | n/c | 75.4 | 81.7 | 8 | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| **PFAS** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTS) | ug/kg | >35% | >2 | 0.10 | 8700 | 10700 | n/c | n/c | - | - | n/c | n/c | < 0.15 | < 0.35 | n/c | 1.3 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | ug/kg | >35% | >2 | 0.10 | 1040 | 1570 | **41** | n/c | - | - | n/c | n/c | < 0.10 | < 0.10 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorobutane Sulfonate | ug/kg | >35% | >2 | 0.10 | 0.12 | < 0.10 | n/c | 0.20 | - | - | n/c | n/c | < 0.10 | < 0.10 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorobutanoic acid (PFBA) | ug/kg | >35% | >2 | 190 | < 240 | < 130 | n/c | n/c | - | - | n/c | n/c | < 300 | < 300 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluoroheptanoic Acid (PFHpA) | ug/kg | >35% | >2 | 0.10 | 2.01 | 2.91 | **37** | n/c | - | - | n/c | n/c | < 0.10 | < 0.10 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorohexane sulfonate (PFHXS) | ug/kg | >35% | >2 | 0.10 | < 0.30 | < 0.40 | n/c | n/c | - | - | n/c | n/c | < 0.10 | < 0.10 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorohexanoic Acid (PFHxA) | ug/kg | >35% | >2 | 0.10 | 183 | 154 | 17 | n/c | - | - | n/c | n/c | 0.17 | 0.16 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorononanoic Acid (PFNA) | ug/kg | >35% | >2 | 0.10 | 0.70 | 1.08 | **43** | n/c | - | - | n/c | n/c | < 0.10 | < 0.10 | n/c | 0.1 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorooctane sulfonate (PFOS) | ug/kg | >35% | >2 | 0.35 | 0.86 | 1.25 | n/c | 1.1 | - | - | n/c | n/c | < 0.35 | < 0.35 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluorooctanoic acid (PFOA) | ug/kg | >35% | >2 | 0.10 | 15.4 | 20.5 | 28 | n/c | - | - | n/c | n/c | < 0.10 | < 0.10 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Perfluoropentanoic Acid (PFPeA) | ug/kg | >35% | >2 | 0.10 | 10.3 | 7.7 | 29 | n/c | - | - | n/c | n/c | 0.17 | 0.11 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| **VOCs + BTEX** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trimethylbenzene | mg/kg | >35% | >2 | 0.050 | 248 | 473 | **62** | n/c | 4.51 | 4.15 | 8 | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| 1,2-dibromoethane | mg/kg | >35% | >2 | 0.050 | < 8.5 | < 13 | n/c | n/c | < 0.15 | < 0.20 | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.400 | < 0.050 | n/c | n/c |
| 1,2-dichloroethane | mg/kg | >35% | >2 | 0.050 | < 0.050 | < 0.050 | n/c | 0.00 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| 1,3,5-Trimethylbenzene | mg/kg | >35% | >2 | 2.5 | 70.7 | 137 | **64** | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| 1-propylbenzene | mg/kg | >35% | >2 | 2.5 | 75.5 | 128 | **52** | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.0050 | < 0.0050 | n/c | 0 | 0.345 | < 0.0050 | **194** | n/c |
| Benzene | mg/kg | >35% | >2 | 0.0050 | 1.65 | 3.43 | **70** | n/c | 0.0091 | 0.0089 | n/c | 0.040 | - | - | n/c | n/c | < 0.0050 | < 0.0050 | n/c | 0 | < 0.0050 | < 0.0050 | n/c | 0 | < 0.015 | < 0.015 | n/c | 0 | 12.8 | 0.114 | **196** | n/c |
| Ethylbenzene | mg/kg | >35% | >2 | 0.015 | 57.7 | 97.1 | **51** | n/c | 0.838 | 0.828 | 1 | n/c | - | - | n/c | n/c | < 0.015 | < 0.015 | n/c | 0 | < 0.015 | < 0.015 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Isopropylbenzene | mg/kg | >35% | >2 | 2.5 | 29.8 | 50.3 | **51** | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| m,p-Xylenes | mg/kg | >35% | >2 | 0.050 | 257 | 416 | **47** | n/c | 3.45 | 3.75 | 8 | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | 51.9 | 0.554 | **196** | n/c |
| Methyl tert-Butyl Ether | mg/kg | >35% | >2 | 0.20 | < 0.20 | < 0.20 | n/c | 0.00 | < 0.20 | < 0.20 | n/c | 0 | - | - | n/c | n/c | < 0.20 | < 0.20 | n/c | 0 | < 0.20 | < 0.20 | n/c | 0 | < 0.20 | < 0.20 | n/c | 0 | < 0.200 | < 0.200 | n/c | 0 |
| n-Butylbenzene | mg/kg | >35% | >2 | 69 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| n-Nonane | mg/kg | >35% | >2 | 0.050 | - | - | n/c | n/c | 4.29 | 5.25 | 20 | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | 80.5 | 2.30 | n/c | n/c |
| o-Xylene | mg/kg | >35% | >2 | 0.050 | 112 | 187 | **50** | n/c | 2.89 | 2.18 | 28 | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | 20.2 | 0.330 | **194** | n/c |
| sec-Butylbenzene | mg/kg | >35% | >2 | 2.5 | 29.5 | 56.3 | **62** | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c |
| Styrene | mg/kg | >35% | >2 | 0.050 | < 2.5 | < 2.5 | n/c | 0.0 | < 0.050 | < 0.050 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 |
| tert-Butylbenzene | mg/kg | >35% | >2 | 2.5 | < 2.5 | < 2.5 | n/c | 0.0 | - | - | n/c | n/c | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | - | - | n/c | n/c | - | - | n/c | n/c |
| Toluene | mg/kg | >35% | >2 | 0.050 | 22.1 | 40.8 | **59** | n/c | 0.126 | 0.135 | n/c | 0.18 | - | - | n/c | n/c | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | < 0.050 | < 0.050 | n/c | 0 | 8.12 | 0.053 | **197** | n/c |
| Xylenes, Total | mg/kg | >35% | >2 | 0.075 | 369 | 603 | **48** | n/c | 6.34 | 5.93 | 7 | n/c | - | - | n/c | n/c | < 0.075 | < 0.075 | n/c | 0 | < 0.075 | < 0.075 | n/c | 0 | < 0.075 | < 0.075 | n/c | 0 | 72.1 | 0.884 | **195** | n/c |

Notes:
All values are expressed in mg/kg unless otherwise noted
SCN = sample control number
FDA = field duplicate available
FD = field duplicate
QA/QC = quality assurance/quality control
RDL = reported detection limit indicates the minimum concentration that could be measured by laboratory instrumentation for a specific sample.
Relative Percent Difference (RPD) is calculated when the mean value is greater than five times the method reporting limit; Golder's internal QA/QC target is less than 35% (less than 50% for PAHs).
Difference Factor (DF) is calculated when the mean value is less than five times the method reporting limit; Golder's internal QA/QC target is less than 2.
NA = not applicable; NC = not calculated
**BOLD** font indicates the parameter analyzed exceeds Golder's internal QA/QC targets.

# Table 6 QAQC GROUNDWATER RESULTS
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

## Relative Percent Difference Calculations

| **Sample Location**<br>**Sample Name**<br>**Sample Collection Date**<br>**Sample Matrix** | **CAS #** | **Units** | **RPD Alert Limit** | **DF Alert Limit** | **RDL** | **5X RDL** | **Is either result >5X RDL** | MW20-02<br>02934-04<br>20-06-19 12:00:00 /<br>WG | MW20-02<br>02934-05<br>20-06-19 12:00:00 /<br>WG | **RPD (%)** | **DF (unitless)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dioxins + Furans** | | | | | | | | | | | |
| 6:2 Fluorotelomer sulfonate | 6:2FTS | ug/L | >50% | >2 | 0.010 | 0.05 | no | 0.024 | 0.032 | n/c | 0.8 |
| 8:2 Fluorotelomer sulfonate | 8:2FTS | ug/L | >50% | >2 | 0.01 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| n-Nonane | 111-84-2 | ug/L | >50% | >2 | 1.0 | 5 | no | < 1.0 | < 1.0 | n/c | 0 |
| **Field + Physical** | | | | | | | | | | | |
| Conductivity, field measured | FIELD_EL_COND | uS/cm | >50% | >2 | - | - | no | 586.6 | 586.6 | n/c | - |
| Dissolved Oxygen, field measured | FIELD_DO | mg/L | >50% | >2 | - | - | no | 4.29 | 4.29 | n/c | - |
| Oxidation Reduction Potential, field measured | FIELD_ORP | mV | >50% | >2 | - | - | no | 117.5 | 117.5 | n/c | - |
| pH, field measured | FIELD_pH | pH units | >50% | >2 | - | - | no | 6.52 | 6.52 | n/c | - |
| Temperature, field measured | FIELD_TEMP | deg c | >50% | >2 | - | - | no | 13.5 | 13.5 | n/c | - |
| **Hydrocarbons** | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | ug/L | >50% | >2 | 0.010 | 0.05 | yes | 0.113 | 0.135 | 18 | n/c |
| 2-methylnaphthalene | 91-57-6 | ug/L | >50% | >2 | 0.010 | 0.05 | yes | 0.072 | 0.081 | 12 | n/c |
| Acenaphthene | 83-32-9 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Acenaphthylene | 208-96-8 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Acridine | 260-94-6 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Anthracene | 120-12-7 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Benz(a)anthracene | 56-55-3 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(a)pyrene | 50-32-8 | ug/L | >50% | >2 | 0.0050 | 0.025 | no | < 0.0050 | < 0.0050 | n/c | 0 |
| Benzo(b,j) fluoranthene | Benz_Fluo_bj | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(g,h,i)perylene | 191-24-2 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Benzo(k)fluoranthene | 207-08-9 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Benzo[b,j,k]fluoranthene | Benz_Fluo_bjk | ug/L | >50% | >2 | 0.015 | 0.075 | no | < 0.015 | < 0.015 | n/c | 0 |
| Chrysene | 218-01-9 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Dibenz(a,h)anthracene | 53-70-3 | ug/L | >50% | >2 | 0.0050 | 0.025 | no | < 0.0050 | < 0.0050 | n/c | 0 |
| Extractable Petroleum Hydrocarbons (C10-C19) | PHC-E-C10C19 | ug/L | >50% | >2 | 250 | 1250 | no | < 250 | < 250 | n/c | 0 |
| Extractable Petroleum Hydrocarbons (C19-C32) | PHC-E-C19C32 | ug/L | >50% | >2 | 250 | 1250 | no | < 250 | < 250 | n/c | 0 |
| Fluoranthene | 206-44-0 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Fluorene | 86-73-7 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Heavy Extractable Petroleum Hydrocarbons (C19-C32) Less PAHs | PHC-E-C19C32PAH | ug/L | >50% | >2 | 250 | 1250 | no | < 250 | < 250 | n/c | 0 |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Light Extractable Petroleum Hydrocarbons (C10-C19) Less PAHs | PHC-E-C10C19PAH | ug/L | >50% | >2 | 250 | 1250 | no | < 250 | < 250 | n/c | 0 |
| Naphthalene | 91-20-3 | ug/L | >50% | >2 | 0.080 | 0.4 | no | < 0.080 | | n/c | n/c |
| Naphthalene | 91-20-3 | ug/L | >50% | >2 | 0.090 | 0.45 | no | | < 0.090 | n/c | n/c |
| Phenanthrene | 85-01-8 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Pyrene | 129-00-0 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Quinoline | 91-22-5 | ug/L | >50% | >2 | 0.080 | 0.4 | no | < 0.080 | | n/c | n/c |
| Quinoline | 91-22-5 | ug/L | >50% | >2 | 0.100 | 0.5 | no | | < 0.100 | n/c | n/c |
| Volatile Hydrocarbons (C6-C10) | VH-C6C10 | ug/L | >50% | >2 | 100 | 500 | no | < 100 | < 100 | n/c | 0 |
| Volatile Petroleum Hydrocarbons (C6-C10) | VPH-C6C10 | ug/L | >50% | >2 | 100 | 500 | no | < 100 | < 100 | n/c | 0 |
| **Metals, Dissolved** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/L | >50% | >2 | 0.0010 | 0.005 | no | 0.0022 | 0.0026 | n/c | 0.4 |
| Antimony | 7440-36-0 | mg/L | >50% | >2 | 0.00010 | 0.0005 | no | < 0.00010 | < 0.00010 | n/c | 0 |
| Cadmium | 7440-43-9 | mg/L | >50% | >2 | 0.0000050 | 0.000025 | yes | 0.000111 | 0.000118 | 6 | n/c |
| Chromium | 7440-47-3 | mg/L | >50% | >2 | 0.00050 | 0.0025 | no | < 0.00050 | < 0.00050 | n/c | 0 |
| Cobalt | 7440-48-4 | mg/L | >50% | >2 | 0.00010 | 0.0005 | yes | 0.00164 | 0.00156 | 5 | n/c |
| Lead | 7439-92-1 | mg/L | >50% | >2 | 0.000050 | 0.00025 | no | < 0.000050 | < 0.000050 | n/c | 0 |
| Titanium | 7440-32-6 | mg/L | >50% | >2 | 0.00030 | 0.0015 | no | < 0.00030 | < 0.00030 | n/c | 0 |
| Zinc | 7440-66-6 | mg/L | >50% | >2 | 0.0010 | 0.005 | no | 0.0032 | 0.0031 | n/c | 0.1 |
| **BC Groundwater: PFAAs** | | | | | | | | | | | |
| Perfluoro-1-Octanesulfonate (PFOS) | 1763-23-1 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Perfluorobutanoic acid | 375-22-4 | ug/L | >50% | >2 | 0.80 | 4 | no | < 0.80 | < 0.80 | n/c | 0 |
| Perfluoroheptanoic Acid (PFHpA) | 375-85-9 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Perfluorohexane sulfonate (PFHXS) | 355-46-4 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Perfluorohexanoic Acid (PFHxA) | 307-24-4 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Perfluoro-n-octanoic acid (PFOA) | 335-67-1 | ug/L | >50% | >2 | 0.010 | 0.05 | no | < 0.010 | < 0.010 | n/c | 0 |
| Perfluorononanoic Acid (PFNA) | 375-95-1 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| Perfluoropentanoic Acid (PFPeA) | 2706-90-3 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| **PFAS** | | | | | | | | | | | |
| Perfluorobutane Sulfonate | 45187-15-3 | ug/L | >50% | >2 | 0.020 | 0.1 | no | < 0.020 | < 0.020 | n/c | 0 |
| **VOCs + BTEX** | | | | | | | | | | | |
| 1,2,4-Trimethylbenzene | 95-63-6 | ug/L | >50% | >2 | 1.0 | 5 | no | < 1.0 | < 1.0 | n/c | 0 |
| 1,2-dibromoethane (Ethylene Dibromide) (EDB) | 106-93-4 | ug/L | >50% | >2 | 0.2 | 1 | no | < 0.2 | < 0.2 | n/c | 0 |
| Benzene | 71-43-2 | ug/L | >50% | >2 | 0.50 | 2.5 | no | < 0.50 | < 0.50 | n/c | 0 |
| Ethylbenzene | 100-41-4 | ug/L | >50% | >2 | 0.50 | 2.5 | no | < 0.50 | < 0.50 | n/c | 0 |
| m,p-Xylenes | 179601-23-1 | ug/L | >50% | >2 | 0.50 | 2.5 | no | < 0.50 | < 0.50 | n/c | 0 |
| Methyl tert-Butyl Ether | 1634-04-4 | ug/L | >50% | >2 | 0.50 | 2.5 | no | < 0.50 | < 0.50 | n/c | 0 |
| o-Xylene | 95-47-6 | ug/L | >50% | >2 | 0.50 | 2.5 | no | 0.86 | 0.80 | n/c | 0.12 |
| Styrene | 100-42-5 | ug/L | >50% | >2 | 0.50 | 2.5 | no | < 0.50 | < 0.50 | n/c | 0 |
| Toluene | 108-88-3 | ug/L | >50% | >2 | 0.50 | 2.5 | no | < 0.50 | < 0.50 | n/c | 0 |
| Xylenes, Total | 1330-20-7 | ug/L | >50% | >2 | 0.75 | 3.75 | no | 0.86 | 0.80 | n/c | 0.08 |
| **VHCs** | | | | | | | | | | | |
| Volatile Hydrocarbons (C6-C10) | VH-C6C10 | ug/L | >50% | >2 | 100 | 500 | no | < 100 | < 100 | n/c | 0 |
| Volatile Petroleum Hydrocarbons (C6-C10) | VPH-C6C10 | ug/L | >50% | >2 | 100 | 500 | no | < 100 | < 100 | n/c | 0 |

Notes:
All values are expressed in ug/L unless otherwise noted
SCN = sample control number
FDA = field duplicate available
FD = field duplicate
QA/QC = quality assurance/quality control
RDL = reported detection limit indicates the minimum concentration that could be measured by laboratory instrumentation for a specific sample.
Relative Percent Difference (RPD) is calculated when the mean value is greater than five times the method reporting limit; Golder's internal QA/QC target is less than 35% (less than 50% for PAHs).
Difference Factor (DF) is calculated when the mean value is less than five times the method reporting limit; Golder's internal QA/QC target is less than 2.
NA = not applicable; NC = not calculated
**BOLD** font indicates the parameter analyzed exceeds Golder's internal QA/QC targets.

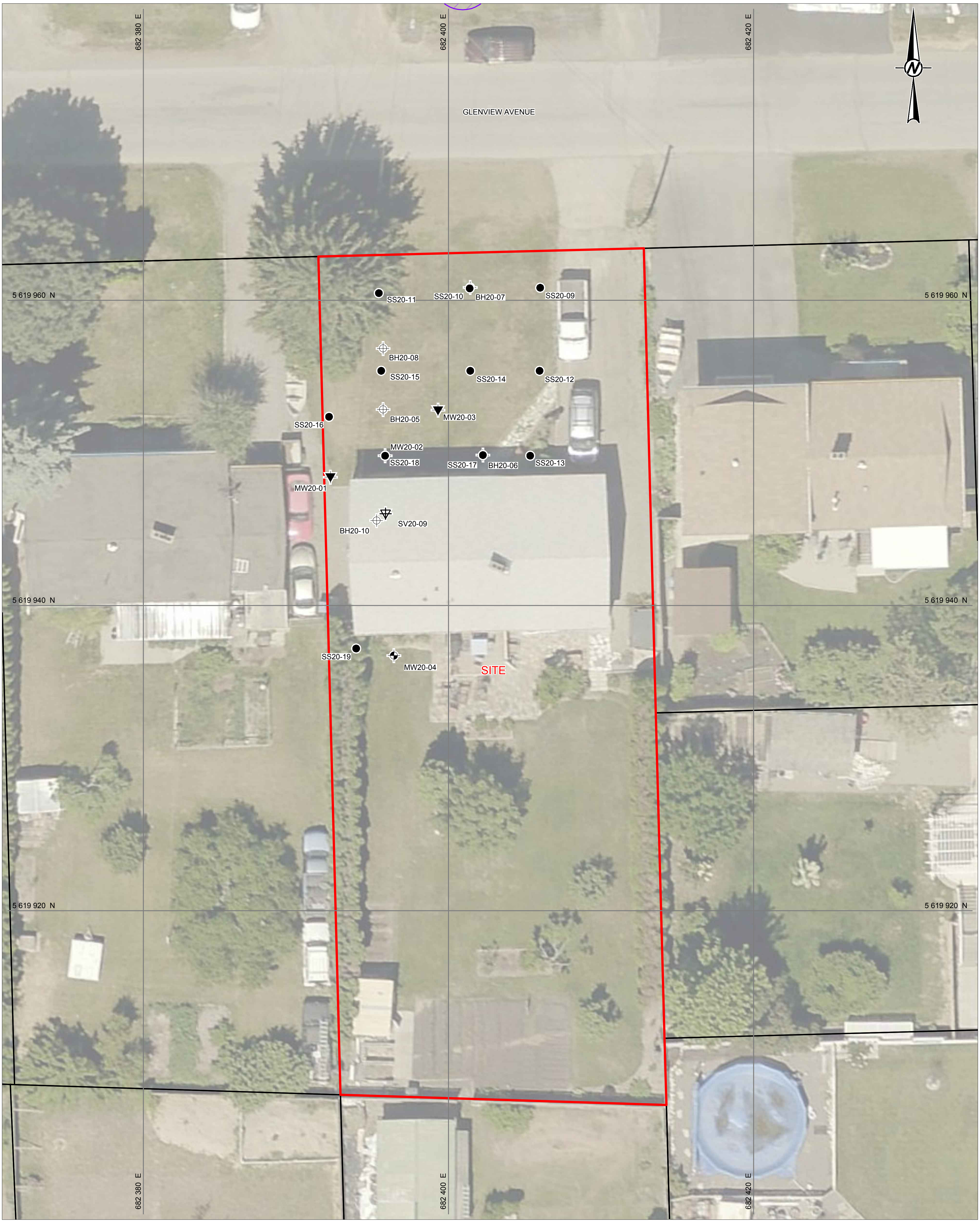
# Table 7 QAQC SOIL VAPOUR RESULTS
# SNOWBIRD ENVIRONMENTAL CLEAN-UP
# KAMLOOPS, BC

## Relative Percent Difference Calculations

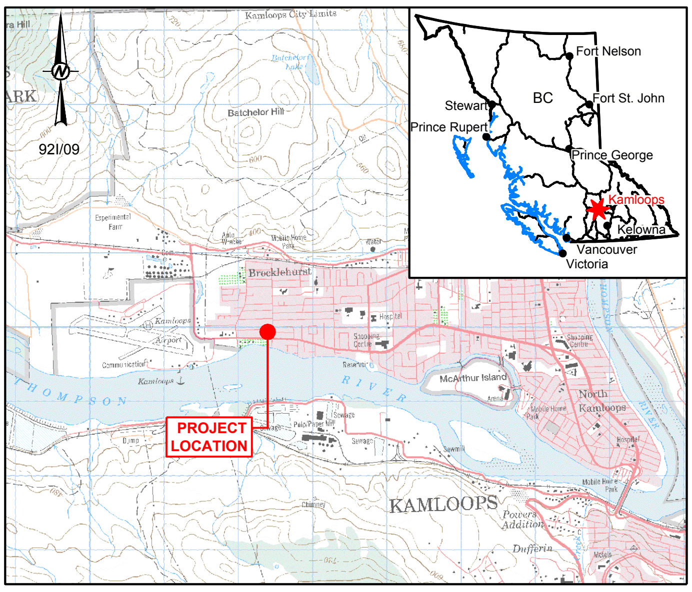
| Sample Location<br>Sample Name<br>Sample Collection Date<br>Sample Matrix | CAS # | Units | RPD Alert Limit | DF Alert Limit | RDL | SV20-03<br>02933-01<br>2020-06-18<br>SV | SV20-03<br>02933-02<br>2020-06-18<br>SV | RPD (%) | DF (unitless) |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| Naphthalene | 91-20-3 | ug/m3 | >50% | >2 | 13 | < 3 | < 3 | n/c | 0 |
| Volatile Hydrocarbons in Vapour (C6-C13) | VH-vC6C13 | ug/m3 | >50% | >2 | 1000 | 26300 | 27600 | 5 | n/c |
| Volatile Petroleum Hydrocarbons in Vapour (C6-C13) | PHC-V-vC6C13 | ug/m3 | >50% | >2 | 3900 | 26000 | 27300 | 5 | n/c |
| **VOCs + BTEX** | | | | | | | | | |
| 1,2,4-Trimethylbenzene | 95-63-6 | ug/m3 | >50% | >2 | 9.8 | 2.19 | 1.89 | n/c | 0.031 |
| 1,2-dibromoethane (Ethylene Dibromide) (EDB) | 106-93-4 | ug/m3 | >50% | >2 | 0.77 | <0.38 | <0.38 | n/c | 0 |
| 1,2-dichloroethane | 107-06-2 | ug/m3 | >50% | >2 | 0.40 | 1.20 | 1.19 | n/c | 0.0250 |
| 1,3,5-Trimethylbenzene | 108-67-8 | ug/m3 | >50% | >2 | 9.8 | <0.98 | <0.98 | n/c | 0 |
| 1,3-Butadiene | 106-99-0 | ug/m3 | >50% | >2 | 2.2 | 18.7 | 17.1 | 9 | n/c |
| Benzene | 71-43-2 | ug/m3 | >50% | >2 | 3.2 | 11.9 | 12.3 | n/c | 0.125 |
| Ethylbenzene | 100-41-4 | ug/m3 | >50% | >2 | 8.7 | 14.2 | 14.0 | n/c | 0.0230 |
| Isopropylbenzene | 98-82-8 | ug/m3 | >50% | >2 | 9.8 | < 9.8 | < 9.8 | n/c | 0 |
| m,p-Xylenes | 179601-23-1 | ug/m3 | >50% | >2 | 17 | < 17 | < 17 | n/c | 0 |
| Methyl Cyclohexane | 108-87-2 | ug/m3 | >50% | >2 | 40 | 990 | 1050 | 6 | n/c |
| Methyl tert-Butyl Ether | 1634-04-4 | ug/m3 | >50% | >2 | 7.2 | < 7.2 | < 7.2 | n/c | 0 |
| n-Decane | 124-18-5 | ug/m3 | >50% | >2 | 29 | < 29 | < 29 | n/c | 0 |
| n-Hexane | 110-54-3 | ug/m3 | >50% | >2 | 35 | 223 | 231 | 4 | n/c |
| o-Xylene | 95-47-6 | ug/m3 | >50% | >2 | 8.7 | 10.1 | 9.6 | n/c | 0.057 |
| Styrene | 100-42-5 | ug/m3 | >50% | >2 | 8.5 | < 8.5 | < 8.5 | n/c | 0 |
| Toluene | 108-88-3 | ug/m3 | >50% | >2 | 7.5 | 33.7 | 29.8 | n/c | 0.52 |
| Xylenes, Total | 1330-20-7 | ug/m3 | >50% | >2 | 20 | < 20 | < 20 | n/c | 0 |

Notes:
All values are expressed in ug/L unless otherwise noted
SCN = sample control number
FDA = field duplicate available
FD = field duplicate
QA/QC = quality assurance/quality control
RDL = reported detection limit indicates the minimum concentration that could be measured by laboratory instrumentation for a specific sample.
Relative Percent Difference (RPD) is calculated when the mean value is greater than five times the method reporting limit; Golder's internal QA/QC target is less than 35% (less than 50% for PAHs).
Difference Factor (DF) is calculated when the mean value is less than five times the method reporting limit; Golder's internal QA/QC target is less than 2.
NA = not applicable; NC = not calculated
**BOLD** font indicates the parameter analyzed exceeds Golder's internal QA/QC targets.

Path: \\golder.gds\complexdata\office\Kelowna\CAD-GIS\Client\PWGSC\CFB Snowbirds Kamloops\99_PROJECTS\20145856\1000\No Task\Enviro\02_PRODUCTION\DWG\Stage 2\ | File Name: 20145856_1000 - Site Plan.dwg | Last Edited By: ryjames Date: 2020-07-17 Time:9:12:46 AM | Printed By: RYJames Date: 2020-07-17 Time:9:18:34 AM



**KEY MAP** - NOT TO SCALE



0 5 10
1:250 METRES

**LEGEND**

| | |
|---|---|
| 🟥 | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ◓ | MONITORING WELL LOCATION |
| ⌖ | BOREHOLE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| ▽ | VAPOUR PROBE LOCATION |
| ● | SURFICIAL SOIL SAMPLE LOCATION |

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS IMAGE IS INTENDED FOR INDICATIVE PURPOSES ONLY

LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28

SITE SURVEY PROVIDED BY ALLNORTH IN DWG FORMAT ON 2020-07-08 FILE No.: 2001767SP_200707_To Client.dwg

KEY PLAN BACKGROUND AND BASE MAPPING FROM CANMATRIX 1: 50000 NTS - 92I/09

DATUM: NAD83, PROJECTION: UTM ZONE 10

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

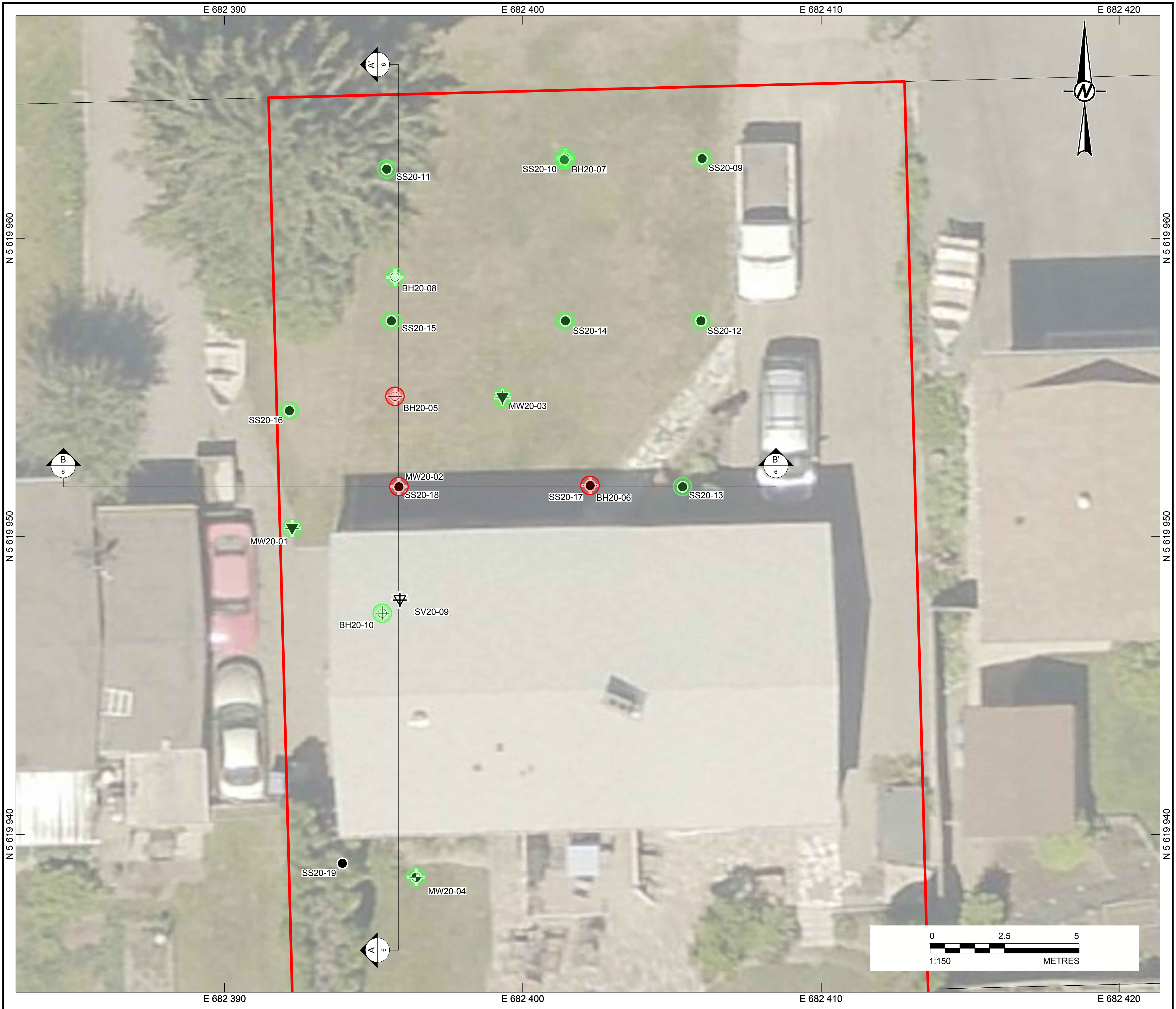
TITLE
**PROJECT LOCATION MAP AND SITE PLAN**

CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 1 |

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



| | | Location | SS20-09 | SS20-10 | SS20-11 | SS20-12 | SS20-13 | SS20-14 | SS20-15 | SS20-16 | SS20-17 | SS20-17 | SS20-18 | SS20-18 | MW20-01 | MW20-01 | MW20-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 25/May/20 | 25/May/20 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 |
| | | Sample Depth | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.9-1.05 m |
| | | QAQC | | | | | | | | | FDA | FD | FDA | FD | FDA | FD | |
| Parameter | CSR $RL_{LD}$ | Unit | | | | | | | | | | | | | | | |
| PID | | ppm | <0.1 | <0.1 | 9 | <0.1 | 1 | 1 | 3 | 1 | 426 | 426 | 878 | 878 | 4 | 4 | 2 |
| 2-methylnaphthalene | 60 | mg/kg | 0.029 | <0.010 | 0.340 | <0.010 | <0.010 | <0.010 | 0.221 | <0.010 | 4.52 | 2.95 | 68.9 | 59.2 | <0.010 | <0.010 | <0.010 |
| Naphthalene | 0.6 | mg/kg | <0.010 | <0.010 | <0.080 | <0.010 | <0.010 | <0.010 | <0.040 | <0.010 | 2.30 | 1.61 | *< 41* | *< 35* | <0.010 | <0.010 | <0.010 |
| Quinoline | 2.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.40 | <0.30 | *< 4.0* | *< 4.0* | <0.050 | <0.050 | <0.050 |
| LEPH | 1000 | mg/kg | <200 | <200 | 300 | <200 | <200 | <200 | 310 | <200 | 2150 | 1490 | 46000 | 41000 | <200 | <200 | <200 |
| HEPH | 1000 | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 1760 | 1450 | <200 | <200 | <200 |
| VPH (C6-C10) | 200 | mg/kg | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 4630 | 8200 | <100 | <100 | <100 |

| | | Location | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-02 | MW20-02 | MW20-02 | MW20-02 | MW20-02 | MW20-03 | MW20-03 | MW20-03 | MW20-04 | MW20-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 |
| | | Sample Depth | 2.4-2.55 m | 4.0 - 4.15 m | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m | 1.8-1.95 m | 3.7-4.0 m | 3.7-4.0 m | 4.6-4.75 m | 5.8-5.95 m | 0.05-0.15 m | 0.9-1.05 m | 3.96-4.11 m | 0.9-1.05 m | 2.4-2.55 m |
| | | QAQC | | | | | | | FDA | FD | | | | | | | |
| Parameter | CSR $RL_{LD}$ | Unit | | | | | | | | | | | | | | | |
| PID | | ppm | 2 | 2 | - | <0.1 | - | 944 | 1742 | 1742 | 38 | 22 | 122 | 14 | 442 | 86 | 4 |
| 2-methylnaphthalene | 60 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 11.7 | 3.22 | 3.57 | 0.064 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Naphthalene | 0.6 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | *<6.5* | *<2.00* | *<2.00* | <0.020 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Quinoline | 2.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <1.5 | <0.300 | <0.400 | <0.010 | <0.010 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| LEPH | 1000 | mg/kg | <200 | <200 | <200 | <200 | <200 | 8920 | 2300 | 2780 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| HEPH | 1000 | mg/kg | <200 | <200 | <200 | <200 | <200 | 240 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| VPH (C6-C10) | 200 | mg/kg | <100 | <100 | <100 | <100 | <100 | 860 | 1510 | 36 | <10 | - | <100 | <100 | <100 | <100 | <100 |

| | | Location | MW20-04 | MW20-04 | MW20-04 | BH20-05 | BH20-05 | BH20-05 | BH20-06 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-10 | BH20-10 | BH20-10 | BH20-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 |
| | | Sample Depth | 3.4 - 3.7 m | 4.0 - 4.6 m | 5.5 - 5.65 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 0.9-1.05 m | 0.05-0.15 m | 0.9-1.05 m | 0.9-1.05 m | 2.4-2.55 m | 4.0-4.3 m | 2.3-2.45 m* | 3.2-3.35 m* | 4.25-4.4 m* | 4.25-4.4 m* |
| | | QAQC | | | | | | | | | FDA | FD | | | | | FDA | FD |
| Parameter | CSR $RL_{LD}$ | Unit | | | | | | | | | | | | | | | | |
| PID | | ppm | 20 | 98 | 2 | 1122 | 2002 | 104 | 8 | 6 | 4 | 4 | 4 | 2 | <0.1 | <0.1 | <0.1 | <0.1 |
| 2-methylnaphthalene | 60 | mg/kg | <0.010 | <0.010 | <0.010 | 13.6 | 34.3 | 2.44 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Naphthalene | 0.6 | mg/kg | <0.010 | <0.010 | <0.010 | *<9.0* | *<30* | *<2.0* | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Quinoline | 2.5 | mg/kg | <0.050 | <0.050 | <0.050 | <2.0 | *<4.0* | <0.30 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.010 | <0.050 | <0.050 | <0.050 | <0.050 |
| LEPH | 1000 | mg/kg | <200 | <200 | <200 | 11300 | 24000 | 1510 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| HEPH | 1000 | mg/kg | <200 | <200 | <200 | 270 | 310 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| VPH (C6-C10) | 200 | mg/kg | <100 | <100 | <100 | 2240 | 3530 | <100 | - | <100 | <100 | <100 | - | <10 | <100 | <100 | <100 | <100 |

**LEGEND**

| | |
|---|---|
| ▬ | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ⊕ | MONITORING WELL LOCATION |
| ⊕ | BOREHOLE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| ▽ | VAPOUR PROBE LOCATION |
| ● | SURFICIAL SOIL SAMPLE LOCATION |
| 🟢 | SOIL PARAMETERS ARE LESS THAN APPLICABLE CSR $RL_{LD}$ STANDARDS |
| 🔴 | ONE OF MORE SOIL PARAMETER EXCEEDS APPLICABLE CSR $RL_{LD}$ STANDARDS |

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS
IMAGE IS INTENDED FOR INDICATIVE PURPOSES ONLY
LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28
SITE SURVEY PROVIDED BY ALLNORTH IN DWG FORMAT ON 2020-07-08
FILE No.: 2001767SP_200707_To Client.dwg
DATUM: NAD83, PROJECTION: UTM ZONE 10

**NOTES**

1. THE LOCATION OF BH20-08 IS APPROXIMATE
2. RESULTS ARE IN mg/kg (MILLIGRAMS PER KILOGRAM) UNLESS NOTED OTHERWISE
3. STANDARDS SHOWN ARE FROM THE CONTAMINATED SITES REGULATION (CSR BC REG 375/96 AND O.C. 1480/96 INCLUDES AMENDMENTS UP TO BC REG 13/2019, 24 JANUARY 2019
4. $RL_{LD}$ = RESIDENTIAL LOW DENSITY
5. LEPH = LIGHT EXTRACTABLE PETROLEUM HYDROCARBONS
6. HEPH = HEAVY EXTRACTABLE PETROLEUM HYDROCARBONS
7. VPH = VOLATILE PETROLEUM HYDROCARBONS
8. ppm = PARTS PER MILLION
9. PAH = POLYCYCLIC AROMATIC HYDROCARBONS
10. FIGURE TO BE READ WITH ACCOMPANYING REPORT
11. VALUES IN THE TABLE HIGHLIGHTED YELLOW EXCEED THE APPLICABLE REGULATORY CRITERIA
12. * THE DEPTH OF SAMPLES COLLECTED AT BH20-10 ARE EXPRESSED AS DEPTH BELOW OUTDOOR GROUND SURFACE
13. ONLY DATA FOR PARAMETERS RETAINED AS CONTAMINANTS OF CONCERN ARE INCLUDED IN THE FIGURE

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

TITLE
**SOIL ANALYTICAL RESULTS - HYDROCARBONS**

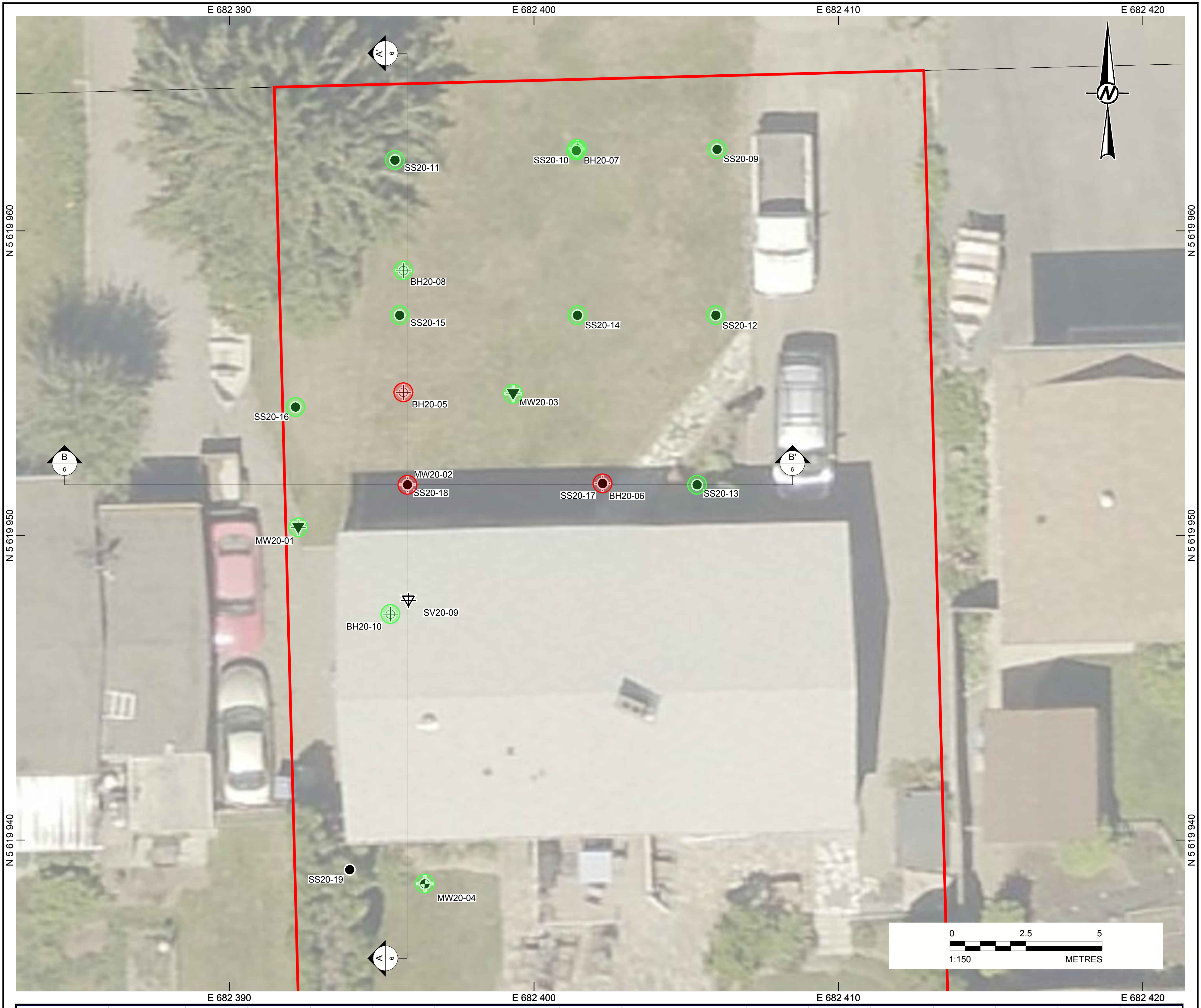
CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 2 |

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

Path: \\golder.gds\complexdata\office\Kelowna\CAD-GIS\Client\PWGSC\CFB Snowbirds Kamloops\99_PROJECTS\20145856\1000\No Task\Enviro\02_PRODUCTION\DWG\Stage 2\ | File Name: 20145856_1000 - Soil Results.dwg | Last Edited By: ryjames Date: 2020-07-17 Time:9:41:58 AM | Printed By: RYJames Date: 2020-07-17 Time:10:15:53 AM



| | | Location | SS20-09 | SS20-10 | SS20-11 | SS20-12 | SS20-13 | SS20-14 | SS20-15 | SS20-16 | SS20-17 | SS20-17 | SS20-18 | SS20-18 | MW20-01 | MW20-01 | MW20-01 | MW20-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 25/May/20 | 25/May/20 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 |
| | | Sample Depth | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.9-1.05 m | 4.0 - 4.15 m |
| | | QAQC | | | | | | | | | FDA | FD | FDA | FD | FDA | FD | | |
| Parameter | CSR RL$_{LD}$ | Unit | | | | | | | | | | | | | | | | |
| PID | | ppm | <0.1 | <0.1 | 9 | <0.1 | 1 | 1 | 3 | 1 | 426 | 426 | 878 | 878 | 4 | 4 | 2 | 2 |
| n-Nonane | 4.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 4.29 | 5.25 | 194 | 557 | <0.050 | <0.050 | <0.050 | <0.050 |
| 1,2-dibromoethane | 3.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.15 | <0.20 | *< 8.5* | *< 13* | <0.050 | <0.050 | <0.050 | <0.050 |
| Benzene | 0.035 | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0091 | 0.0089 | 1.65 | 3.43 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Toluene | 0.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 0.126 | 0.135 | 22.1 | 40.8 | <0.050 | <0.050 | <0.050 | <0.050 |
| Ethylbenzene | 15 | mg/kg | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | 0.838 | 0.828 | 57.7 | 97.1 | <0.015 | <0.015 | <0.015 | <0.015 |
| Xylenes | 6.5 | mg/kg | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | 6.34 | 5.93 | 369 | 603 | <0.075 | <0.075 | <0.075 | <0.075 |

| | | Location | MW20-01 | MW20-01 | MW20-01 | MW20-02 | MW20-02 | MW20-02 | MW20-02 | MW20-02 | MW20-03 | MW20-03 | MW20-03 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | MW20-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 |
| | | Sample Depth | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m | 1.8-1.95 m | 3.7-4.0 m | 3.7-4.0 m | 4.6-4.75 m | 5.8-5.95 m | 0.05-0.15 m | 0.9-1.05 m | 3.96-4.11 m | 0.9-1.05 m | 2.4-2.55 m | 3.4 - 3.7 m | 4.0 - 4.6 m | 5.5 - 5.65 m |
| | | QAQC | | | | | FDA | FD | | | | | | | | | | |
| Parameter | CSR RL$_{LD}$ | Unit | | | | | | | | | | | | | | | | |
| PID | | ppm | - | <0.1 | - | 944 | 1742 | 1742 | 38 | 22 | 122 | 14 | 442 | 86 | 4 | 20 | 98 | 2 |
| n-Nonane | 4.5 | mg/kg | <0.050 | <0.050 | <0.050 | - | 80.5 | 2.30 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| 1,2-dibromoethane | 3.5 | mg/kg | <0.050 | <0.050 | <0.050 | - | <0.400 | <0.050 | <0.050 | - | <0.050 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Benzene | 0.035 | mg/kg | <0.0050 | <0.0050 | <0.0050 | 0.399 | 0.345 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0074 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Toluene | 0.5 | mg/kg | <0.050 | <0.050 | <0.050 | 7.03 | 8.12 | 0.053 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Ethylbenzene | 15 | mg/kg | <0.015 | <0.015 | <0.015 | 15.2 | 12.8 | 0.114 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Xylenes | 6.5 | mg/kg | <0.075 | <0.075 | <0.075 | 91.1 | 72.1 | 0.884 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |

| | | Location | MW20-01 | MW20-01 | MW20-01 | MW20-02 | BH20-05 | BH20-05 | BH20-05 | BH20-06 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-10 | BH20-10 | BH20-10 | BH20-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 |
| | | Sample Depth | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m | 1.8-1.95 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 0.9-1.05 m | 0.05-0.15 m | 0.9-1.05 m | 0.9-1.05 m | 4.0-4.3 m | 2.3-2.45 m* | 3.2-3.35 m* | 4.25-4.4 m* | 4.25-4.4 m* |
| | | QAQC | | | | | | | | | | FDA | FD | | | | FDA | FD |
| Parameter | CSR RL$_{LD}$ | Unit | | | | | | | | | | | | | | | | |
| PID | | ppm | - | <0.1 | - | 944 | 1122 | 2002 | 104 | 8 | 6 | 4 | 4 | 2 | <0.1 | <0.1 | <0.1 | <0.1 |
| n-Nonane | 4.5 | mg/kg | <0.050 | <0.050 | <0.050 | - | 233 | 304 | 1.25 | <0.050 | <0.060 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| 1,2-dibromoethane | 3.5 | mg/kg | <0.050 | <0.050 | <0.050 | - | <0.60 | <0.90 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Benzene | 0.035 | mg/kg | <0.0050 | <0.0050 | <0.0050 | 0.399 | 0.818 | 1.93 | 0.0115 | - | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Toluene | 0.5 | mg/kg | <0.050 | <0.050 | <0.050 | 7.03 | 15.1 | 28.3 | 0.145 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Ethylbenzene | 15 | mg/kg | <0.015 | <0.015 | <0.015 | 15.2 | 25.5 | 49.5 | 0.270 | - | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Xylenes | 6.5 | mg/kg | <0.075 | <0.075 | <0.075 | 91.1 | 154 | 298 | 1.78 | - | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |

**LEGEND**

| | |
|---|---|
| 🟥 | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ⊕ | MONITORING WELL LOCATION |
| ⊕ | BOREHOLE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| ▽ | VAPOUR PROBE LOCATION |
| ● | SURFICIAL SOIL SAMPLE LOCATION |
| 🟢 | SOIL PARAMETERS ARE LESS THAN APPLICABLE CSR RL$_{LD}$ STANDARDS |
| 🔴 | ONE OF MORE SOIL PARAMETER EXCEEDS APPLICABLE CSR RL$_{LD}$ STANDARDS |

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS
IMAGE IS INTENDED FOR INDICATIVE PURPOSES ONLY
LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28
SITE SURVEY PROVIDED BY ALLNORTH IN DWG FORMAT ON 2020-07-08
FILE No.: 2001767SP_200707_To Client.dwg
DATUM: NAD83, PROJECTION: UTM ZONE 10

**NOTES**

1. THE LOCATION OF BH20-08 IS APPROXIMATE
2. RESULTS ARE IN mg/kg (MILLIGRAMS PER KILOGRAM) UNLESS NOTED OTHERWISE
3. STANDARDS SHOWN ARE FROM THE CONTAMINATED SITES REGULATION (CSR BC REG 375/96 AND O.C. 1480/96 INCLUDES AMENDMENTS UP TO BC REG 13/2019, 24 JANUARY 2019
4. RL$_{LD}$ = RESIDENTIAL LOW DENSITY
5. VOC = VOLATILE ORGANIC COMPOUNDS
6. BTEX = BENZENE, TOLUENE, ETHYLBENZENE, XYLENE
7. FIGURE TO BE READ WITH ACCOMPANYING REPORT
8. VALUES IN THE TABLE HIGHLIGHTED YELLOW EXCEED THE APPLICABLE REGULATORY CRITERIA
9. * THE DEPTH OF SAMPLES COLLECTED AT BH20-10 ARE EXPRESSED AS DEPTH BELOW OUTDOOR GROUND SURFACE
10. ONLY DATA FOR PARAMETERS RETAINED AS CONTAMINANTS OF CONCERN ARE INCLUDED IN THE FIGURE

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

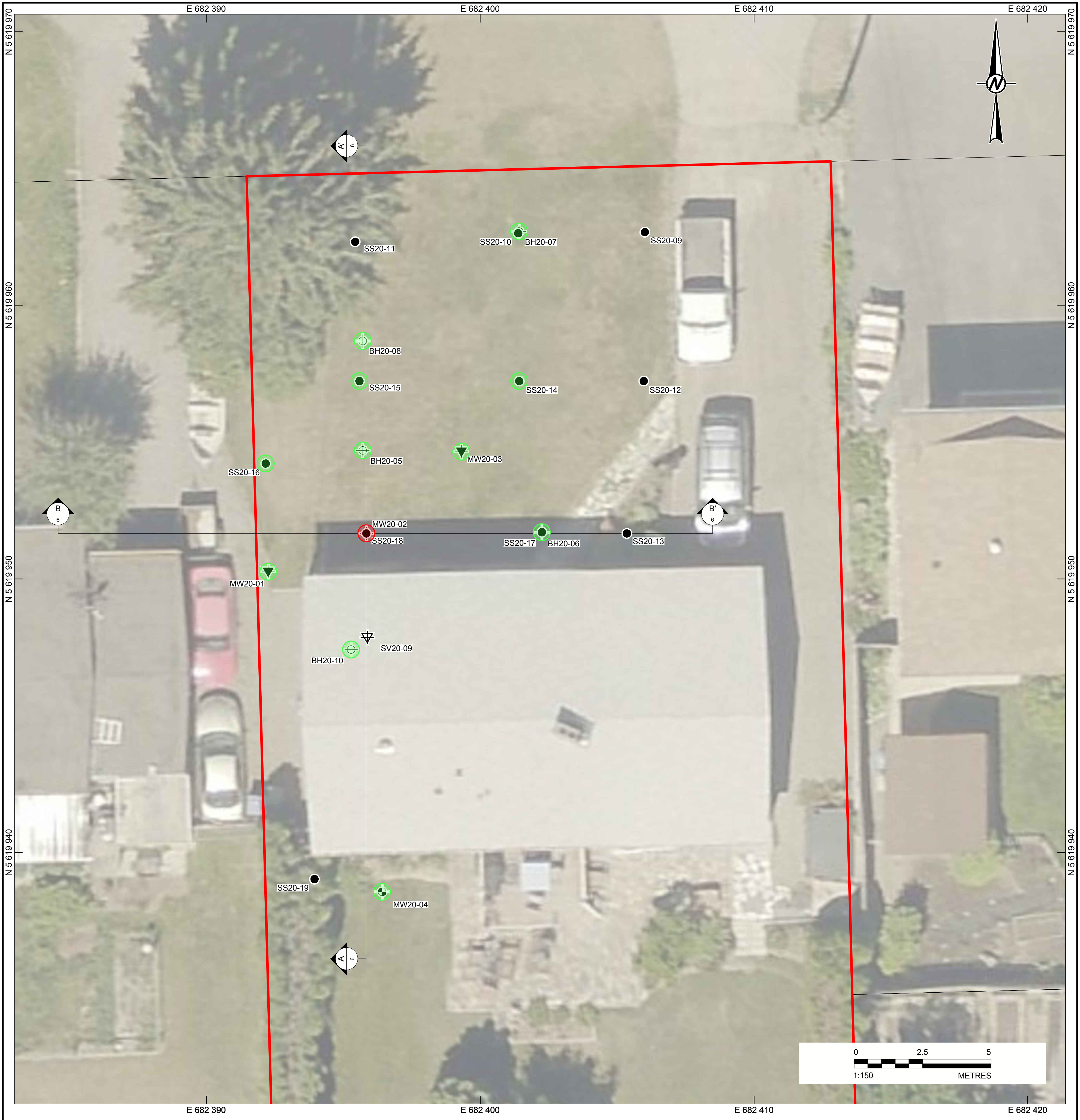
TITLE
**SOIL ANALYTICAL RESULTS - BTEX/VOC**

CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 3 |

Path: \\golder.gds\complexdata\office\Kelowna\CAD-GIS\Client\PWGSC\CFB Snowbirds Kamloops\99_PROJECTS\20145856\1000\No Task\Enviro\02_PRODUCTION\DWG\Stage 2\ | File Name: 20145856_1000 - Soil Results.dwg | Last Edited By: ryjames Date: 2020-07-10 Time:3:03:02 PM | Printed By: RYJames Date: 2020-07-17 Time:9:27:24 AM



|  | Location | SS20-14 | SS20-15 | SS20-16 | SS20-17 | SS20-17 | SS20-18 | SS20-18 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Sample Date | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 25/May/20 | 25/May/20 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 |
|  | Sample Depth | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 4.0 - 4.15 m | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m |
|  | QAQC |  |  |  | FDA | FD | FDA | FD | FDA | FD |  |  |  |  |  |  |

| Parameter | CSR $RL_{LD}$ | Unit |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH |  | pH | 6.96 | 6.61 | 6.71 | 6.11 | 5.86 | 6.81 | 6.93 | 8.05 | 8.14 | 8.06 | 8.16 | 7.72 | 6.79 | 7.38 | 7.39 |
| Cadmium | 1-20 | mg/kg | 0.266 | 0.202 | 0.147 | 0.169 | 0.173 | 32.8 | 26.6 | 0.139 | 0.166 | 0.118 | 0.080 | 0.035 | 0.065 | 0.063 | 0.090 |
| Chromium | 60 | mg/kg | 58.9 | 45.4 | 50.2 | 45.1 | 49.5 | 75.8 | 79.8 | 45.9 | 43.2 | 39.8 | 41.2 | 20.0 | 27.7 | 15.8 | 16.9 |

|  | Location | MW20-02 | MW20-02 | MW20-02 | MW20-03 | MW20-03 | MW20-04 | MW20-04 | MW20-04 | BH20-05 | BH20-05 | BH20-05 | BH20-08 | BH20-10 | BH20-10 | BH20-10 | BH20-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Sample Date | 12-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 12-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 |
|  | Sample Depth | 3.7-4.0 m | 3.7-4.0 m | 4.6-4.75 m | 0.05-0.15 m | 0.9-1.05 m | 3.4 - 3.7 m | 4.0 - 4.6 m | 5.5 - 5.65 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 4.0-4.3 m | 2.3-2.45 m* | 3.2-3.35 m* | 4.25-4.4 m* | 4.25-4.4 m* |
|  | QAQC | FDA | FD |  |  |  |  |  |  |  |  |  |  |  |  | FDA | FD |

| Parameter | CSR $RL_{LD}$ | Unit |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH |  | pH | 7.19 | 7.29 | 7.39 | 6.51 | 6.93 | 7.70 | 7.56 | 6.93 | 7.13 | 7.20 | 7.50 | 8.31 | 7.35 | 7.55 | 7.37 | 7.43 |
| Cadmium | 1-20 | mg/kg | 0.118 | 0.097 | 0.039 | 0.203 | 0.116 | 0.046 | 0.034 | 0.142 | 0.227 | 0.121 | 0.218 | 0.032 | 0.042 | 0.048 | 0.037 | 0.035 |
| Chromium | 60 | mg/kg | 21.6 | 23.0 | 20.2 | 45.6 | 52.6 | 17.7 | 18.9 | 26.0 | 58.2 | 53.8 | 45.0 | 11.3 | 17.5 | 18.6 | 19.7 | 16.3 |

**LEGEND**

|  |  |
|---|---|
| ━ | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ◐ | MONITORING WELL LOCATION |
| ⊕ | BOREHOLE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| ▽ | VAPOUR PROBE LOCATION |
| ● | SURFICIAL SOIL SAMPLE LOCATION |
| 🟢 | SOIL PARAMETERS ARE LESS THAN APPLICABLE CSR $RL_{LD}$ STANDARDS, |
| 🔴 | ONE OF MORE SOIL PARAMETER EXCEEDS APPLICABLE CSR $RL_{LD}$ STANDARDS |

**NOTES**

1. THE LOCATION OF BH20-08 IS APPROXIMATE
2. RESULTS ARE IN mg/kg (MILLIGRAMS PER KILOGRAM) UNLESS NOTED OTHERWISE
3. STANDARDS SHOWN ARE FROM THE CONTAMINATED SITES REGULATION (CSR BC REG 375/96 AND O.C. 1480/96 INCLUDES AMENDMENTS UP TO BC REG 13/2019, 24 JANUARY 2019
4. $RL_{LD}$ = RESIDENTIAL LOW DENSITY
5. FIGURE TO BE READ WITH ACCOMPANYING REPORT
6. VALUES IN THE TABLE HIGHLIGHTED YELLOW EXCEED THE APPLICABLE REGULATORY CRITERIA
7. * THE DEPTH OF SAMPLES COLLECTED AT BH20-10 ARE EXPRESSED AS DEPTH BELOW OUTDOOR GROUND SURFACE
8. ONLY DATA FOR PARAMETERS RETAINED AS CONTAMINANTS OF CONCERN ARE INCLUDED IN THE FIGURE

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS
IMAGE IS INTENDED FOR INDICATIVE PURPOSES ONLY
LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28
SITE SURVEY PROVIDED BY ALLNORTH IN DWG FORMAT ON 2020-07-08
FILE No.: 2001767SP_200707_To Client.dwg
DATUM: NAD83, PROJECTION: UTM ZONE 10

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

TITLE
**SOIL ANALYTICAL RESULTS - METALS**

CONSULTANT
GOLDER

|  |  |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 4 |

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

**LEGEND**

| | |
|---|---|
| 🟥 | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ⊕ | MONITORING WELL LOCATION |
| ⊕ | BOREHOLE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| ▽ | VAPOUR PROBE LOCATION |
| ● | SURFICIAL SOIL SAMPLE LOCATION |
| 🟩 | SOIL PARAMETERS ARE LESS THAN APPLICABLE CSR $RL_{LD}$ STANDARDS, |
| 🟥 | ONE OF MORE SOIL PARAMETER EXCEEDS APPLICABLE CSR $RL_{LD}$ STANDARDS |

**NOTES**

1. THE LOCATION OF BH20-08 IS APPROXIMATE
2. RESULTS ARE IN mg/kg (MILLIGRAMS PER KILOGRAM) UNLESS NOTED OTHERWISE
3. STANDARDS SHOWN ARE FROM THE CONTAMINATED SITES REGULATION (CSR BC REG 375/96 AND O.C. 1480/96 INCLUDES AMENDMENTS UP TO BC REG 13/2019, 24 JANUARY 2019
4. $RL_{LD}$ = RESIDENTIAL LOW DENSITY
5. PFAS = PERFLUORINATED AND POLYFLUORINATED ALKYL SUBSTANCES
6. PFAS INCLUDES: PERFLUOROBUTANE SULFONATE (PFBS) AND PERFLUOROOCTANCE SULFONATE (PFOS)
7. FIGURE TO BE READ WITH ACCOMPANYING REPORT
8. ONLY DATA FOR PARAMETERS RETAINED AS CONTAMINANTS OF CONCERN ARE INCLUDED IN THE FIGURE

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS
IMAGE IS INTENDED FOR INDICATIVE PURPOSES ONLY
LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28
SITE SURVEY PROVIDED BY ALLNORTH IN DWG FORMAT ON 2020-07-08
FILE No.: 2001767SP_200707_To Client.dwg
DATUM: NAD83, PROJECTION: UTM ZONE 10

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

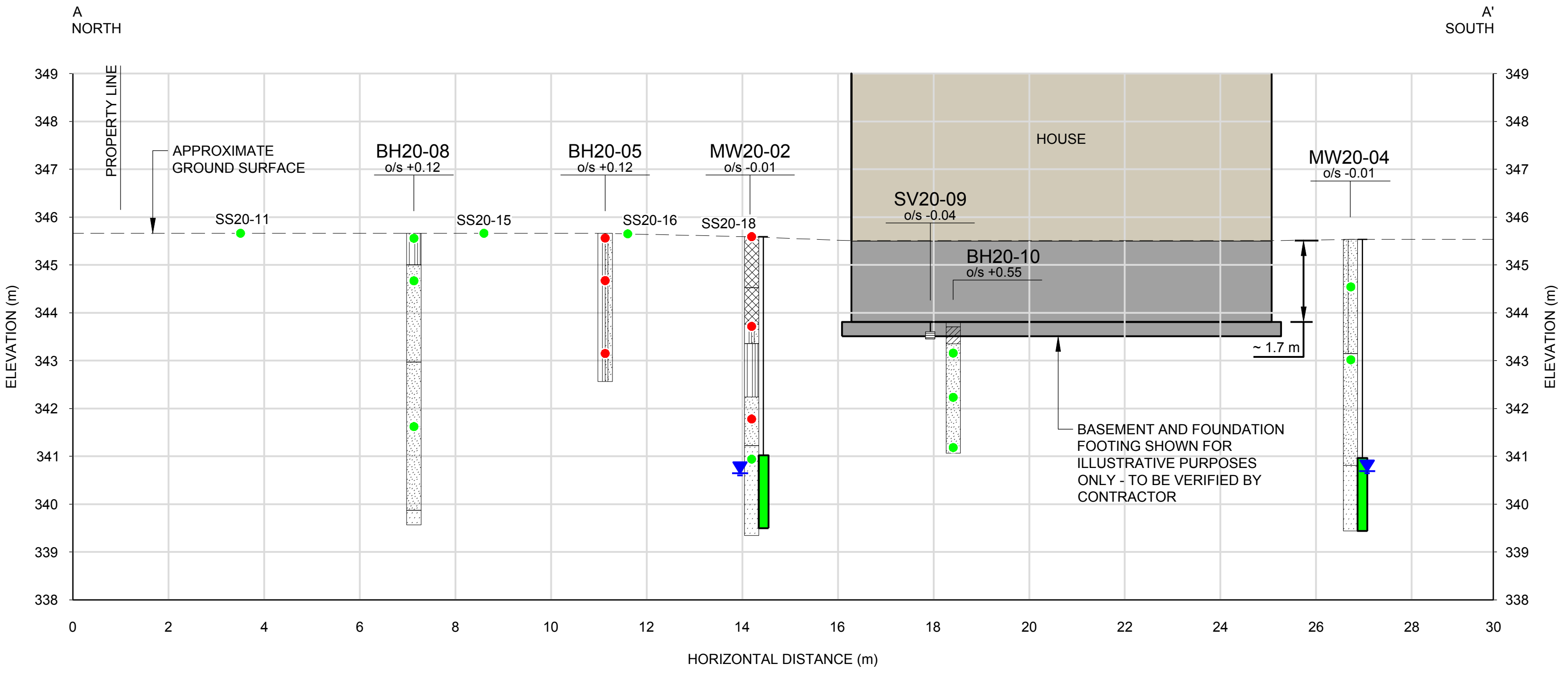
TITLE
**SOIL ANALYTICAL RESULTS - PFAS**

CONSULTANT
GOLDER

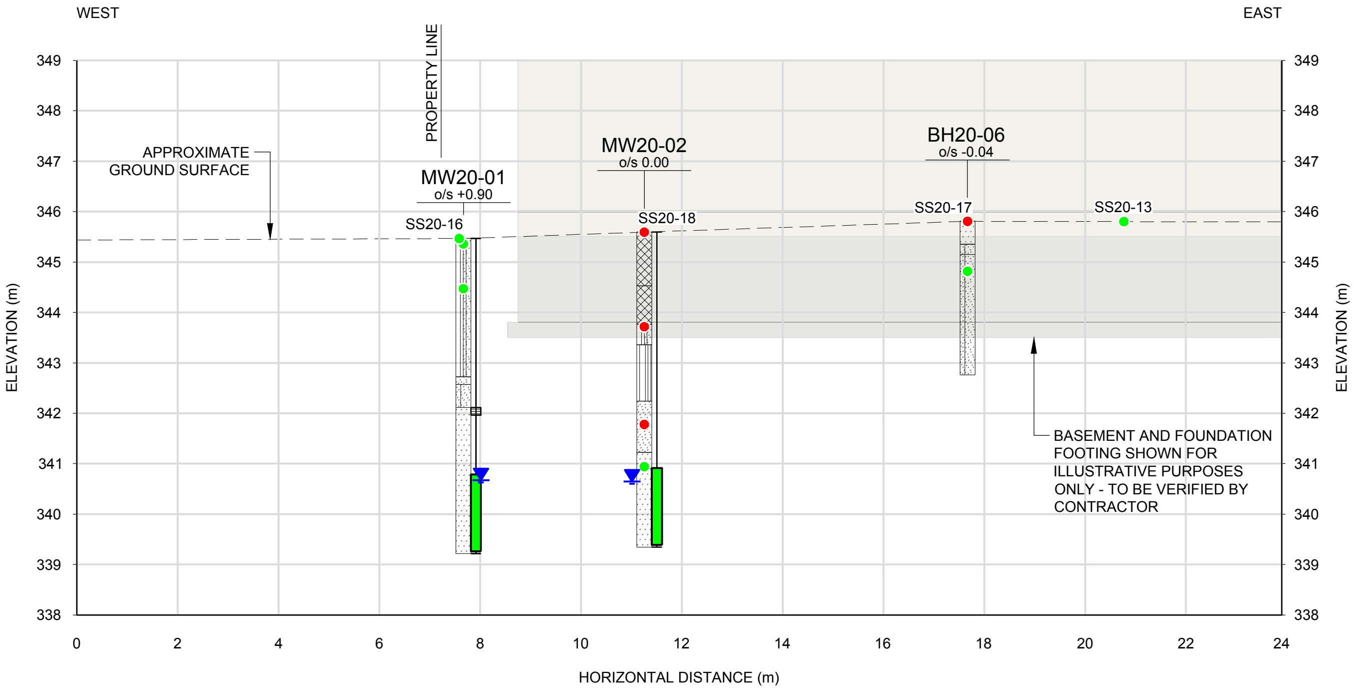
| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 5 |

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



HORZ SCALE 1:150
VERT SCALE 1:150
A
2
CROSS-SECTION A-A'



HORZ SCALE 1:150
VERT SCALE 1:150
B
2
CROSS-SECTION B-B'

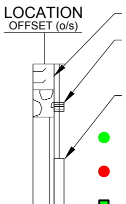
| | | Location | SS20-11 | SS20-13 | SS20-15 | SS20-16 | SS20-17 | SS20-17 | SS20-18 | SS20-18 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-01 | MW20-02 | MW20-02 | MW20-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 26/May/20 | 25/May/20 | 25/May/20 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 12-Jun-2020 |
| | | Sample De | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 4.0 - 4.15 m | 4.6 - 4.9 m | 5.5 - 5.65 m | 5.8 - 6.1 m | 1.8-1.95 m | 3.7-4.0 m | 3.7-4.0 m |
| | | QAQC | | | | | FDA | FD | FDA | FD | FDA | FD | | | | | | | | FDA | FD |
| Parameter | CSR RLLD$^1$ | Unit | | | | | | | | | | | | | | | | | | | |
| Cadmium | 3-20 | mg/kg | - | - | 0.202 | 0.147 | 0.169 | 0.173 | 32.8 | 26.6 | 0.139 | 0.166 | 0.118 | 0.080 | 0.035 | 0.065 | 0.063 | 0.090 | - | 0.118 | 0.097 |
| Chromium | 60 | mg/kg | - | - | 45.4 | 50.2 | 45.1 | 49.5 | 75.8 | 79.8 | 45.9 | 43.2 | 39.8 | 41.2 | 20.0 | 27.7 | 15.8 | 16.9 | - | 21.6 | 23.0 |
| n-Nonane | 4.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | 4.29 | 5.25 | 194 | 557 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | - | 80.5 | 2.30 |
| 1,2-dibromoethane | 3.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.15 | <0.20 | *< 8.5* | *< 13* | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | - | <0.400 | <0.050 |
| Benzene | 0.035 | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0091 | 0.0089 | 1.65 | 3.43 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.399 | 0.345 | <0.0050 |
| Toluene | 0.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | 0.126 | 0.135 | 22.1 | 40.8 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 7.03 | 8.12 | 0.053 |
| Ethylbenzene | 15 | mg/kg | <0.015 | <0.015 | <0.015 | <0.015 | 0.838 | 0.828 | 57.7 | 97.1 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | 15.2 | 12.8 | 0.114 |
| Xylenes, Total | 6.5 | mg/kg | <0.075 | <0.075 | <0.075 | <0.075 | 6.34 | 5.93 | 369 | 603 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | 91.1 | 72.1 | 0.884 |
| 2-methylnaphthalene | 60 | mg/kg | 0.340 | <0.010 | 0.221 | <0.010 | 4.52 | 2.95 | 68.9 | 59.2 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 11.7 | 3.22 | 3.57 |
| Naphthalene | 0.6 | mg/kg | <0.080 | <0.010 | <0.040 | <0.010 | 2.30 | 1.61 | *< 41* | *< 35* | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | *<6.5* | *<2.00* | *<2.00* |
| Quinoline | 2.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.40 | <0.30 | *< 4.0* | *< 4.0* | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <1.5 | <0.300 | <0.400 |
| LEPH | 1000 | mg/kg | 300 | <200 | 310 | <200 | 2150 | 1490 | 46000 | 41000 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 8920 | 2300 | 2780 |
| HEPH | 1000 | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | 1760 | 1450 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 240 | <200 | <200 |
| VPH | 200 | mg/kg | <100 | <100 | <100 | <100 | <100 | <100 | 4630 | 8200 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | 860 | 1510 | 36 |

| | | Location | MW20-02 | MW20-02 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | MW20-04 | BH20-05 | BH20-05 | BH20-05 | BH20-06 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-08 | BH20-10 | BH20-10 | BH20-10 | BH20-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 12-Jun-2020 | 12-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 10-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 11-Jun-2020 | 12-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 | 26-Jun-2020 |
| | | Sample De | 4.6-4.75 m | 5.8-5.95 m | 0.9-1.05 m | 2.4-2.55 m | 3.4 - 3.7 m | 4.0 - 4.6 m | 5.5 - 5.65 m | 0.05-0.15 m | 0.9-1.05 m | 2.4-2.55 m | 0.9-1.05 m | 0.05-0.15 m | 0.9-1.05 m | 0.9-1.05 m | 2.4-2.55 m | 4.0-4.3 m | 2.3-2.45 m* | 3.2-3.35 m* | 4.25-4.4 m* | 4.25-4.4 m* |
| | | QAQC | | | | | | | | | | | | | FDA | FD | | | | | FDA | FD |
| Parameter | CSR RLLD$^1$ | Unit | | | | | | | | | | | | | | | | | | | | |
| Cadmium | 3-20 | mg/kg | 0.039 | - | - | - | 0.046 | 0.034 | 0.142 | 0.227 | 0.121 | 0.218 | - | - | - | - | - | 0.032 | 0.042 | 0.048 | 0.037 | 0.035 |
| Chromium | 60 | mg/kg | 20.2 | - | - | - | 17.7 | 18.9 | 26.0 | 58.2 | 53.8 | 45.0 | - | - | - | - | - | 11.3 | 17.5 | 18.6 | 19.7 | 16.3 |
| n-Nonane | 4.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 233 | 304 | 1.25 | <0.050 | <0.060 | <0.050 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| 1,2-dibromoethane | 3.5 | mg/kg | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.60 | <0.90 | <0.050 | - | <0.050 | <0.050 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Benzene | 0.035 | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.818 | 1.93 | 0.0115 | - | <0.0050 | <0.0050 | <0.0050 | - | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Toluene | 0.5 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | 15.1 | 28.3 | 0.145 | - | <0.050 | <0.050 | <0.050 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Ethylbenzene | 15 | mg/kg | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 | 25.5 | 49.5 | 0.270 | - | <0.015 | <0.015 | <0.015 | - | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| Xylenes, Total | 6.5 | mg/kg | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 | 154 | 298 | 1.78 | - | <0.075 | <0.075 | <0.075 | - | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |
| 2-methylnaphthalene | 60 | mg/kg | 0.064 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 13.6 | 34.3 | 2.44 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Naphthalene | 0.6 | mg/kg | <0.020 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | *<9.0* | *<30* | *<2.0* | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Quinoline | 2.5 | mg/kg | <0.010 | <0.010 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <2.0 | *<4.0* | <0.30 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.010 | <0.050 | <0.050 | <0.050 | <0.050 |
| LEPH | 1000 | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 11300 | 24000 | 1510 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| HEPH | 1000 | mg/kg | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 270 | 310 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| VPH | 200 | mg/kg | <10 | - | <100 | <100 | <100 | <100 | <100 | 2240 | 3530 | <100 | - | <100 | <100 | <100 | - | <10 | <100 | <100 | <100 | <100 |

0 2.5 5
1:150 METRES

**LEGEND**

- - - - - - - APPROXIMATE GROUND SURFACE



SOIL STRATIGRAPHY
VAPOUR PROBE
WELL SCREEN INTERVAL

● SOIL CONCENTRATION MEETS APPLICABLE STANDARDS
● SOIL CONCENTRATION IS GREATER THAN ONE OR MORE APPLICABLE STANDARD
▯ GROUNDWATER CONCENTRATION MEETS APPLICABLE STANDARDS
▼ MEASURED WATER LEVEL (JUNE 10-12, 2020)

**TEST HOLE GRAPHICS**

| | | | | | |
|---|---|---|---|---|---|
| ☐ | NO DESCRIPTION AVAILABLE | ▨ | SAND (SP) | ▯ | SILT (MH) |
| ▩ | FILL | ▨ | SAND (SW) | ▯ | SILT (ML) |

VARIOUS COMBINATIONS OF THE ABOVE SYMBOLS HAVE BEEN USED TO REPRESENT MIXTURES OF THE ABOVE MATERIALS.

**NOTES**

1. THE LOCATION OF BH20-08 IS APPROXIMATE
2. RESULTS ARE IN mg/kg (MILLIGRAMS PER KILOGRAM) UNLESS NOTED OTHERWISE
3. STANDARDS SHOWN ARE FROM THE CONTAMINATED SITES REGULATION (CSR BC REG 375/96 AND O.C. 1480/96 INCLUDES AMENDMENTS UP TO BC REG 13/2019, 24 JANUARY 2019
4. $RL_{LD}$ = RESIDENTIAL LOW DENSITY
5. LEPH = LIGHT EXTRACTABLE PETROLEUM HYDROCARBONS
6. HEPH = HEAVY EXTRACABLE PETROLEUM HYDROCARBONS
7. VPH = VOLATILE PETROLEUM HYDROCARBONS
5. FIGURE TO BE READ WITH ACCOMPANYING REPORT
6. VALUES IN THE TABLE HIGHLIGHTED YELLOW EXCEED THE APPLICABLE REGULATORY CRITERIA
7. ONLY DATA FOR PARAMETERS RETAINED AS CONTAMINANTS OF CONCERN ARE INCLUDED IN THE FIGURE

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

TITLE
**CROSS-SECTION A-A' AND B-B'**

CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 6 |

**LEGEND**

| | |
|---|---|
| 🟥 | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ⊕ | MONITORING WELL LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| 🟢 | PARAMETERS ANALYZED MET THE MOST CONSERVATIVE CSR STANDARDS FOR DRINKING WATER AND/OR FRESHWATER AQUATIC LIFE. SAMPLING CONDUCTED JUNE, 2020 |

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY

LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28

DATUM: NAD83, PROJECTION: UTM ZONE 10

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

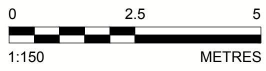
TITLE
**GROUNDWATER ANALYTICAL RESULTS**

CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 7 |

| | | Location | SV20-01 | | SV20-03 | | SV20-03 | | SV20-09 |
|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 2020-06-18 | | 2020-06-18 | | 2020-06-18 | | 2020-06-26 |
| | | Sampling Depth (mbgs) | 3.8– 4.1 | | 3.8– 4.1 | | 3.5–3.8 | | |
| | | | Indoor Air | Outdoor Air | Indoor Air | Outdoor Air | Indoor Air | Outdoor Air | Indoor Air |
| | | Attentuation factor (α) | Unattenuated | 0.00000061 | Unattenuated | 0.00000061 | Unattenuated | 0.00000061 | Unattenuated |
| **Parameter** | **CSR$^2$ (AL/PL/RL)** | **Units** | | | | | | | |
| Naphthalene | **3** | ug/m3 | **< 13** | 0.0000079 | **< 13** | 0.0000079 | **< 13** | 0.0000079 | **< 3.3** |
| Volatile Petroleum Hydrocarbons in Vapour (C6-C13) | **1000** | ug/m3 | **71000** | 0.043 | **26000** | 0.016 | **27300** | 0.0167 | **13600** |
| 1,2-dibromoethane | **0.5** | ug/m3 | **< 0.77** | 0.00000047 | **< 0.77** | 0.00000047 | **< 0.77** | 0.00000047 | < 0.19 |
| Benzene | **1.5** | ug/m3 | **44.7** | 0.0000273 | **11.9** | 0.00000726 | **12.3** | 0.00000750 | **4.85** |
| Xylenes, Total | **100** | ug/m3 | **261** | 0.000159 | < 20 | 0.000012 | < 20 | 0.000012 | 40.3 |
| 1,3-Butadiene | **2** | ug/m3 | **36.7** | 0.0000224 | **18.7** | 0.0000114 | **17.1** | 0.0000104 | < 0.55 |
| 1,2,4-Trimethylbenzene | **7** | ug/m3 | **< 9.8** | 0.0000060 | **< 9.8** | 0.0000060 | **< 9.8** | 0.0000060 | **9.4** |
| 1,3,5-Trimethylbenzene | **3.5** | ug/m3 | **21.1** | 0.0000129 | **< 9.8** | 0.0000060 | **< 9.8** | 0.0000060 | 2.5 |
| Methyl Cyclohexane | **1500** | ug/m3 | **2900** | 0.0018 | 990 | 0.000604 | 1050 | 0.000641 | **1660** |



**LEGEND**

| | |
|---|---|
| 🟥 | SITE BOUNDARY |
| — | LOT BOUNDARY |
| ▽ | VAPOUR PROBE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| 🟢 | SOIL VAPOUR PARAMETERS ARE LESS THAN APPLICABLE CSR SANDARDS |
| 🔴 | ONE OR MORE SOIL VAPOUR PARAMETER EXCEEDS APPLICABLE CSR STANDARDS |

**NOTES**

1. RESULTS ARE IN µg/m$^3$ (MICROGRAMS PER CUBIC METRE) UNLESS NOTED OTHERWISE
2. STANDARDS SHOWN ARE FROM THE CONTAMINATED SITES REGULATION (CSR BC REG 375/96 AND O.C. 1480/96 INCLUDES AMENDMENTS UP TO BC REG 13/2019, 24 JANUARY 2019
3. AL/RL/PL = AGRICULTURAL LAND USE/PARK LAND USE/RESIDENTIAL LAND USE
4. FIGURE TO BE READ WITH ACCOMPANYING REPORT
5. VALUES IN THE TABLE HIGHLIGHTED YELLOW EXCEED THE APPLICABLE REGULATORY CRITERIA
6. ONLY DATA FOR PARAMETERS RETAINED AS CONTAMINANTS OF CONCERN ARE INCLUDED IN THE FIGURE
7. TO EVALUATE SOIL VAPOUR INDOOR EXPOSURE, NO ATTENUATION FACTOR WAS APPLIED DUE TO CRACKS IN THE FOUNDATION AND BASEMENT SLAB

**REFERENCE(S)**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY

LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28

DATUM: NAD83, PROJECTION: UTM ZONE 10

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
SNOWBIRDS ENVIRONMENTAL CLEANUP
KAMLOOPS, BC

TITLE
**SOIL VAPOUR ANALYTICAL RESULTS**

CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-17 |
| DESIGNED | AU |
| PREPARED | RTJ |
| REVIEWED | AV |
| APPROVED | EVK |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 8 |

# APPENDIX A

# Site Photos

**Photo 1: Aerial view of the crash Site obtained 23 May 2020.**

**Photo 2: Photo looking South towards the crash site taken 26 May 2020.**

**Photo 3: Surficial soil sampling location SS20-17 (collected 26 May 2020).**

**Photo 4: Soils obtained from Auger drilling on 11 June 2020.**

**Photo 5: Auger drill rig onsite on 11 June 2020.**

**Photo 6: Auger drill rig onsite at location MW20-02 on 11 June 2020 for soil sampling and monitoring well installation.**

**Photo 7: Soil sampling from auger rig on 11 June 2020.**

**Photo 8: Looking downhole at MW20-03 on 11 June 2020.**

**Photo 9: Groundwater sampling at MW20-04 on 18 June 2020.**

**Photo 10: Equipment decontamination with PFAS-free water bath 18 June 2020.**

**Photo 11: Soil vapour sampling at MW20-03 on 19 June 2020.**

**Photo 12: Flow regulator and vacuum gauge of Summa Cannister samples.**

**Photo 13: Background soil sample obtained 0.05 - 0.15 m below ground surface on 19 June 2020**

**Photo 14: Borehole location BH20-10 after concrete was patched (bottom left of photo).**

**Photo 15: Temporary sub-slab vapour probe SV20-09 in the concrete slab foundation of the house.**

## APPENDIX B

# DND Spill Report Form

# HAZMAT INCIDENT/SPILL REPORT FORM

## A. GENERAL INFORMATION (All sections must be completed and information typed or printed)

| 1. Name of person submitting report | 2. Telephone | 3. Unit | 4. Section |
|---|---|---|---|
| Cheryl-Ann Beckles | 306-229-2881 | 15 Wing | Environment |

**5. Spill Initially reported to:**
B.C Ministry of Environment and Climate Change Strategy, Emergency Management British Columbia (EMBC) 1-800-663-3456. The EMBC Incident Report Number is **200560**.

**a. Section/ Unit:** 15 Wing, 431 Sqn

**b. Date (dd/mm/yyyy):** 17/05/2020

**c. Time (HH:MM):** 15:56

**d. Method: verbal ☐ , phone X , or email ☐**

| **6. Date and Time of Occurrence/Discovery** | **Date and Time Clean-Up** |
|---|---|
| **Date (dd/mm/yyyy):** 17/05/2020 | **Date (dd/mm/yyyy):** |
| **Time (HH:MM):** ~11:45 | **Time (HH:MM):** |

## B. SPILL INCIDENT INFORMATION

**7. Materials Spilled/Release:** fuels and oils

| **8. Quantity Spilled (litres or kilograms):** | **9. Quantity Recovered (litres or kilograms):** |
|---|---|
| Engine Oil – 4.2 L<br>Hydraulic Fluid – 5.9 L<br>F34,JP8 - 1552 L<br>Diesel – 168.2 L | |

**10. Source of Spill:** CT114 Tutor

**11. Cause of Spill:** Crash incident

**12. Effects of Spill:**

**13. Action taken to Mitigate Effects:**

## B. LOCATION

**14. Site of spill/incident:**
Residential area of Kamloops, British Columbia.

| **15. Did spill: (check all that apply)** | |
|---|---|
| - enter catch basin or storm drain? ☐ | **Distance from drain or catch basin: metres** |
| - travel off base property? ☐ | **Distance to property boundary: metres** |
| - enter surface water? ☐ | **Distance to surface water: metres** |

| |
|---|
| **C. WEATHER** |
| **16. Conditions and Temperature (°C):** ~ 14ºC |
| **D. CLEAN-UP** |
| **17. Contaminated spill response material and equipment collected from site?** |
| **18. Disposal location of contaminated material (B132?):** |
| **19. Actions taken to replace used spill response equipment:** |

| |
|---|
| **20. ADDITIONAL INFORMATION** |
| |
| |
| |
| |
| |
| |
| |
| |
| |

| **W Env O Office use only** | |
|---|---|
| *Reported Incident to DRMIS?* | *Notified External Agencies?* Yes, B.C Ministry of Environment and Climate Change Strategy, Emergency Management British Columbia (EMBC)<br>*The EMBC Incident Report Number is 200560.* |
| *Required follow up actions:* | |
| *Is a Significant Incident Required?* | *W Env O completed site visit? Yes, Marie Goulden, 19 Wing Environment Officer* |

**APPENDIX C**

# Potential Contaminants of Concern

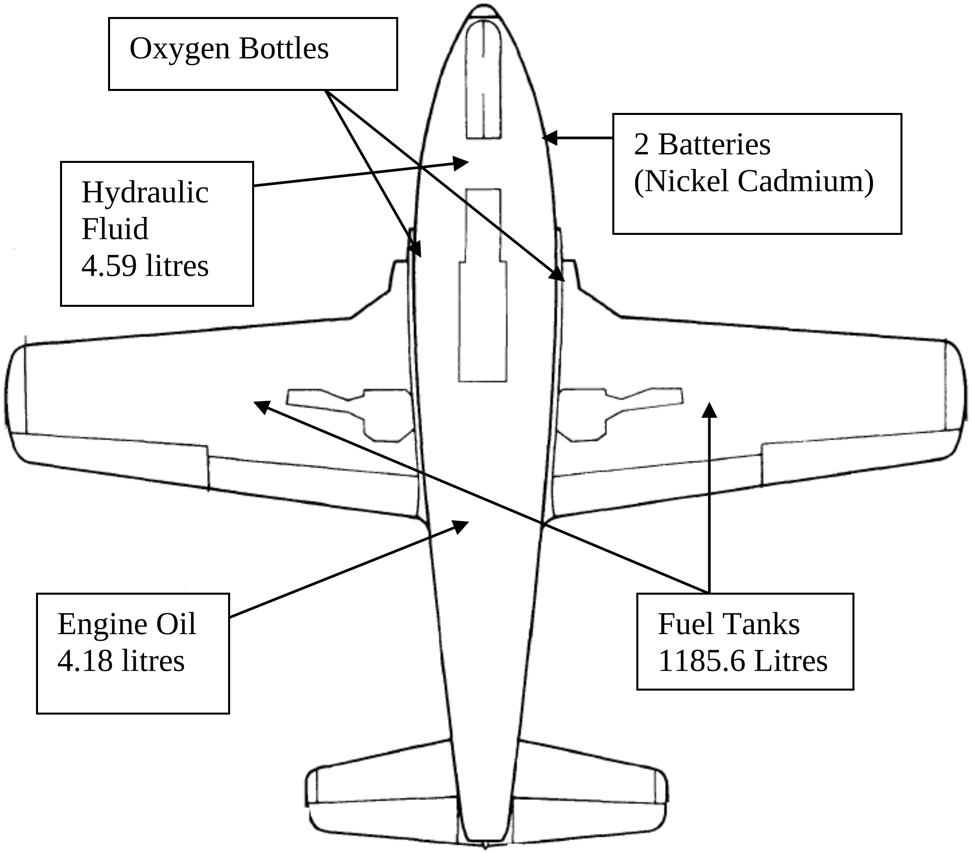
## CT-114 Tutor Fact Sheet

| Hazards | Quantity | Location | Impacts | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Land | Mitigation | Water | Mitigation | Air | Regulation | Human Health |
| **AFFF** | Not on board aircrafts. Used to put out fires in crashes. | A fire suppressant. | Aqueous film forming foams (AFFF) fire suppressing system may contain Perfluorooctane Sulfonate (PFOS), which is a known toxicant and is extremely difficult to remove by biodegradation, either naturally or accelerated. | N/A | Toxic to aquatic organisms. Fluorinated surfactants are persistent chemicals. Foams generally have high BOD values and their rapid biodegradation can deplete dissolved oxygen levels in water bodies which, in turn, may lead to asphyxiation of aquatic organisms (WHMIS MSDS). | N/A | N/A | This substance has been added to the CEPA List of Toxic Substances. It is entering or may enter the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity.<br>In addition, stocks of PFOS-based AFFFs placed on the market before December 27, 2006, may be used until June 27, 2011. | Routes of entry include dermal, inhalation and ingestion. Potential health effects include skin and eye irritation. Potentially a hepatoxin and immune suppressant. Not a carcinogen (WHMIS MSDS). |
| **Batteries (NiCad)** | Two (2) batteries | Front of aircraft | NiCad batteries contain cadmium, which is a toxic heavy metal and therefore requires special care during battery disposal. Cadmium strongly adsorbs to organic matter in soils. When cadmium is present in soils it can be extremely dangerous. | Phyto-remediation of cadmium and other heavy metals (lead, zinc) from soils can be accomplished by the use of such "hyperaccumulator" plants as Alpine pennycress that can accumulate up to 1,000 mg of cadmium per kg of dry plant matter. | In aquatic ecosystems cadmium can bio accumulate in mussels, oysters, shrimps, lobsters and fish. The susceptibility to cadmium can vary greatly between aquatic organisms. Salt-water organisms are known to be more resistant to cadmium poisoning than freshwater organisms.<br>Animals eating or drinking cadmium sometimes get high blood-pressures, liver disease and nerve or brain damage.<br>(Lenntech - www.lenntech.com) | N/A | When heated in air, it volatises and burns readily with a bright flame producing a brownish-yellow cadmium oxide fume. The fumes are toxic and the yellowish powder it forms is amorphous. | Regulated by CEPA - Schedule I<br>Exposure Limits - TWA: 0.01 (ppm)<br>Acute oral toxicity (LD50): 890 mg/kg for animals<br>Acute toxicity of the dust (LC50): 229.9 mg/m3 4 hour(s) for animals<br>WHMIS :CLASS D-1A: Material causing immediate and serious toxic effects | Cadmium is first transported to the liver through the blood. There, it bonds to proteins to form complexes that are transported to the kidneys. Cadmium accumulates in the kidneys, where it damages filtering mechanisms. This causes the excretion of essential proteins and sugars from the body and further kidney damage. It takes a long time for cadmium that has accumulated in kidneys to be excreted from the human body. Other health effects that can be caused by cadmium are:<br>- Diarrhea, stomach pains and severe vomiting<br>- Bone fracture<br>- Reproductive failure and possibly even infertility<br>- Damage to the central nervous system<br>- Damage to the immune system<br>- Psychological disorders<br>- Possibly DNA damage or cancer development<br>(Lenntech - www.lenntech.com) |
| **Cadmium** | Unknown | N/A | NiCd batteries contain cadmium, which is a toxic heavy metal and therefore requires special care during battery disposal. Cadmium strongly adsorbs to organic matter in soils. When cadmium is present in soils it can be extremely dangerous to terrestrial plants and animals.(Lenntech) | Phyto-remediation of cadmium and other heavy metals (lead, zinc) from soils can be accomplished by the use of such "hyperaccumulator" plants as Alpine pennycress that can accumulate up to 1,000 mg of cadmium per kg of dry plant matter. (Lenntech) | In aquatic ecosystems cadmium can bio-accumulate in mussels, oysters, shrimps, lobsters and fish. The susceptibility to cadmium can vary greatly between aquatic organisms. Salt-water organisms are known to be more resistant to cadmium poisoning than freshwater organisms. Ingestion of cadmium by animals can result in high blood-pressures, liver disease and nerve or brain damage (Lenntech) | N/A | When heated in air, it volatises and burns readily with a bright flame producing a brownish-yellow cadmium oxide fume. The fumes are toxic and the yellowish powder it forms is amorphous. (Lenntech) | Regulated by CEPA - Schedule I<br>Exposure Limits - TWA: 0.01 (ppm)<br>Acute oral toxicity (LD50): 890 mg/kg for animals<br>Acute toxicity of the dust (LC50): 229.9 mg/m$^3$ 4 hour(s) for animals<br>WHMIS :CLASS D-1A: Material causing immediate and serious toxic effects | Cadmium is first transported to the liver through the blood. There, it bonds to proteins to form complexes that are transported to the kidneys. Cadmium accumulates in the kidneys, where it damages filtering mechanisms. This causes the excretion of essential proteins and sugars from the body and further kidney damage. It takes a long time for cadmium that has accumulated in kidneys to be excreted from the human body. Other health effects that can be caused by cadmium are:<br>- Diarrhea, stomach pains and severe vomiting<br>- Bone fracture<br>- Reproductive failure and possibly even infertility<br>- Damage to the central nervous system<br>- Damage to the immune system<br>- Psychological disorders<br>- Possibly DNA damage or cancer development<br>(Lenntech - www.lenntech.com) |
| **Engine Oil** | 4.18 Litres | Engine of aircraft. | Engine oils contain PAH's, which can cause toxicity and long term effects. | Clean up of soil required - possible testing depending on quantity. Remove contaminated soils, and dispose of as per DND Hazwaste policy. | May be toxic to aquatic organisms, depending on type of fluid. | Remove all ignition sources. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Complete protective clothing including self-contained breathing apparatus | N/A | Spill reporting to EC required if more than 100L spilled as per DND requirement. | Found in modern jet oil, tricresyl phosphate (TCP) can lead to drowsiness, headaches, respiratory problems or neurological illnesses, a condition scientifically know as Aerotoxic Syndrome. TCP is used only in jet engine oil, where it acts as an anti-wear.(Witkowski, 2010) |
| **Fire Extinguishers** | Unknown | Unknown | Agent Unknown | Agent Unknown | Agent Unknown | Agent Unknown | Agent Unknown | Agent Unknown | Agent Unknown |
| **Fuel** | 5 fuel tanks (1185.6 Litres),<br>+<br>2 Auxiliary Tanks (379.2 Litres) | Centre of aircraft between wings,<br>and<br>External auxiliary tanks slung from the fuselage. | Hydrocarbon contamination in soil. | Clean up of soil required - possible testing depending on quantity. Remove contaminated soils, and dispose of as per DND Hazwaste policy. | Oil spreads into a thin layer on the water surface as a sheen. Once in the water, oil undergoes weathering, a process that describes the physical, chemical, and biological changes that occur when oil interacts with the environment. Weathering reduces the more toxic elements in oil products over time, as exposure to air, sunlight, wave and tidal action and certain microscopic organisms degrades and/or disperses oil. Weathering rates depend on factors such as type of oil, weather, temperature, and the type of shoreline and bottom that occur in the spill area. Jet Fuels are highly volatile and evaporate quickly. It is one of the most acutely toxic oils and generally affect aquatic life (fish, invertebrates, and plants) that live in the upper water column. | Remove all ignition sources. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Complete protective clothing including self-contained breathing apparatus. | N/A | Under the federal Fisheries Act, the release of any substance which is deleterious to fish or fish habitat is prohibited. Spill reporting to EC required if more than 100L as per DND requirement | Potential symptoms: Skin irritation (itching, burning, redness, rash), dermatitis, headache, fatigue, anorexia, dizziness, difficulty concentrating, poor coordination. Acute symptoms from ingestion include vomiting, diarrhea, cramps; drowsiness, restlessness, irritability, loss of consciousness, death, pneumonitis (from aspiration). (US Dept. of Labour OSHA) |

## CT-114 Tutor Fact Sheet

| Hazards | Quantity | Location | Impacts | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Land | Mitigation | Water | Mitigation | Air | Regulation | Human Health |
| **HFCs and CFCs** | Unknown | Air conditioning equipment | Many different types of CFC's and HFC's. A common one is Freon 113 (CFC). Because it is a liquid that does not bind well to soil, Freon 113 that makes its way into the ground can move through the ground and enter groundwater. Plants and animals are not likely to store Freon. (US EPA) | N/A | N/A | N/A | Ozone depleting substance. | Environment Canada - Must report leaks more than 100kg.<br>Ozone Depleting Substances Regulation<br>Prepare for risks that a thoughtful and reasonable person would foresee; and respond to risks and incidents as soon as possible (DAOD 4003). | N/A |
| **Hydraulic Fluid** | 4.59 Litres | See Fact Sheet | If spilled on soil, some of the ingredients in the hydraulic fluids mixture may stay on the top, while others may sink into the groundwater. How fast the ingredients move through soil depends on many things. These include how much is spilled, how much rain falls on the spill, and the type of soil (for example, hydraulic fluids will move quickly in sandy soil, but will move slower in heavy clay). | Clean up of soil required - possible testing depending on quantity. Remove contaminated soils, and dispose of as per DND Hazwaste policy. | In water, some ingredients of hydraulic fluids will transfer to the bottom and stay there. Fish may contain some hydraulic fluid ingredients. Eventually, the ingredients of hydraulic fluids are degraded in the environment, but complete degradation may take more than a year. (ATSDR) | Remove all ignition sources. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Complete protective clothing including self-contained breathing apparatus. | Remove all ignition sources. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Complete protective clothing including self-contained breathing apparatus. Remove contaminated soils, and dispose of as per DND Hazwaste policy. | Spill reporting to EC required if more than 100L spilled, as per DND requirement. Under the federal Fisheries Act, the release of any substance which is deleterious to fish or fish habitat is prohibited. | The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and EPA have not classified mineral oil hydraulic fluids, polyalphaolefin hydraulic fluids, and organophosphate ester hydraulic fluids for carcinogenic effects. Hydraulic fluids are often complex mixtures of many chemical components. A particular hydraulic fluid can differ in its chemical components from another hydraulic fluid even if the two fluids are in the same class. Thus, effects of exposure may differ. (ATSDR) |
| **Lead** | Unknown | Battery coverings in air crafts | Lead may be absorbed by soil particles and organic materials, especially those near the source of the lead. | Remove contaminated soils, and dispose of as per DND Hazwaste requirement. | Lead is largely insoluble in water, it is usually a minor constituent of surface and ground water. Because of lead's low solubility in water, its "uptake" in plants is usually limited. | N/A | N/A | Under the federal Fisheries Act, the release of any substance which is deleterious to fish or fish habitat is prohibited. Shipping or transport of substances containing lead are regulated under the federal Transportation of Dangerous Goods Act, while use of compounds containing lead are controlled by the Hazardous Products Act, the Food and Drug Act, and the Pest Control Products Act. Lead is also included in the Workplace Hazardous Materials Information System, operated by Health Canada. CEPA has reduced the lead content limit from 5000 mg/kg (0.5 percent by weight) to 600 mg/kg (0.06 percent by weight).<br>Canadian Drinking Water Quality Guidelines - Max. Acceptable Concentration - 0.01 mg/L | Short-term exposure to high levels of lead can cause vomiting, diarrhea, convulsions, coma or even death. Severe cases of lead poisoning are rare in Canada.(Heatlh Canada) |
| **Lead Paints** | Unknown | Outer shell of aircraft - older models only. | Lead may be absorbed by soil particles and organic materials, especially those near the source of the lead. | Remove contaminated soils, and dispose of as per DND Hazwaste requirement. | Lead is largely insoluble in water, it is usually a minor constituent of surface and ground water. Because of lead's low solubility in water, its "uptake" in plants is usually limited. | N/A | N/A | Shipping or transport of substances containing lead are regulated under the federal Transportation of Dangerous Goods Act, while use of compounds containing lead are controlled by the Hazardous Products Act, the Food and Drug Act, and the Pest Control Product Act. | Under the Surface Coating Materials Regulations, which came into effect in 2005, the lead limit was further reduced from 1976 levels. Paint manufacturers could no longer add lead to their paint. Some specialty coatings can contain higher levels of lead, but if they do, they must be labelled to warn against applying the paint to surfaces that children and pregnant women might come in contact with. Most indoor and outdoor paints produced before 1950 contained substantial amounts of lead. Stripping or sanding of old paint that contains lead may result in inhalation of lead particles.(Health Canada) |
| **Oxygen System** | Two (2) bottles | Located on each side of the aircraft in front of wings. | If grease or oil is exposed to high concentrations of pressurized oxygen, can cause explosions. | N/A | N/A | N/A | If there is physical damage to the cylinder, valves or plumbing, it can cause an explosive rupture. Oil grease and other foreign matter on oxygen equipment can cause violent explosions. | N/A | Liquid oxygen (a cryogenic fluid) may cause dangerous burns, and vessels in which it is stored may cause skin to freeze to them. Splashing, and eye damage, may occur.<br>If a container is defective or seriously damaged or tampered with, it may burst violently, creating shrapnel. Flammable substances, may flare up suddenly and uncontrollably in the presence of pure oxygen. Some substances that readily burn react so fast with the boil-off of pure liquid oxygen that they may explode.<br>Oxygen gas that boils off can "supercharge" the surroundings, exposing individuals breathing that atmosphere to possible oxygen toxicity. |

# ***CT 114 Tutor – Aircraft Fact Sheet***



<u>Additional Fuel</u>
2 Auxiliary Tanks:189.6 litres each
2 Smoke Tanks: 84.1 litres each

Source: Post Crash Environmental Guidelines, Department of National Defence, 2004

# Material Safety Data Sheet

## LA2199
## Methyl Carbitol Fuel Additive Grade

## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

**Product Id:** LA2199
**Product Name:** Methyl Carbitol Fuel Additive Grade
**Synonyms:** None
**Chemical Family:** None Known
**Application:** Solvent. Fuel Additive.

**Distributed By:**
Univar Canada Ltd.
9800 Van Horne Way
Richmond, BC
V6X 1W5

**Prepared By:** The Environment, Health and Safety Department of Univar Canada Ltd.
**Preparation date of MSDS:** 27/Apr/2015
**Telephone number of preparer: 1-866-686-4827**

**24-Hour Emergency Telephone Number (CANUTEC): (613) 996-6666**

## 2. HAZARDS IDENTIFICATION

**Potential Acute Health Effects:**
**Eye Contact:** May cause pain disproportionate to the level of irritation to eye tissue. May cause slight transient (temporary) eye irritation.
**Skin Contact:** Prolonged contact is essentially nonirritating to skin. Prolonged skin contact is unlikely to result in absorption of harmful amounts.
**Inhalation:** No significant irritation expected from a single short-term exposure.
**Ingestion:** Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

## 3. COMPOSITION / INFORMATION ON INGREDIENTS

| Ingredients | Percentage (W/W) | LD50s and LC50s Route & Species: |
|---|---|---|
| Diethylene Glycol Monomethyl Ether<br>111-77-3 | 99-100 | LC50 Inhalation Vapor >400 ppm (Rat) 13hrs<br>LD50 Dermal >2000 mg/kg (Rabbit)<br>LD50 Oral 4140 mg/kg (Rat) |
| Ethylene Glycol<br>107-21-1 | 0.1-1 | Oral LD50 Rat = 4000 mg/kg |

**Note:** No additional remark.

## 4. FIRST AID MEASURES

**Eye Contact:** Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.
**Skin Contact:** Wash skin with plenty of water.
**Inhalation:** Remove person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, get immediate medical attention.
**Ingestion:** Do NOT induce vomiting unless directed to do so by medical personnel. Do not give anything by mouth to an unconscious person. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs. Seek medical attention.
**Notes to Physician:** Treatment based on sound judgment of physician and individual reactions of patient.

## 5. FIRE FIGHTING MEASURES

**Flash Point:** 91 °C / 197 °F
**Flash Point Method:** Tag Closed Cup ASTM D3278
**Autoignition Temperature:** 240°C /464°F
**Flammable Limits in Air (%):** Lower: 1.38% Upper: 22.7%
**Extinguishing Media:** Water fog or fine spray, carbon dioxide, dry chemical, foam. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Do not use direct water stream, which will spread fire.
**Special Exposure Hazards:** Isolate and restrict area access. Move containers from fire area if you can do it without risk. Use water spray to cool fire-exposed containers and structures. Consider use of unmanned hose holder or monitor nozzles. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from the end of tanks. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Container may rupture from gas generation in a fire situation.
**Hazardous Decomposition/Combustion Materials (under fire conditions):** Decomposition products can include and are not limited to: Carbon monoxide. Carbon dioxide.
**Special Protective Equipment:** Fire fighters should wear full protective clothing, including self-contained breathing equipment.
**NFPA RATINGS FOR THIS PRODUCT ARE:** HEALTH 2, FLAMMABILITY 2, INSTABILITY 0
**HMIS RATINGS FOR THIS PRODUCT ARE:** HEALTH 2, FLAMMABILITY 2, REACTIVITY 0

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautionary Measures:** Wear appropriate protective equipment.
**Environmental Precautionary Measures:** Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. Consult local authorities.
**Procedure for Clean Up:** Isolate spill and stop leak where safe. Restrict access to unprotected personnel. Small spills: soak up with absorbent material and scoop into containers. Large spills : prevent contamination of waterways. Dike and pump into suitable containers. Clean up residual with absorbent material, place in appropriate container and flush with water.

## 7. HANDLING AND STORAGE

**Handling:** For industrial use only. Handle and open containers with care. Avoid contact with eyes, skin and clothing. Do not ingest. Avoid inhalation of chemical. Empty containers may contain hazardous product residues. Keep the containers closed when not in use. Protect against physical damage. Use appropriate personnel protective equipment. Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperature possibly resulting in spontaneous combustion. Do not cut, drill, grind, weld or perform similar operations on or near containers. Use with adequate ventilation.
**Storage:** Store in a cool, dry, well ventilated area, away from heat and ignition sources. Place away from incompatible materials. Store in accordance with good industrial practices. Store in the following materials(s): Carbon steel. Stainless steel. Phenolic lined steel drums. Do not store in aluminum, copper, copper alloys and galvanized containers. Storage Period: Bulk - 6 Months, Steel drums - 24 Months.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Engineering Controls:**

Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.
**Respiratory Protection:** If exposure exceeds occupational exposure limits, use an appropriate NIOSH approved respirator. In case of spill or leak resulting in unknown concentration, use a NIOSH approved supplied air respirator. Organic vapor respirator.
**Gloves:**

Appropriate chemical resistant gloves should be worn. Impervious gloves. Butyl rubber gloves.
**Skin Protection:** Normal work coveralls.
**Eyes:** Safety glasses with side shields or chemical goggles.
**Other Personal Protection Data:** Ensure that eyewash stations and safety showers are proximal to the work-station location.

| Ingredients | Exposure Limit - ACGIH | Exposure Limit - OSHA | Immediately Dangerous to Life or Health - IDLH |
|---|---|---|---|
| Diethylene Glycol Monomethyl Ether | Not available. | Not available. | Not Available. |
| Ethylene Glycol | 100 mg/m$^3$ Ceiling | 50 ppm Ceiling<br>125 mg/m$^3$ Ceiling | Not Available. |

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Physical State:** Liquid
**Color:** Colorless
**Odor:** Mild Sweet
**pH** Not Available.
**Specific Gravity:** 1.020 @ 20°C
**Boiling Point:** 194°C /381°F
**Freezing/Melting Point:** -69°C / -92°F
**Vapor Pressure:** 0.19 mmHg @ 20°C
**Vapor Density:** 4.2
**% Volatile by Volume:** 100
**Evaporation Rate:** 0.02
**Solubility:** Soluble in water.
**VOCs:** Not Available.
**Viscosity:** 3.5 mPa.s @ 25°C
**Molecular Weight:** 120.2 g/mol
**Other:** Not Available.

## 10. STABILITY AND REACTIVITY

**Chemical Stability:** Stable.
**Hazardous Polymerization:** Will not occur.
**Conditions to Avoid:** Product can oxidize at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.
**Materials to Avoid:** Strong oxidizers. Strong acids and bases.
**Hazardous Decomposition Products:** Decomposition products can include and are not limited to: Aldehydes. Ketones. Organic acids.
**Additional Information:**

No additional remark.

## 11. TOXICOLOGICAL INFORMATION

**Principle Routes of Exposure**

**Ingestion:** Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.
**Skin Contact:** Prolonged contact is essentially nonirritating to skin. Prolonged skin contact is unlikely to result in absorption of harmful amounts.
**Inhalation:** No significant irritation expected from a single short-term exposure.

## 11. TOXICOLOGICAL INFORMATION

**Eye Contact:** May cause pain disproportionate to the level of irritation to eye tissue. May cause slight transient (temporary) eye irritation.

**Additional Information:** In animals, diethylene glycol methyl ether has been reported to produce effects in the liver and kidney and, only after very high oral doses, in the testes and thymus.

**Acute Test of Product:**
**Acute Oral LD50:** Not Available.
**Acute Dermal LD50:** Not Available.
**Acute Inhalation LC50:** Not Available.

**Carcinogenicity:**

| Ingredients | IARC - Carcinogens | ACGIH - Carcinogens |
|---|---|---|
| Diethylene Glycol Monomethyl Ether | Not listed. | Not listed. |
| Ethylene Glycol | Not listed. | A4 |

**Carcinogenicity Comment:** No additional information available.

**Reproductive Toxicity/ Teratogenicity/ Embryotoxicity/ Mutagenicity:** In animals, diethylene glycol methyl ether is slightly toxic to the fetus at doses nontoxic to the mother following skin contact; birth defects have been seen only following high oral doses which have little relevance to human exposure.

## 12. ECOLOGICAL INFORMATION

**Ecotoxicological Information:**

| Ingredients | Ecotoxicity - Fish Species Data | Acute Crustaceans Toxicity: | Ecotoxicity - Freshwater Algae Data |
|---|---|---|---|
| Diethylene Glycol Monomethyl Ether | 5741 mg/L LC50 (Pimephales promelas) 96 h<br>7500 mg/L LC50 (Lepomis macrochirus) 96 h<br>7500 mg/L LC50 (Lepomis macrochirus) 96 h static | Not Available. | 500 mg/L EC50 Desmodesmus subspicatus 72 h |
| Ethylene Glycol | 14 - 18 mL/L LC50 (Oncorhynchus mykiss) 96 h static<br>40000 - 60000 mg/L LC50 (Pimephales promelas) 96 h static<br>16000 mg/L LC50 (Poecilia reticulata) 96 h static<br>27540 mg/L LC50 (Lepomis macrochirus) 96 h static<br>40761 mg/L LC50 (Oncorhynchus mykiss) 96 h static<br>41000 mg/L LC50 (Oncorhynchus mykiss) 96 h | Not Available. | 6500 - 13000 mg/L EC50 Pseudokirchneriella subcapitata 96 h |

**Other Information:** Movement & Partitioning
Bioconcentration potential is low (BCF less than 100 or log Pow less than 3). Potential for mobility in soil is very high (Koc between 0 and 50).
Henry's Law Constant (H): 4.43E-8 atm*m3/mole; 25 °C Estimated
Partition coefficient, n-octanol/water (log Pow): -1.18 Estimated
Partition coefficient, soil organic carbon/water (Koc): < 1 Estimated

Persistence and Degradability
Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Material is ultimately biodegradable (reaches > 70% mineralization in OECD test(s) for inherent biodegradability).

Indirect Photo degradation with OH Radicals

Rate Constant - 2.60E-11 cm3/s
Atmospheric Half-life - 4.9 h
Method - Estimated

OECD Biodegradation Tests:
Biodegradation - 77.9 % ;100 %
Exposure Time - 28 d ; 28 d
Method - OECD 301B Test ; OECD 302B Test

Biological oxygen demand (BOD):
BOD 10  20.8 %
BOD 20  65.9 %

Theoretical Oxygen Demand: 1.73 mg/mg

ECOTOXICITY
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50 >100 mg/L in the most sensitive species tested).

## 13. DISPOSAL CONSIDERATIONS

**Disposal of Waste Method:** Disposal of all wastes must be done in accordance with municipal, provincial and federal regulations.
**Contaminated Packaging:** Empty containers should be recycled or disposed of through an approved waste management facility.

## 14. TRANSPORT INFORMATION

**DOT (U.S.):**
**DOT Shipping Name:** Not Regulated.
**DOT Hazardous Class** Not Applicable.
**DOT UN Number:** Not Applicable.
**DOT Packing Group:** Not Applicable.
**DOT Reportable Quantity (lbs):** Not Available.
**Note:** No additional remark.
**Marine Pollutant:** No.

**TDG (Canada):**
**TDG Shipping Name:** Not Regulated.
**Hazard Class:** Not Applicable.
**UN Number:** Not Applicable.
**Packing Group:** Not Applicable.
**Note:** No additional remark.
**Marine Pollutant:** No.

## 15. REGULATORY INFORMATION

**U.S. TSCA Inventory Status:** All components of this product are either on the Toxic Substances Control Act (TSCA) Inventory List or exempt.

**Canadian DSL Inventory Status:** All components of this product are either on the Domestic Substances List (DSL), the Non-Domestic Substances List (NDSL) or exempt.

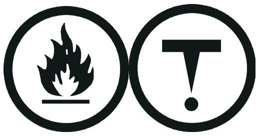
**U.S. Regulatory Rules**

| Ingredients | CERCLA/SARA - Section 302: | SARA (311, 312) Hazard Class: | CERCLA/SARA - Section 313: |
|---|---|---|---|
| Diethylene Glycol Monomethyl Ether | Not Listed. | Not Listed. | Not Listed. |
| Ethylene Glycol | Not Listed. | Listed | Listed |

**California Proposition 65:** Not Listed.
**MA Right to Know List:** Listed.
**New Jersey Right-to-Know List:** Listed.
**Pennsylvania Right to Know List:** Listed.

**Additional Notes:** Not Available.

**WHMIS Hazardous Class:**
B3 COMBUSTIBLE LIQUIDS
D2A VERY TOXIC MATERIALS
D2B TOXIC MATERIALS



## 16. OTHER INFORMATION

|   |   |
|---|---|
| **Additional Information:** | This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR. |
| **Disclaimer:** | NOTICE TO READER:<br>Univar, expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.<br>Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar Sales Office.<br>All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process. |

*****END OF MSDS*****


008
3% AFFF
CATEGORY
3
Ansulite
3%
LIQUID CONCENTRATE, FIRE EXTINGUISHING, AQUEOUS FILM-FORMING FOAM
3% FOAM CONCENTRATE
PRIMARILY FOR USE ON AIRCRAFT RESCUE FIREFIGHTING + ALL CATEGORY 1 APPLICATIONS
#2
432163
FORMULATION DC-3
LOT NO. C 3504
DATE PACKED 6 15
ANSUL
ANSUL
MAUSER

## APPENDIX D

# Borehole, Monitoring Well and Soil Vapour Logs

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF MONITORING WELL: MW20-01

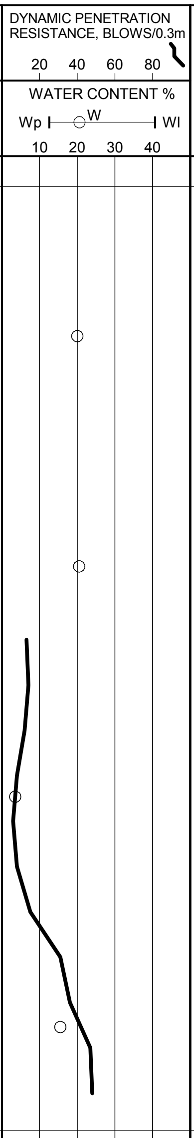
SHEET 1 OF 1

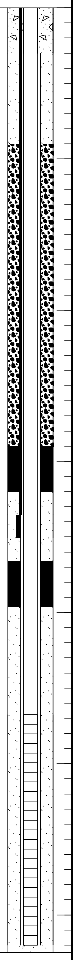
CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619948.42 E: 682392.26

DRILLING DATE: 06/11&12/2020
DRILLING CONTRACTOR: Lynx Creek/On the Mark

DATUM: Ground Surface

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | ELEV. DEPTH (m) | GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED | PID ppm | ADDITIONAL LAB. TESTING | PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ground Surface | 345.47 | | | | | | | | | | | |
| 0 | | Hydrovac | **(ML-SM)** SILT and SAND;brown, trace organics, no staining; moist, firm. | 0.00 | 1 | HV | | | | 1 | 02926-04/05 | | ⊕ | | Flushmount & Concrete |
| | | | - grades to no organics at 0.6m depth | | | | | | | | | | | | Sand |
| 1 | | | | | 2 | HV | | | | 2 | 02926-06 | | ⊕ | | |
| | | | | | | | | | 100 | | | | | | |
| 2 | | | | | | | | | | | | | | | Bentonite Chips |
| | | | | | 3 | HV | | | | 3 | 02926-07 | | ⊕ | | |
| | | | | 342.72 | | | | | | | | | | | |
| | | | **(SP)** SAND, fine; light brown, no staining; moist, loose. | 342.57<br>2.90 | | | | | | | | | | | |
| 3 | Track Mounted Auger Drill | Hollow Stem Auger (Casing:6 in. Casing: ) | **(SM)** SILTY SAND, fine; brown, no staining; moist, firm. | | | | | | | | | | | | Granular Bentonite<br>PVC Pipe |
| | | | **(SW)** SAND, fine to medium; grey, no staining; moist, loose to compact. | 342.11<br>3.35 | | | | | | | | | | | Vapour Probe<br>Sand<br>Granular Bentonite |
| | | | | | | | | 1 | | | | | | | |
| 4 | | | | | 4 | AS | | | | 4 | 02927-03 | | ⊕ | | |
| 5 | | | - wet at 5 m depth | | | | | | | | | | | | 10/20 Silica Sand |
| | | | | | | | | 2 | | | | | | | #10 Screen |
| | | | | | 5 | AS | | | | 5 | 02927-04 | | ⊕ | | |
| 6 | | | - grades to fine to coarse at 5.2m depth, becoming dense | 339.22<br>6.25 | | | | | | | | | | | |
| | | | End of Monitoring Well. | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |





PID ppm ⊕ 50 100 150 200
PID ppm □ 500 1000 1500 2000

DEPTH SCALE
1 : 50

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF MONITORING WELL: MW20-02

SHEET 1 OF 1

DATUM: Ground Surface

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619949.82 E: 682395.85

DRILLING DATE: 06/10&12/2020
DRILLING CONTRACTOR: Lynx Creek/On the Mark

DRILLING RIG: Track Mounted Auger Drill (3.05 m to 6.25 m)

DRILLING METHOD: Hydrovac (0.00 m to 3.05 m); Hollow Stem Auger (Casing:6 in. Casing; ) (3.05 m to 6.25 m)

| SOIL PROFILE – DESCRIPTION | ELEV. | DEPTH (m) |
|---|---|---|
| Ground Surface | 345.59 | |
| FILL - disturbed during wreckage removal and backfilling | | 0.00 |
| **(ML-SM)** SILT and SAND; brown, trace organics, no staining; moist, firm. | 343.76 | 1.83 |
| **(ML)** SILT, trace sand; brown with red mottling, no staining; moist, soft. | 343.36 | 2.24 |
| **(SP)** SAND, fine; brown, no staining; moist, loose. | 342.24 | 3.35 |
| **(SW)** SAND, fine to coarse; brown to grey, no staining; wet, loose to compact. | 341.22 | 4.37 |
| End of Monitoring Well. | 339.34 | 6.25 |

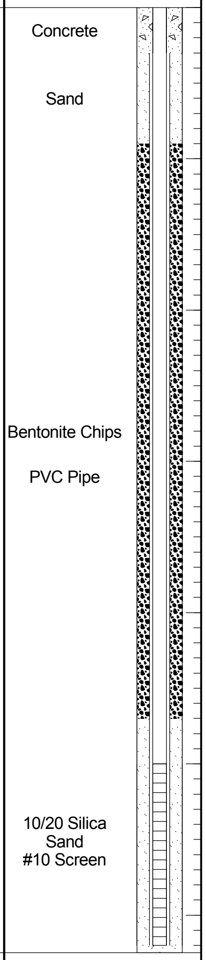
| GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED |
|---|---|---|---|---|---|---|---|
| 1 | HV | | | | 1 | 02926-01 | |
| | | | | 100 | | | |
| 2 | HV | | | | 2 | 02926-02/03 | |
| 3 | AS | | 1 | 70 | 3 | 02928-01/02 | |
| 4 | AS | | | | 4 | 02928-03 | |
| | | | 2 | | | | |
| 5 | AS | | | | 5 | 02928-04 | |

PID ppm ⊕ 50 100 150 200
PID ppm ☐ 500 1000 1500 2000

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80
WATER CONTENT % Wp ⊢ W ⊣ Wl 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION



DEPTH SCALE
1 : 50

GOLDER

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF MONITORING WELL: MW20-03

SHEET 1 OF 1

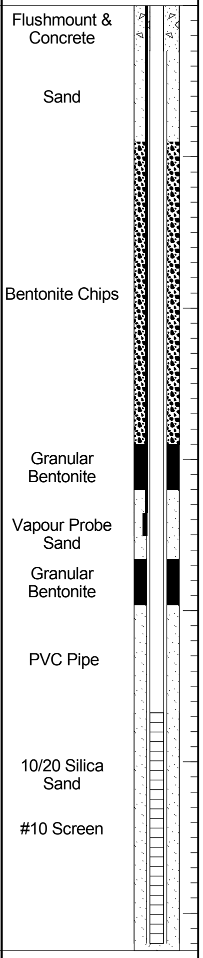
CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619952.81 E: 682399.32

DRILLING DATE: 06/10&12/2020
DRILLING CONTRACTOR: Lynx Creek/On the Mark

DATUM: Ground Surface

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | ELEV. / DEPTH (m) | GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED | PID ppm ⊕ 50 100 150 200 / PID ppm ☐ 500 1000 1500 2000 | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 / WATER CONTENT % Wp W Wl 10 20 30 40 | ADDITIONAL LAB. TESTING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Ground Surface | 345.68 |  |  |  |  |  |  |  |  |  |  |  |
| 0 |  | Hydrovac | **(SW)** SAND, fine; brown, no staining; moist, loose. | 0.03 | 1 | HV |  |  | 100 | 1 | 02925-04 |  | ⊕ |  |  |
|  |  |  | **(SM)** SILT, trace rootlets; dark brown, no staining; moist, soft. |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 |  |  | **(ML-SM)** SILT and SAND; grey, trace organics, no staining; moist, firm. | 344.81<br>0.86 | 2 | HV |  |  |  | 2 | 02925-05 |  | ⊕ |  | Sieve |
| 2 |  |  | **(ML-SM)** SILT and SAND; grey with red mottling, no staining; moist, firm. | 344.15<br>1.52 | 3 | HV |  |  |  | 3 | 02926-06 |  | ⊕ |  | Sieve |
| 3 | Track Mounted Auger Drill | Hollow Stem Auger (Casing:6 in. Casing; ) | **(SP)** SAND, fine, trace rounded gravel; brown, no staining; moist, loose. | 342.78<br>2.90 | 4 | AS |  | 1 | 80 | 4 | 02926-12/02927-01 |  | ⊕ |  | Sieve |
| 5 |  |  | **(SW)** SAND, fine to medium, trace coarse sand, interbedded fine sand seams; reddish brown, no staining; wet, loose to compact. | 340.50<br>5.18 | 5 | AS |  | 2 | 90 | 5 | 02927-02 |  | ⊕ |  | Sieve |
| 6 |  |  | **(SP)** SAND; grey, no staining; wet, loose to compact.<br>- grades to light grey at 6.1 m depth | 339.73<br>5.94 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | End of Monitoring Well. | 339.43<br>6.25 |  |  |  |  |  |  |  |  |  |  |  |

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION



DEPTH SCALE
1 : 50

GOLDER

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF MONITORING WELL: MW20-04

SHEET 1 OF 1

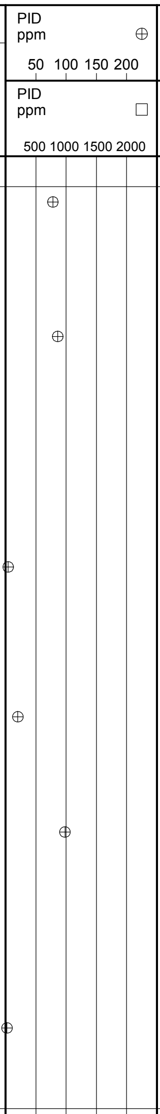
DATUM: Ground Surface

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619937.26 E: 682395.85

DRILLING DATE: 06/10&11/2020
DRILLING CONTRACTOR: Lynx Creek/On the Mark

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | ELEV. DEPTH (m) |
|---|---|---|---|---|
| | | | Ground Surface | 345.54 |
| 0 | | Hydrovac | **(SM)** SILT, trace rootlets; light brown, no staining; moist, soft. | 0.00 |
| 2.39 | | | **(SP)** SAND, fine; light brown, no staining; moist, loose. | 343.15<br>2.39 |
| 3 | Track Mounted Auger Drill | Hollow Stem Auger (Casing:6 in. Casing; ) | | |
| 4.72 | | | **(SW)** SAND, fine to coarse; brown, no staining; wet, loose to compact.<br>- interbedded fine grey sand lenses from 4.7m depth to 6.1 m depth | 340.81<br>4.72 |
| 6.10 | | | End of Monitoring Well. | 339.44<br>6.10 |

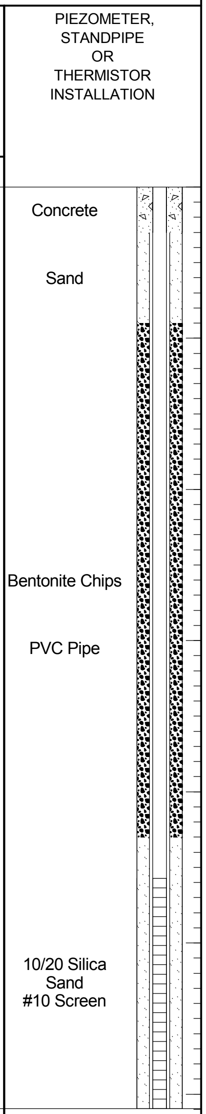
| GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED |
|---|---|---|---|---|---|---|---|
| 1 | HV | | | | 1 | 02925-07 | |
| 2 | HV | | | 100 | 2 | 02925-08 | |
| 3 | HV | | | | 3 | 02925-09 | |
| 4 | AS | | 1 | | 4 | 02927-05 | |
| 5 | AS | | 2 | | 5 | 02927-06 | |
| 6 | AS | | 3 | | 6 | 02927-07 | |



DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

WATER CONTENT %: Wp W Wl: 10 20 30 40

ADDITIONAL LAB. TESTING



DEPTH SCALE
1 : 50

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF BOREHOLE: BH20-05

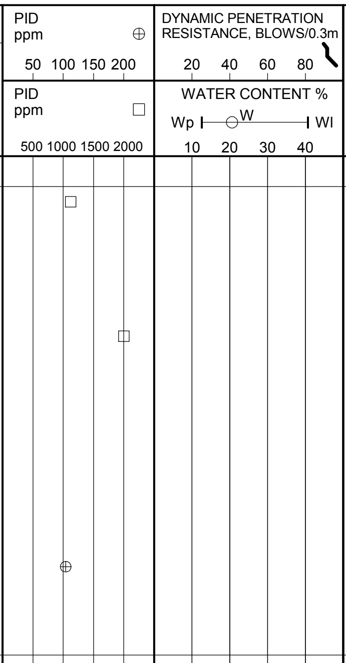
SHEET 1 OF 1

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619952.85 E: 682395.72

DRILLING DATE: 06/10/2020
DRILLING CONTRACTOR: Lynx Creek

DATUM: Ground Surface

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED | ADDITIONAL LAB. TESTING | PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Ground Surface |  | 345.66 |  |  |  |  |  |  |  |  |  |  |
| 0 |  | Hydrovac | **(ML-SM)** SILT and SAND; grey to brown, trace organics, no staining; moist, firm. |  | 0.00 | 1 | HV |  |  |  | 1 | 02925-10 |  |  | 10/20 Silica Sand |
| 1 |  |  |  |  |  | 2 | HV |  |  |  | 2 | 02925-11 |  |  |  |
|  |  |  | - grades to brown at 1.2m depth |  |  |  |  |  |  | 100 |  |  |  |  |  |
| 2 |  |  | - grades to brown with orange mottling at 2.1m depth |  |  |  |  |  |  |  |  |  |  |  | Bentonite Chips |
|  |  |  | - trace fine to medium light grey sand from 2.4m to 3m depth |  |  | 3 | HV |  |  |  | 3 | 02925-12 |  |  |  |
| 3 |  |  |  |  | 342.56<br>3.10 |  |  |  |  |  |  |  |  |  |  |
|  |  |  | End of Borehole. |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



DEPTH SCALE
1 : 50

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF BOREHOLE: BH20-06

SHEET 1 OF 1

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619949.86 E: 682402.26

DRILLING DATE: 06/10/2020
DRILLING CONTRACTOR: Lynx Creek

DATUM: Ground Surface

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | GEOTECH SAMPLES: NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES: NUMBER | SCN | ANALYSED | PID ppm ⊕ 50 100 150 200<br>PID ppm □ 500 1000 1500 2000 | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80<br>WATER CONTENT % Wp ⊢ ○W ⊣ Wl 10 20 30 40 | ADDITIONAL LAB. TESTING | PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ground Surface | | 345.81 | | | | | | | | | | | | |
| 0 | | Hydrovac | **(SW)** SAND, fine; brown, no staining; moist, loose. | | 0.00 | 1 | HV | | | | 1 | 02925-01 | | ⊕ | | | 10/20 Silica Sand |
| | | | **(SM)** SILT; light brown, no staining; moist, soft. | | 345.35<br>0.46 | | | | | | | | | | | | |
| | | | **(SM)** SILT; light brown with orange mottling, no staining; moist, soft.<br>- rootlets from 0.7m to 1.2m depth | | 345.15<br>0.66 | 2 | HV | | | 100 | 2 | 02925-02 | | ⊕ | | | Bentonite Chips |
| | | | - trace fine sand from 2.4m to 2.6m depth | | | 3 | HV | | | | 3 | 02925-03 | | ⊕ | | | |
| 3 | | | End of Borehole. | | 342.76<br>3.05 | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF BOREHOLE: BH20-07

SHEET 1 OF 1

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619960.85 E: 682401.43

DRILLING DATE: 06/10/2020
DRILLING CONTRACTOR: Lynx Creek

DATUM: Ground Surface

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED | PID ppm ⊕ 50 100 150 200; PID ppm □ 500 1000 1500 2000 | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80; WATER CONTENT % Wp W Wl 10 20 30 40 | ADDITIONAL LAB. TESTING | PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ground Surface | | 345.43 | | | | | | | | | | | | |
| 0 | | Hydrovac | **(ML)** SILT, trace fine sand; brown, no staining; moist, soft. | | 0.00 | 1<br>2 | HV<br>HV | | | 100 | 1<br>2 | 02929-01/02<br>02929-03 | ⊕<br>⊕ | | | | 10/20 Silica Sand<br>Bentonite Chips |
| | | | | | 344.82<br>0.61 | | | | | | | | | | | | |
| | | | End of Borehole. | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

GOLDER

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_BOREHOLE (GEO/ENVIRO) 2018 ryjames 9/7/20

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF BOREHOLE: BH20-08

SHEET 1 OF 1

DATUM: Ground Surface

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC

DRILLING DATE: 06/11&13/2020
DRILLING CONTRACTOR: Lynx Creek/On the Mark

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE | | | GEOTECH SAMPLES | | | | | CHEMISTRY SAMPLES | | | PID ppm ⊕<br>50 100 150 200<br>PID ppm □<br>500 1000 1500 2000 | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m<br>20 40 60 80<br>WATER CONTENT %<br>Wp ⊢—○W—⊣ Wl<br>10 20 30 40 | ADDITIONAL LAB. TESTING | PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | NUMBER | SCN | ANALYSED | | | | |
| | | | Ground Surface | | | | | | | | | | | | | | |
| 0 | | Hydrovac | **(ML)** SILT, trace sand, organics; dark brown, no staining; moist, soft. | | 0.00 | 1 | HV | | | | 1 | 02926-08 | | ⊕ | | | 10/20 Silica Sand |
| | | | **(SP)** SAND, fine, trace silt; grey with orange mottling, no staining; moist, loose. | | 0.66 | | | | | | | | | | | | |
| 1 | | | | | | 2 | HV | | | | 2 | 02926-09/10 | | ⊕ | | | |
| | | | | | | | | | | 100 | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | |
| | | | | | | 3 | HV | | | | 3 | 02926-11 | | ⊕ | | | |
| | | | **(SP)** SAND, fine, trace medium sand; brown, no staining; moist, loose. | | 2.69 | | | | | | | | | | | | |
| 3 | Track Mounted Auger Drill | Hollow Stem Auger (Casing:6 in. Casing; ) | | | | | | | | | | | | | | | Bentonite Chips |
| | | | | | | | | | 1 | 100 | | | | | | | |
| 4 | | | | | | 4 | AS | | | | 4 | 02928-05/06 | | ⊕ | | | |
| 5 | | | - grades to wet at 4.9m depth | | | | | | | | | | | | | | |
| | | | | | | | | | 2 | 100 | | | | | | | |
| | | | | | | 5 | AS | | | | 5 | 02928-07 | | ⊕ | | | |
| | | | **(SW)** SAND, fine to coarse; brown, no staining; wet, loose. | | 5.79 | | | | | | | | | | | | |
| 6 | | | End of Borehole. | | 6.10 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

GOLDER

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF BOREHOLE: BH20-10

SHEET 1 OF 1

DATUM: Ground Surface

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619945.57 E: 682395.29

DRILLING DATE: 06/26/2020
DRILLING CONTRACTOR: Rocky Mountain Drilling

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED | PID ppm ⊕ 50 100 150 200 / PID ppm □ 500 1000 1500 2000 | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 / WATER CONTENT % Wp ⊢ ○W ⊣ Wl 10 20 30 40 | ADDITIONAL LAB. TESTING | PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ~ 1.1 m below ground surface elevation | | 344.47 | | | | | | | | | | | | |
| 0 | | Pionjar Drill with Split Spoon Sampler (Casing:102 mm; ) | CONCRETE SLAB | | 344.37<br>0.10 | | | | | | | | | | | | 10/20 Silica Sand |
| | | | **(CL)** SILTY CLAY; brown; soft, dry. | | 344.01<br>0.46 | | | | | | | | | | | | |
| | | | **(SP)** SAND; grey; soft, dry.<br>- rust coloured staining at 0.6m depth | | | 1 | SS | | | | 1 | 02945-01 | ⊕ | | | | |
| 1 | | | | | | | | | | | | | | | | | |
| | | | | | | 2 | SS | | | | 2 | 02945-02 | ⊕ | | | | Bentonite Chips |
| 2 | | | | | | | | | | | | | | | | | |
| | | | | | 341.73<br>2.74 | 3 | SS | | | | 3 | 02945-03 & DUP | ⊕ | | | | |
| 3 | | | End of Borehole. | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

GOLDER

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: AU
CHECKED: EvK

## APPENDIX E

# Soil Disposal Manifests

# MOVEMENT DOCUMENT / MANIFEST
# DOCUMENT DE MOUVEMENT / MANIFESTE

This Movement document/manifest conforms to all federal and provincial environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement.

Movement Document / Manifest Reference No.
N° de référence du document de mouvement/manifeste
**BA76176-2**

## A Generator / consignor — Producteur / expéditeur

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (1): BCG 00321
Company name / Nom de l'entreprise: Department of National Defence
Mailing address / Adresse postale: Bldg 103, 19 Wing Comox PO Box 1000 Station Main — City / Ville: Lazo — Province: BC — Postal code / Code postal: V0R 2K0
E-mail / Courrier électronique: marie.goulden@forces.gc.ca — Tel. No. / N° de tél.: 250)339-8187
Shipping site address / Adresse du lieu de l'expédition: 2425 Glenview Ave
City / Ville: Kamloops — Province: BC — Postal code / Code postal: V2B 4L5

**Intended Receiver / consignee — Réceptionnaire / destinataire prévu** (2): Sumas Environmental
Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial: K1BWEP4598
Mailing address / Adresse postale: 456 Dene Drive — City / Ville: Kamloops — Province: BC — Postal code / Code postal: V2H 1P4
E-mail / Courrier électronique: rob@sumas.net — Tel. No. / N° de tél.: 250) 374-4151
Receiving site address / Adresse du lieu de destination: Same
City / Ville — Province — Postal code / Code postal

## B Carrier — Transporteur

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (23): LT1389
Company name / Nom de l'entreprise: Lynx Creek Industrial + Hydrovac Ltd
Mailing address / Adresse postale: 701 East Athabasca St — City / Ville: Kamloops — Province — Postal code / Code postal: V2H 1C7
E-mail / Courrier électronique: brad@lynxcreekhydrovac.com — Tel. No. / N° de tél.: 250 299-2167
Vehicle / Véhicule — Registration No. / N° d'immatriculation: ML 9686 — Prov. (24)
Trailer - Rail car No. 1 / 1re remorque - wagon
Trailer - Rail car No. 2 / 2e remorque - wagon
Port of entry / Point d'entrée: International use only — Port of exit / Point de sortie (25): International use only

*Carrier Certification : I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part A and that the information contained in Part B is complete and correct.* (26)
*Attestation du transporteur : J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur en vue de leur livraison au réceptionnaire / destinataire, tels qu'ils figurent à la partie A et que les renseignements inscrits à la partie B sont exacts et complets.*

Name of authorized person (print): / Nom de l'agent autorisé (caractères d'imprimerie) : Bert Fehr
Tel. No. / N° de tél.: (639-999-8366
Year / Année: 2006 — Month / Mois: 06 — Day / Jour: 10 — Signature

## C Receiver / consignee — Réceptionnaire / destinataire

Reference Nos. of other movement document(s)/manifest(s) used / N° de référence des autres documents de mouvement/manifestes utilisés
Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial
Receiver / consignee information same as in Part A / Les renseignements du réceptionnaire / destinataire sont les mêmes qu'à la Partie A
☐ Yes / Oui ☐ No, complete the box below / Non, remplir la case ci-dessous
Company name / Nom de l'entreprise
Mailing address / Adresse postale
City / Ville — Province — Postal code / Code postal
E-mail / Courrier électronique — Tel. No. / N° de tél. ( )
Receiving site address / Adresse du lieu de destination
Date received / Date de réception: Year / Année — Month / Mois — Day / Jour — Time / Heure ☐ A.M. ☐ P.M. (29)
If waste or recyclable material to be transferred, specify intended company name/ Si les dechets ou matières recyclables doivent être transférés, préciser le nom du destinataire — (30) Registration No./Provincial ID No. / N° d'immatriculation/d'id provincial

| Prov. code / Code prov. (3) | Shipping name / Appellation réglementaire (4) | Class / Classe / Sub. class(es) / Classe(s) sub. (5) | UN No. / N° NU (6) | Packing / risk gr. / Gr. d'emballage/ de risque (7) | Quantity shipped / Quantité expédiée | Units / L or / ou Kg / Unités (8) | Packaging/Contenant No. / N° (9) | Codes Int – ext. | Phys. state / État phys. (10) | Quantity received / Quantité reçue | Units / L or / ou kg / Unités (31) | Comments / Commentaires (32) | Handling / Code / Code de manutention (33) | Shipment / Envoi Accepted / Accepté (34) | Refused / Refusé | Decont. Pack. Cont. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) N/A | Hydrovac Slurry greater than 3% oil | N/A | N/A | N/A | 3000 | L | 1 | 03 | L | 3680 | Kg | scale ticket | 01 | ✓ | | |
| (ii) | | | | | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | | | | | |

| | Notice No. / N° de notification (11) | Notice Line No / N° de ligne de la notification (12) | Shipment / Envoi | Of / De (13) | D or R code / Code D ou R (14) | C code / Code C (15) | Basel Annex VIII or OECD Code / Annexe VIII de Bâle ou Code OCDE (16) | H code / Code H (17) | Y code / Code Y | National code in country of / Code du pays: Export / Exportation (18) | Import / Importation | Customs code(s) / Code(s) de douanes (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) | | | | | | | | | | | | |
| (ii) | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | |

International use only

If handling code "Other" (specify) / Si code de manutention « autre » (spécifier)

*Receiver / consignee certification : I certify that the information contained in Part C is correct and complete. / Attestation du réceptionnaire / destinataire : J'atteste que tous les renseignements à la partie C sont exacts et complets.*
Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): Robert Griffith
Signature — Tel. No. / N° de tél.: 2503744151

Special handling / Manutention spéciale (22)
☐ Attached /Ci-joint: ☐ As follows/ Ci-contre : 1 800 663-3456 24hr#

**Generator / consignor certification:** *I certify that the information contained in Part A is correct and complete. I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.*
**Attestation du producteur / expéditeur:** *J'atteste que tous les renseignements à la partie A sont exacts et complets. Je déclare que le contenu de ce chargement est décrit ci-dessus de façon complète et exacte par la désignation officielle de transport et qu'il est convenablement classé, emballé, marqué, étiqueté, muni de plaques-étiquettes et à tous égards bien conditionné pour être transporté conformément aux réglementations internationales et nationales applicables.*

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): Reagan MacKenzie
Signature
Tel. No. / N° de tél. (20): 604 619-5957

(21) Date shipped / Date d'expédition: Year / Année: 2006 — Month / Mois: 06 — Day / Jour: 10 — Time / Heure: ☐ A.M. ☒ P.M 1430
Scheduled arrival date / Date d'arrivée prévue: Year / Année: 2006 — Month / Mois: 06 — Day / Jour: 10

**Instructions on reverse**
**Instructions au verso**

**Copy / Copie 1 (white / blanch**

SUMAS
ENVIRONMENTAL SERVICES INC.

4623 BYRNE ROAD
BURNABY, BC V5J 3H6
TELEPHONE (604) 682-6678
FAX (604) 687-8108
HEAD OFFICE (604) 682-6678

# Certified Scale Ticket

PROJECT NO.: BA 76176-2

TIME & DATE:

CLIENT: 17:57:29 10/06/2020

MATERIAL:

DESCRIPTION: <C/IL ☐ >C/IL ☐ SW ☐
SUSPECT ☐ CONFIRMED ☐

GROSS WT:

TARE WT: 33120 kg

NET WT: 29440 kg

TRUCKING CO.: 3600 kg

TRUCK NO.:

DRIVER:

NO.: B- 104484

# MOVEMENT DOCUMENT / MANIFEST
# DOCUMENT DE MOUVEMENT / MANIFESTE

This Movement document/manifest conforms to all federal and provincial environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement.

**BA76176-2**
Movement Document / Manifest Reference No.
N° de référence du document de mouvement/manifeste

## A Generator / consignor Producteur / expéditeur

Registration No. / Provincial ID No. N° d'immatriculation - d'id. provincial (1): BCG 00321
Company name / Nom de l'entreprise: Department of [illegible] Defence
Mailing address / Adresse postale: [illegible] Station [illegible] City / Ville: Lazo Province: BC Postal code / Code postal: V0R 2L0
E-mail / Courrier électronique: [illegible].gc.ca Tel. No. / N° de tél.: (250) 339 - 187
Shipping site address / Adresse du lieu de l'expédition: 2425 Glenview Ave
City / Ville: Kamloops Province: BC Postal code / Code postal: V2B 4L5

**Intended Receiver / consignee Réceptionnaire / destinataire prévu** (2): Sumas Environmental
Registration No. / Provincial ID No. N° d'immatriculation - d'id. provincial: KIBWGP4598
Mailing address / Adresse postale: 456 Dene Drive City / Ville: Kamloops Province: BC Postal code / Code postal: V2H 1P4
E-mail / Courrier électronique: robin sumas.[illegible] Tel. No. / N° de tél.: (250) 374 4147
Receiving site address / Adresse du lieu de destination: Same
City / Ville: Province: Postal code / Code postal:

## B Carrier Transporteur

Registration No. / Provincial ID No. N° d'immatriculation - d'id. provincial (23): LT1389
Company name / Nom de l'entreprise: Lynx Creek Industrial & Hydrovac Ltd
Mailing address / Adresse postale: 70 East Athabasca St City / Ville: Kamloops Province: Postal code / Code postal: V2H 1C7
E-mail / Courrier électronique: brade lynxcreekhydrovac.com Tel. No. / N° de tél.: (250) 377 2167

| Vehicle / Véhicule | Registration No. / N° d'immatriculation | Prov. (24) |
|---|---|---|
| Trailer - Rail car No. 1<br>1re remorque - wagon | ML 9686 | |
| Trailer - Rail car No. 2<br>2e remorque - wagon | | |

Port of entry Point d'entrée: International use only Port of exit Point de sortie: International use only (25)

*Carrier Certification :* I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part A and that the information contained in Part B is complete and correct (26)
*Attestation du transporteur :* J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur en vue de leur livraison au réceptionnaire / destinataire, tels qu'ils figurent à la partie A et que les renseignements inscrits à la partie B sont exacts et complets.
Name of authorized person (print): Nom de l'agent autoriré (caractères d'imprimerie) : Bert Tekv Tel. No. / N° de tél.: ( ) 68 999 8366
Year / Année: 2010 Month / Mois: 06 Day / Jour: 15 Signature :

## C Receiver / consignee Réceptionnaire / destinataire

Reference Nos. of other movement document(s)/manifest(s) used / N° de référence des autres documents de mouvement/manifestes utilisés (27):
Receiver / consignee Réceptionnaire / destinataire: Sumas Env Services
Registration No. / Provincial ID No. N° d'immatriculation - d'id. provincial (28): KIBWGP4598
Receiver / consignee information same as in Part A
Les renseignements du réceptionnaire / destinataire sont les mêmes qu'à la Partie A
☑ Yes / Oui ☐ No, complete the box below / Non, remplir la case ci-dessous

Company name / Nom de l'entreprise:
Mailing address / Adresse postale:
City / Ville: Province: Postal code / Code postal:
E-mail / Courrier électronique: Tel. No. / N° de tél.: ( )
Receiving site address / Adresse du lieu de destination:

Date received / Date de réception — Year / Année: 2010 Month / Mois: 06 Day / Jour: 10 Time / Heure: ☐ A.M. ☑ P.M. (29)
If waste or recyclable material to be transferred, specify intended company name/ Si les dechets ou matières recyclables doivent être transférés, préciser le nom du destinataire (30):
Registration No./Provincial ID No. N° d'immatriculation/d'id provincial:

| | Prov. code Code prov. (3) | Shipping name Appellation réglementaire (4) | Class / Classe Sub. class(es) Classe(s) sub. (5) | UN No. N° NU (6) | Packing / risk gr. Gr. d'emballage/ de risque (7) | Quantiy shipped Quantité expédiée | Units L or / ou Kg Unités (8) | Packaging/Contenant No. / N° (9) | Codes Int.– ext. | Phys. state État phys. (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| (i) | N/A | Hydrovac Slurry [illegible] | N/A | N/A | N/A | 3000L | | 1 | 03 | L |
| (ii) | | | | | | | | | | |
| (iii) | | | | | | | | | | |
| (iv) | | | | | | | | | | |

| Quantity received Quantité reçue | Units L or / ou kg Unités (31) | Comments Commentaires (32) | Handling Code / Code de manutention (33) | Shipment / Envoi Accepted Accepté (34) | Shipment / Envoi Refused Refusé | Decont. Pack. Cont. (35) | Decont. Veh. Véh. |
|---|---|---|---|---|---|---|---|
| 3680 | Kg | scale ticket | 01 | ✓ | | | ✓ |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | Notice No. N° de notification | Notice Line No N° de ligne de la notification (11) | Shipment Envoi (12) | Of / De | D or R code Code D ou R (13) | C code Code C (14) | Basel Annex VIII or OECD Code Annexe VIII de Bâle ou Code OCDE (15) | H code Code H (16) | Y code Code Y (17) | National code in country of / Code du pays Export Exportation (18) | Import Importation | Customs code(s) Code(s) de douanes (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) | | | | | | | | | | | | |
| (ii) | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | |

International use only

If handling code "Other" (specify) Si code de manutention « autre » (spécifier) (36):

*Receiver / consignee certification :* I certify that the information contained in Part C is correct and complete. / *Attestation du réceptionnaire / destinataire :* J'atteste que tous les renseignements à la partie C sont exacts et complets. (37)
Name of authorized person (print) Nom de l'agent autorisé (caractère d'imprimerie): Robert Galliltn'
Signature: RM
Tel. No. / N° de tél.: 250 374 4151

*Generator / consignor certification:* I certify that the information contained in Part A is correct and complete. I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.
*Attestation du producteur / expéditeur:* J'atteste que tous les renseignements à la partie A sont exacts et complets. Je déclare que le contenu de ce chargement est décrit ci-dessus de façon complète et exacte par la désignation officielle de transport et qu'il est convenablement classé, emballé, marqué, étiqueté, muni de plaques-étiquettes et à tous égards bien conditionné pour être transporté conformément aux réglementations internationales et nationales applicables.
Name of authorized person (print) Nom de l'agent autorisé (caractère d'imprimerie): [illegible]
Signature
Tel. No. / N° de tél.: ( ) (20)

Special handling / Manutention spéciale (22): ☐ Attached /Ci-joint: ☐ As follows/ Ci-contre :

Date shipped / Date d'expédition (21) — Year / Année: Month / Mois: Day / Jour: Time / Heure: ☐ A.M. ☐ P.M
Scheduled arrival date / Date d'arrivée prévue — Year / Année: Month / Mois: 06 Day / Jour: 10

**Instructions on reverse**
**Instructions au verso**

**Copy / Copie 3 (yellow / jaune**

# MOVEMENT DOCUMENT / MANIFEST
# DOCUMENT DE MOUVEMENT / MANIFESTE

This Movement document/manifest conforms to all federal and provincial environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement.

**BA76154-9**
Movement Document / Manifest Reference No.
N° de référence du document de mouvement/manifeste

## A Generator / consignor — Producteur / expéditeur

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (1): BCG 00321
Company name / Nom de l'entreprise: Department of National Defence
Mailing address / Adresse postale: [illegible] City / Ville: Lazo Province: BC Postal code / Code postal: V0R 2K6
E-mail / Courrier électronique: marie.goudenzte@es.f.ca Tel. No. / N° de tél.: (250) 339-5147
Shipping site address / Adresse du lieu de l'expédition: 2425 Glenview Ave
City / Ville: Kamloops Province: BC Postal code / Code postal: V2B 4L5

**Intended Receiver / consignee — Réceptionnaire / destinataire prévu** (2)
Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial: KABWEP4528
Sumas Environmental
Mailing address / Adresse postale: 456 Orme Drive City / Ville: Kamloops Province: BC Postal code / Code postal: V2H 1P4
E-mail / Courrier électronique: rob@sumas.net Tel. No. / N° de tél.: (250) 374 4151
Receiving site address / Adresse du lieu de destination: Same
City / Ville: Province: Postal code / Code postal:

## B Carrier — Transporteur

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (23): LT 1389
Company name / Nom de l'entreprise: Lynx Creek Hydrovac [illegible] BC Ltd
Mailing address / Adresse postale: 201 [illegible] City / Ville: Kamloops Province: BC Postal code / Code postal: V2H 1C7
E-mail / Courrier électronique: brad@lynxcreekhydrovac.com Tel. No. / N° de tél.: (250) 299-2167

| Vehicle / Véhicule | Registration No. / N° d'immatriculation | Prov. (24) |
|---|---|---|
| Trailer - Rail car No. 1<br>1re remorque - wagon | ML 9684 | |
| Trailer - Rail car No. 2<br>2e remorque - wagon | | |

Port of entry / Point d'entrée: International use only Port of exit / Point de sortie: International use only (25)

*Carrier Certification : I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part A and that the information contained in Part B is complete and correct.* (26)
*Attestation du transporteur : J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur en vue de leur livraison au réceptionnaire / destinataire, tels qu'ils figurent à la partie A et que les renseignements inscrits à la partie B sont exacts et complets.*
Name of authorized person (print): / Nom de l'agent autoriré (caractères d'imprimerie) : Brad Betty
Tel. No. / N° de tél.: (250) 299 2167
Year / Année: 2010 Month / Mois: 06 Day / Jour: 11 Signature :

## C Receiver / consignee — Réceptionnaire / destinataire

Reference Nos. of other movement document(s)/manifest(s) used / N° de référence des autres documents de mouvement/manifestes utilisés (27):
Sumas Env Services
Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (28): KABWEP4528
Receiver / consignee information same as in Part A
Les renseignements du réceptionnaire / destinataire sont les mêmes qu'à la Partie A
☑ Yes / Oui ☐ No, complete the box below / Non, remplir la case ci-dessous
Company name / Nom de l'entreprise:
Mailing address / Adresse postale:
City / Ville: Province: Postal code / Code postal:
E-mail / Courrier électronique: Tel. No. / N° de tél.: ( )
Receiving site address / Adresse du lieu de destination:
Date received / Date de réception (29): Year / Année: 2010 Month / Mois: 06 Day / Jour: 11 Time / Heure: ☐ A.M. ☑ P.M.
If waste or recyclable material to be transferred, specify intended company name/ Si les dechets ou matières recyclables doivent être transférés, préciser le nom du destinataire (30):
Registration No./Provincial ID No. / N° d'immatriculation/d'id provincial:

| | Prov. code / Code prov. (3) | Shipping name / Appellation réglementaire (4) | Class / Classe Sub. class(es) / Classe(s) sub. (5) | UN No. / N° NU (6) | Packing / risk gr. / Gr. d'emballage/ de risque (7) | Quantiy shipped / Quantité expédiée | Units L or / ou Kg / Unités (8) | Packaging/Contenant No. / N° (9) | Packaging/Contenant Codes Int.– ext. | Phys. state / État phys. (10) | Quantity received / Quantité reçue | Units L or / ou kg / Unités (31) | Comments / Commentaires (32) | Handling Code / Code de manutention (33) | Shipment / Envoi Accepted / Accepté (34) | Shipment / Envoi Refused / Refusé | Decont. Pack. Cont. (35) | Decont. Veh. / Véh. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) | N/A | Hydrovac Slurry greater than 3% oil | N/A | N/A | N/A | | | 1 | 13 | L | 1530 | KG | SCALE TICKET | 03 | ✓ | | ✓ | |
| (ii) | | | | | | | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | | | | | | | |

| | Notice No. / N° de notification (11) | Notice Line No / N° de ligne de la notification (12) | Shipment / Envoi (13) | Of / De (14) | D or R code / Code D ou R (15) | C code / Code C (16) | Basel Annex VIII or OECD Code / Annexe VIII de Bâle ou Code OCDE (17) | H code / Code H | Y code / Code Y | National code in country of / Code du pays Export / Exportation (18) | Import / Importation | Customs code(s) / Code(s) de douanes (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) | | | | | | | | | | | | |
| (ii) | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | |

International use only

If handling code "Other" (specify) / Si code de manutention « autre » (spécifier) (36):

*Receiver / consignee certification : I certify that the information contained in Part C is correct and complete. / Attestation du réceptionnaire / destinataire : J'atteste que tous les renseignements à la partie C sont exacts et complets.* (37)
Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): Jeremy White
Signature: JW
Tel. No. / N° de tél.: 250-374-4151

Special handling / Manutention spéciale (22): ☐ Attached /Ci-joint: ☐ As follows/ Ci-contre :

*Generator / consignor certification: I certify that the information contained in Part A is correct and complete. I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.*
*Attestation du producteur / expéditeur: J'atteste que tous les renseignements à la partie A sont exacts et complets. Je déclare que le contenu de ce chargement est décrit ci-dessus de façon complète et exacte par la désignation officielle de transport et qu'il est convenablement classé, emballé, marqué, étiqueté, muni de plaques-étiquettes et à tous égards bien conditionné pour être transporté conformément aux réglementations internationales et nationales applicables.*

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): Reagan MacKenzie
Signature
Tel. No. / N° de tél. (20): (4411) 5957
Date shipped / Date d'expédition (21): Year / Année: 2010 Month / Mois: 06 Day / Jour: 11 Time / Heure: 1030 ☑ A.M. ☐ P.M
Scheduled arrival date / Date d'arrivée prévue: Year / Année: 2010 Month / Mois: 06 Day / Jour: 11

**Instructions on reverse**
**Instructions au verso**

**Copy / Copie 3 (yellow / jaune**

# MOVEMENT DOCUMENT / MANIFEST
# DOCUMENT DE MOUVEMENT / MANIFESTE

This Movement document/manifest conforms to all federal and provincial environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement.

**BA76157-2**

Movement Document / Manifest Reference No.
N° de référence du document de mouvement/manifeste

## A Generator / consignor — Producteur / expéditeur

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (1): BCG 00321

Company name / Nom de l'entreprise: Department of National Defence

Mailing address / Adresse postale: Bldg 109 19 Wing COMOX PO Box 1000 Station Main
City / Ville: Lazo
Province: BC
Postal code / Code postal: V0R 2K0

E-mail / Courrier électronique: marie.goulden.gc.ca
Tel. No. / N° de tél.: ( ) 250-339-8197

Shipping site address / Adresse du lieu de l'expédition: 2425 Glenview AVE
City / Ville: Kamloops
Province: BC
Postal code / Code postal: V2B 4L5

**Intended Receiver / consignee — Réceptionnaire / destinataire prévu** (2)
SUMAS ENVIRONMENTAL

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial: KIBWGP4598

Mailing address / Adresse postale: 456 Dene Dr
City / Ville — Province — Postal code / Code postal

E-mail / Courrier électronique: Kamloops BC
Tel. No. / N° de tél.: ( ) 2503744151

Receiving site address / Adresse du lieu de destination: Same
City / Ville — Province — Postal code / Code postal: [illegible]

## B Carrier — Transporteur

Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (23): LT1000

Company name / Nom de l'entreprise: SUMAS ENVIRONMENTAL

Mailing address / Adresse postale: ~~456 Dene Dr~~ 4623 Byrne Rd
City / Ville — Province — Postal code / Code postal

E-mail / Courrier électronique: Burnaby BC
Tel. No. / N° de tél.: ( ) 6048826678

| Vehicle / Véhicule | Registration No. / N° d'immatriculation | Prov. (24) |
|---|---|---|
| Trailer - Rail car No. 1<br>1re remorque - wagon | ML 1986 | BC |
| Trailer - Rail car No. 2<br>2e remorque - wagon | | |

Port of entry / Point d'entrée: International use only
Port of exit / Point de sortie: International use only (25)

*Carrier Certification : I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part A and that the information contained in Part B is complete and correct.* (26)
*Attestation du transporteur : J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur en vue de leur livraison au réceptionnaire / destinataire, tels qu'ils figurent à la partie A et que les renseignements inscrits à la partie B sont exacts et complets.*

Name of authorized person (print): / Nom de l'agent autoriré (caractères d'imprimerie) : Bruce Hartman
Tel. No. / N° de tél.: ( ) 2503744151

Year / Année: 20 — Month / Mois: 06 — Day / Jour: 13
Signature :

## C Receiver / consignee — Réceptionnaire / destinataire

Reference Nos. of other movement document(s)/manifest(s) used / N° de référence des autres documents de mouvement/manifestes utilisés (27):

Sumas Env Services
Registration No. / Provincial ID No. — N° d'immatriculation - d'id. provincial (28): KIBWGP4598

Receiver / consignee information same as in Part A
Les renseignements du réceptionnaire / destinataire sont les mêmes qu'à la Partie A
☒ Yes / Oui ☐ No, complete the box below / Non, remplir la case ci-dessous

Company name / Nom de l'entreprise:
Mailing address / Adresse postale:
City / Ville — Province — Postal code / Code postal
E-mail / Courrier électronique — Tel. No. / N° de tél. ( )
Receiving site address / Adresse du lieu de destination:

Date received / Date de réception: Year / Année: 20 — Month / Mois: 06 — Day / Jour: 13
Time / Heure (29): ☐ A.M. ☒ P.M.

If waste or recyclable material to be transferred, specify intended company name/ Si les dechets ou matières recyclables doivent être transférés, préciser le nom du destinataire
Registration No./Provincial ID No. / N° d'immatriculation/d'id provincial (30):

| | Prov. code / Code prov. (3) | Shipping name / Appellation réglementaire (4) | Class / Classe Sub. class(es) / Classe(s) sub. (5) | UN No. / N° NU (6) | Packing / risk gr. / Gr. d'emballage/ de risque (7) | Quantiy shipped / Quantité expédiée | Units L or / ou Kg / Unités (8) | Packaging/Contenant No. / N° (9) | Packaging/Contenant Codes Int.– ext. | Phys. state / État phys. (10) | Quantity received / Quantité reçue | Units L or / ou kg / Unités (31) | Comments / Commentaires (32) | Handling Code / Code de manutention (33) | Shipment / Envoi Accepted / Accepté (34) | Shipment / Envoi Refused / Refusé | Decont. Pack. Cont. (35) | Decont. Veh. / Véh. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) | NA | DRILL CUTTINGS - BC HAZARDOUS - EPH greater than 3% oil | NA | NA | NA | 5-55 gallon drums | | 1 | 03 | L | 5-55 Gallon drums | KG | | 03 | ✓ | | ✓ | |
| (ii) | | | | | | | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | | | | | | | |

| | Notice No. / N° de notification (11) | Notice Line No / N° de ligne de la notification (12) | Shipment / Envoi (13) | Of / De | D or R code / Code D ou R | C code / Code C (14) | Basel Annex VIII or OECD Code / Annexe VIII de Bâle ou Code OCDE (15) | H code / Code H (16) | Y code / Code Y (17) | National code in country of / Code du pays: Export / Exportation (18) | Import / Importation | Customs code(s) / Code(s) de douanes (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (i) | | | | | | | | | | | | |
| (ii) | | | | | | | | | | | | |
| (iii) | | | | | | | | | | | | |
| (iv) | | | | | | | | | | | | |

International use only

If handling code "Other" (specify) / Si code de manutention « autre » (spécifier) (36):

*Receiver / consignee certification : I certify that the information contained in Part C is correct and complete. / Attestation du réceptionnaire / destinataire : J'atteste que tous les renseignements à la partie C sont exacts et complets.* (37)

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): Jeremy White
Tel. No. / N° de tél.: 250-374-4151
Signature

Special handling / Manutention spéciale (22): NO PLACARDS
☐ Attached /Ci-joint: ☐ As follows/ Ci-contre :

*Generator / consignor certification: I certify that the information contained in Part A is correct and complete. I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.*
*Attestation du producteur / expéditeur: J'atteste que tous les renseignements à la partie A sont exacts et complets. Je déclare que le contenu de ce chargement est décrit ci-dessus de façon complète et exacte par la désignation officielle de transport et qu'il est convenablement classé, emballé, marqué, muni de plaques-étiquettes et à tous égards bien conditionné pour être transporté conformément aux réglementations internationales et nationales applicables.*

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): Reagan MacKenzie
Signature
Tel. No. / N° de tél. (20): (604) 6195557

Date shipped / Date d'expédition (21): Year / Année: 20 — Month / Mois: 06 — Day / Jour: 13
Time / Heure: ☒ A.M. ☐ P.M 0900
Scheduled arrival date / Date d'arrivée prévue: Year / Année: 20 — Month / Mois: 06 — Day / Jour: 13

**Instructions on reverse**
**Instructions au verso**

**Copy / Copie 3 (yellow / jaune**

**SUMAS**
**ENVIRONMENTAL**
**SERVICES INC.**

08 June 2020

Golder Associates Ltd.
Attn: Alanna Umphrey, Environmental Technician
2nd Floor, 3795 Carey Road
Victoria, BC V8Z-6T8

Re: ALS Lab Report L2451986 and L2451374 for PFOS & VOC/Hydrocarbon

Dear Alanna

Sumas Environmental Services Inc. (Sumas) has reviewed contaminated soil data as described in ALS Lab Report L2451986 and L2451374.

This letter is to confirm Sumas Kamloops is permitted to receive this waste as described by these lab reports for transfer and disposal to a licensed disposal facility.

The hydrovac slurry and drill cuttings will be treated as hazardous, stabilized at Sumas Kamloops and sent for disposal via TDG Manifest to the Secure Energy Pembina Class 1 and 2 Landfill. This landfill is a hazardous waste landfill permitted to accept drilling waste, Class 1 and 2 contaminated soils, asbestos, and various industrial wastes.

Certificates of Disposal for the waste will be issued after the waste has been shipped for final disposal.

Please let me know if you need any more information.

Sincerely,

Sumas Environmental Services Inc.
Rob Griffiths
Field Service Manager
456 Dene Drive
Kamloops BC V2H-1P4

# Appendix A

**Government of Alberta ■**
Environment

# APPROVAL

## PROVINCE OF ALBERTA

## *ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT*
## R.S.A. 2000, c.E-12, as amended.

APPROVAL NO. 48516-01-00

APPLICATION NO. 005-48516

EFFECTIVE DATE: February 26, 2010

EXPIRY DATE: March 31, 2019

APPROVAL HOLDER: PEMBINA AREA LANDFILL LTD.

ACTIVITY: **CONSTRUCTION, OPERATION AND RECLAMATION OF THE**

Pembina Area Landfill, consisting of a Class I and Class II Landfill, where more than 10,000 tonnes per year of hazardous waste and non-hazardous waste are disposed of

**IS SUBJECT TO THE ATTACHED TERMS AND CONDITIONS.**

Designated Director under the Act
David Helmer, P.Eng.

Date Signed February 26, 2010

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## PART 1: DEFINITIONS

### SECTION 1.1: DEFINITIONS

1.1.1 All definitions from the Act and the regulations under the *Environmental Protection and Enhancement Act* apply except where expressly defined.

1.1.2 In all PARTS of this approval:

(a) "Act" means the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c.E-12, as amended;

(b) "action leakage rate" means the amount of leakage that would occur through the primary liner, based on two holes per hectare, each with a diameter of 2 mm and that is calculated to be 790 L/ha/day;

(c) "active landfill area" means the portion of the landfill that has received or is receiving waste for disposal, where the final barrier layer has not been placed, and includes areas that are being used for interim management of waste prior to disposal;

(d) "APEGGA" means the Association of Professional Engineers, Geologists and Geophysicists of Alberta;

(e) "application" means the written submissions to the Director in respect of application number 005-48516;

(f) "Aquatic and Terrestrial Ecosystem Monitoring Plan" means the Pembina Area Landfill Aquatic and Terrestrial Monitoring Plan (Oct. 2008) submitted in Appendix E of the application, and authorized in writing by the Director in a letter dated July 9, 2009, subject to 4.7.2;

(g) "as-built plans" means survey plans, signed and stamped by a professional registered with APEGGA, that document variances from design or construction plans that were either approved or authorized according to the terms and condition of this approval;

(h) "bulk liquid" means a liquid transported in a vehicle tank or body that is not contained in barrels or other such containers;

(i) "cell" means a designed or designated area of the landfill comprised of an excavation or earthen structure in which waste is enclosed by a cover;

(j) "cell closure" means the capping of a cell with a barrier layer and topsoil at a minimum;

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(k) "Class I cell" means a cell designed with the following at a minimum:

- (i) a primary liner consisting of an 80 mil (2.0 mm) HDPE geomembrane,
- (ii) a secondary liner consisting of a composite liner,
- (iii) a leachate collection and removal system above the primary liner, and
- (iv) a leak detection system between the primary and secondary liners;

(l) "Class II cell" means a cell designed with the following at a minimum:

- (i) for cells constructed before January 1, 2010:
  - (A) a clay liner, and
  - (B) a leachate collection and removal system above the clay liner, and
- (ii) for cells constructed after January 1, 2010:
  - (A) a composite liner, and
  - (B) a leachate collection and removal system above the composite liner;

(m) "clay liner" means a liner that:

- (i) is comprised of clay material compacted to achieve an in-place hydraulic conductivity of $1x10^{-9}$ metres/second or less, and
- (ii) for Class I cells, has a minimum thickness of 1.0 metre at all points measured perpendicular to the slope, and
- (iii) for Class II cells with a single liner design, has a minimum thickness of 1.0 metre at all points measured perpendicular to the slope, and
- (iv) for Class II cells with a composite liner design, has a minimum thickness of 0.6 metres at all points measured perpendicular to the slope;

(n) "compliance boundary" means the locations where measurements of groundwater quality for regulatory purposes are taken to assess the landfill's performance;

(o) "composite liner" means a liner comprised of either:

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(i) a clay liner directly overlain by a 60 mil (1.5 mm) HDPE geomembrane, or

(ii) an alternate design to the satisfaction of the Director;

(p) "construction quality assurance" means an integrated system of management activities involving planning, implementation, documentation, assessment, reporting and quality improvement to identify the level to which construction is in compliance with the specifications;

(q) "construction quality control" means the overall system of technical activities that measures the attributes and performance of construction to verify that construction meets the specifications;

(r) "control chart" means a graph plotting analytical concentrations versus time, with control points designed to alert the analyst to trends beyond normal sampling variability, before established criteria are exceeded;

(s) "cover" means soil or other material that is used to cover compacted waste in a cell;

(t) "day" means any sampling period of 24 consecutive hours unless otherwise specified;

(u) "decommissioning" means the dismantling and decontamination undertaken subsequent to the termination or abandonment of any activity or any part of any activity regulated under the Act;

(v) "decontamination" means the treatment or removal of substances from the landfill and affected lands;

(w) "Director" means an employee of the Government of Alberta designated as a Director under the Act;

(x) "dismantling" means the removal of buildings, structures, process and pollution abatement equipment, vessels, storage facilities, material handling facilities, railways, roadways, pipelines and any other installations that are being or have been used or held for or in connection with the landfill;

(y) "final closure" means the period of time when waste is no longer placed in the defined portion of the landfill and activities are undertaken to complete the final cover system and decommission components and facilities that are no longer required, and this period of time includes the construction of any additional components or monitoring systems that are necessary for post-closure;

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(z) "final cover" means a designed system, natural or man made, that is placed on the surface of a cell that has reached its maximum designated waste elevation to control transmission of moisture and conforms to the end use plan;

(aa) "geomembrane" means a sheet of manufactured synthetic material designed to control the migration of liquid and gas;

(bb) "grab sample" means an individual sample collected in less than 30 minutes and which is representative of the substance sampled;

(cc) "groundwater" means groundwater as defined in the *Water Act*;

(dd) "HDPE" means high density polyethylene;

(ee) "hydraulic conductivity" means the ease with which water can be transported through a material;

(ff) "ISO 17025" means the international standard, developed and published by International Organization for Standardization (ISO), specifying management and technical requirements for laboratories;

(gg) "incompatible wastes" means substances which when mixed can produce effects which are harmful to human health or the environment such as heat, pressure, fire, explosion, violent reaction, toxic dusts, mists, fumes or gases, or flammable fumes or gases;

(hh) "landfill" means all buildings, structures, cells, storage facilities, material handling facilities, process and pollution abatement equipment, vessels, trenches, roadways, berms, monitoring wells, pipelines and other installations, and includes the land, located on Southwest Quarter of Section 17, Southeast Quarter of Section 18, Northwest Quarter of Section 8 and Northeast Quarter of Section 7 Township 50, Range 11, West of the 5th Meridian, that is being or has been used or held for or in connection with the Pembina Area Landfill;

(ii) "leachate" means a liquid that has been in contact with waste in a cell and has undergone chemical or physical changes;

(jj) "leachate collection system" means a system that gathers leachate so that it may be removed from the landfill and which could include a permeable drainage layer, a network of perforated pipes, and sumps or manholes from where leachate can be removed;

(kk) "liner" means a continuous layer placed beneath and at the sides of a cell that is compatible with the waste and restricts the migration of leachate;

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(ll) "local environmental authority" means the Department of Environment, in the Province of Alberta, or the agency that has the equivalent responsibilities for any jurisdiction outside the Province;

(mm) "major ions" are defined as the following dissolved constituents: calcium, magnesium, sodium, potassium, iron, manganese, chloride, carbonate, bicarbonate, nitrate and nitrite (as nitrogen), fluoride, and sulphate;

(nn) "maximum acceptable leachate head" means the maximum depth of leachate above the;

(i) primary liner in a multiple liner design, or

(ii) clay liner in a single liner design

not including the sumps;

(oo) "maximum designated waste elevation" means the maximum elevation of waste of approximately 982 metres above sea level (ASL) as described in the application;

(pp) "monitoring system" means all equipment used for sampling, conditioning, analyzing or recording data in respect of any parameter listed or referred to in this approval including equipment used for continuous monitoring;

(qq) "monitoring well" means a well drilled at a site to measure groundwater levels or collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the concentration of groundwater constituents;

(rr) "month" means calendar month;

(ss) "municipal solid waste" means solid waste resulting from or incidental to municipal, community, commercial, institutional and recreation activities, and includes garbage, rubbish, ashes, street cleanings, abandoned automobiles, and all other solid wastes except hazardous waste, industrial solid waste, oilfield waste and biomedical waste;

(tt) "new cell" means a cell that is constructed on or after January 1, 2010;

(uu) "nutrients" are defined as the following dissolved constituents: ammonium (as nitrogen), nitrate and nitrite (as nitrogen), total kjeldahl nitrogen, total organic carbon, and total phosphate;

(vv) "petroleum hydrocarbon fractions" are defined as extractable F2 ($C_{10}$-$C_{16}$) and F3 ($C_{16}$-$C_{34}$) constituents analyzed by GC-FID technology;

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(ww) "post-closure" means:

  (i) a minimum period of 25 years from the final closure of the landfill,

  (ii) the groundwater quality in the groundwater monitoring wells meets the quality objectives specified in the approval, and

  (iii) the quality and quantity of leachate generated from the leachate collection system meet objectives that, in the opinion of the Director, show the landfill has stabilized;

(xx) "primary liner" means the uppermost liner in a multiple liner design;

(yy) "QA/QC" means quality assurance and quality control;

(zz) "representative grab sample" means a grab sample consisting of equal volume portions of water collected from at least four sites between 0.20-0.30 metres below the water surface within a pond;

(aaa) "run-off" means any rainwater or meltwater that drains as surface flow from the active landfill area, excluding leachate;

(bbb) "run-off control system" means any parts of the landfill that collect, store or treat run-off such as berms and run-off control ponds as described in the application;

(ccc) "run-on" means any rainwater or meltwater that may drain as surface flow into the active landfill area;

(ddd) "run-on control system" means parts of the landfill that divert run-on away from the active landfill area;

(eee) "secondary liner" means the lowermost liner in a Class I cell design;

(fff) "soil" means mineral or organic earthen materials that can be, have been, or are being altered by weathering, biological processes, or human activity;

(ggg) "structural components" means liners, leachate collection systems, leak detection systems, final cover systems, surface water management systems and any other landfill components that are necessary for the protection of human health and the environment;

(hhh) "subsoil" means the layer of soil directly below the topsoil, to a maximum depth of 1.2 metres below the topsoil surface, that consists of the B and C horizons as defined in *The System of Soil Classification for Canada*, Agriculture and Agri-

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

Food Canada, 1998, Publication 1643, Third Edition, as amended or replaced from time to time;

(iii) "suitable quality" means topsoil having a good, fair or poor rating as described in the *Soil Quality Criteria Relative to Disturbance and Reclamation,* Alberta Agriculture March, 1987, as amended;

(jjj) "surface water management system" means a system that manages run-off and run-on;

(kkk) "TDGR" means the *Transportation of Dangerous Goods Regulations* (SOR/2001-286) made under the *Transportation of Dangerous Goods Act*, 1992 (Canada), as amended;

(lll) "tank" means a stationary device, designed to contain an accumulation of a substance, which is constructed primarily of non-earthen materials that provide structural support;

(mmm) "third-party hazardous waste" means hazardous waste generated on property that is not owned by the approval holder;

(nnn) "topsoil" means the uppermost layers of soil that consist of the L,F,H,O, and A horizons as defined in *The System of Soil Classification for Canada*, Agriculture and Agri-Food Canada, 1998, Publication 1643, Third Edition, as amended or replaced from time to time;

(ooo) "trace metals" are defined as the following dissolved constituents: aluminum, antimony, arsenic, boron, barium, beryllium, bismuth, cadmium, cobalt, chromium, copper, lithium, molybdenum, nickel, phosphorus, lead, selenium, silver, strontium, thallium, tin, titanium, vanadium, and zinc;

(ppp) "waste storage area(s)" means the area(s) designated for waste storage prior to treatment or final disposal, as authorized in writing by the Director;

(qqq) "week" means any consecutive 7-day period unless otherwise specified;

(rrr) "working face" means that portion of the active landfill area where waste is currently being deposited, spread and compacted; and

(sss) "year" means a calendar year, unless otherwise specified.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## PART 2: GENERAL

### SECTION 2.1: GENERAL

2.1.1 The approval holder shall immediately report to the Director by telephone any contravention of the terms and conditions of this approval at 1-780-422-4505.

2.1.2 The approval holder shall submit a written report to the Director within 7 days of the reporting pursuant to 2.1.1.

2.1.3 The terms and conditions of this approval are severable. If any term or condition of this approval or the application of any term or condition is held invalid, the application of such term or condition to other circumstances and the remainder of this approval shall not be affected thereby.

2.1.4 The approval holder shall notify the Director in writing within 30 days of all changes in the corporate status of the approval holder.

2.1.5 The approval holder shall immediately notify the Director in writing if any of the following events occur:

(a) the approval holder is served with a petition into bankruptcy;

(b) the approval holder files an assignment in bankruptcy or Notice of Intent to make a proposal;

(c) a receiver or receiver-manager is appointed;

(d) an application for protection from creditors is filed for the benefit of the approval holder under any creditor protection legislation; or

(e) any of the assets which are the subject matter of this approval are seized for any reason.

2.1.6 If the approval holder monitors for any substances or parameters which are the subject of operational limits as described in this approval more frequently than is required and using procedures authorized in this approval, then the approval holder shall provide the results of such monitoring as an addendum to the reports required by this approval.

2.1.7 All abbreviations used in this approval follow those given in *Standard Methods for the Examination of Water and Wastewater* published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation, 1998, as amended, unless otherwise specified in this approval.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

2.1.8 *Environmental Protection and Enhancement Act* Approval No. 48516-00-00, as amended, is cancelled.

## SECTION 2.2: RECORD KEEPING

2.2.1 The approval holder shall record and retain all the following information in respect of any sampling conducted or analyses performed in accordance with this approval for a minimum of ten years, unless otherwise authorized in writing by the Director:

(a) the place, date and time of sampling;

(b) the dates the analyses were performed;

(c) the analytical techniques, methods or procedures used in the analyses;

(d) the names of the persons who collected and analyzed each sample; and

(e) the results of the analyses.

## SECTION 2.3: ANALYTICAL REQUIREMENTS

2.3.1 With respect to any sample required to be taken pursuant to this approval, the approval holder shall ensure that:

(a) collection;

(b) preservation;

(c) storage;

(d) handling; and

(e) analysis;

shall be conducted in accordance with the following unless otherwise authorized in writing by the Director:

(i) for air monitoring:

(A) the *Methods Manual for Chemical Analysis of Atmospheric Pollutants*, Alberta Environment, 1993, as amended; and

(B) the *Air Monitoring Directive*, Alberta Environment, 1989, as amended;

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(ii) for run-on, run-off, leachate, leak detection liquid, and groundwater parameters:

  (A) the *Standard Methods for the Examination of Water and Wastewater*, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation, 1998, as amended;

(iii) for whole effluent toxicity tests:

  (A) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout*, Environment Canada, Environmental Protection Series 1/RM/13, July 1990, as amended;

  (B) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia Magna*, Environment Canada, Environmental Protection Series 1/RM/14, July 1990, as amended;

  (C) the *Biological Test Method: Growth Inhibition Test Using the Freshwater Alga Selenastrum capricornutum*, Environment Canada, Environmental Protection Series, November 1992, as amended;

  (D) the *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia*, Environment Canada, Environmental Protection Series 1/RM/21, February 1992, as amended;

  (E) the *Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows*, Environment Canada, Environmental Protection Series 1/RM/22, February 1992, as amended; and

  (F) the *Biological Test Method: Toxicity Test Using Luminescent Bacteria (Photobacterium phosphoreum)*, Environment Canada, Environmental Protection Series, 1/RM/24, November 1992, as amended;

(iv) for soil samples:

  (A) *Soil Sampling and Methods of Analysis*, Lewis Publishers, 1993, as amended;

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(B) the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, USEPA, SW-846, September 1986, as amended;

(C) the *Soil Quality Criteria Relative to Disturbance and Reclamation*, Alberta Agriculture, March 1987, as amended;

(D) the *Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites – Volume I: Main Report*, CCME EPC-NCS62E, 1993, as amended; and

(E) the *Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites – Volume II: Analytical Method Summaries*, CCME EPC-NCS66E, 1993, as amended;

(v) for waste analysis:

(A) the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, USEPA, SW-846, September 1986, as amended; or

(B) the *Methods Manual for Chemical Analysis of Water and Wastes*, Alberta Environmental Centre, Vegreville, Alberta, 1996, AECV96-M1 as amended; or

(C) the *Toxicity Characteristic Leaching Procedure (TCLP)* USEPA Regulation 40 CFR261, Appendix II, Method No. 1311, as amended; or

(D) the *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, and the Water Environment Federation, as amended; or

(E) the *Interim Compilation of Test Methods and Methods of Dangerous Goods Regulations*, Environment Canada, as amended.

2.3.2 The approval holder shall analyze all samples that are required to be obtained by this approval in a laboratory accredited pursuant to ISO 17025, as amended, for the specific parameter(s) to be analyzed, unless otherwise authorized in writing by the Director.

2.3.3 The approval holder shall comply with the terms and conditions of any written authorization issued by the Director under 2.3.2.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## PART 3: LANDFILL CONSTRUCTION

### SECTION 3.1: GENERAL

3.1.1 The approval holder shall construct the landfill as described in the application, unless otherwise specified in this approval.

3.1.2 Prior to the construction of any:

- (a) cell;
- (b) surface water management system; or
- (c) cell closure system

the approval holder shall submit to the Director, the following plans for the proposed construction, signed and stamped by a professional registered with APEGGA:

- (i) a Design Plan and Specifications for the proposed construction;
- (ii) a Construction Quality Assurance Plan; and
- (iii) a Construction Quality Control Plan.

3.1.3 The approval holder shall only construct each of the following as authorized in writing by the Director:

- (a) cell;
- (b) surface water management system; and
- (c) cell closure system.

3.1.4 The Design Plan and Specifications in 3.1.2 for any new cell shall include at a minimum all of the following:

- (a) a composite liner for any Class II cells;
- (b) a primary liner and secondary liner for any Class I cells;
- (c) a leachate collection system capable of maintaining the maximum acceptable leachate head for any new cells;
- (d) a leak detection system for any Class I cells; and

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(e) a surface water management system for any new cells to prevent flow onto and off of the active landfill area for events up to at least the peak discharge from a 1 in 25 year – 24 hour duration rainfall event.

3.1.5 The Design Plan and Specifications in 3.1.2 for any cell closure shall include, at a minimum, all of the following unless otherwise authorized in writing by the Director:

(a) a final barrier layer to the satisfaction of the Director;

(b) a topsoil layer, above the final barrier layer, with a minimum thickness to the satisfaction of the Director;

(c) a contoured profile having no slope exceeding 30%;

(d) a contoured profile such that no water pools over the cells; and

(e) a vegetative cover.

3.1.6 The approval holder shall not deviate from the Design Plan and Specifications, as submitted under 3.1.2, unless the following conditions are met:

(a) the deviation results in a minor adjustment to the Design Plan and Specifications in 3.1.2 to suit field conditions encountered; and

(b) the deviation will result in an equivalent design performance of the landfill.

3.1.7 Prior to commencing the operation of any new cell following construction, the approval holder shall:

(a) have constructed the surface water management system for that cell;

(b) implement a groundwater monitoring system for that cell, as necessary, subject to 4.11.2; and

(c) submit to the Director a summary report of the Construction Quality Assurance and Construction Quality Control results signed and stamped by a professional registered with APEGGA.

3.1.8 The summary report in 3.1.7 shall contain the following information, as a minimum:

(a) confirmation that the landfill has been constructed according to:

(i) the Construction Quality Assurance Plan;

(ii) the Construction Quality Control Plan; and

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(iii) the Design Plan and Specifications subject to the deviations as per 3.1.6;

(b) documentation of any minor deviations as per 3.1.6; and

(c) confirmation by the professional registered with APEGGA, that deviations as per 3.1.6 will result in an equivalent design performance of the landfill.

3.1.9 The approval holder shall notify the Director in writing at least 14 days prior to commencing operations of any new cell.

3.1.10 The approval holder shall maintain:

(a) the integrity of the liners;

(b) the integrity of the leachate collection and removal system; and

(c) the integrity of the leak detection system.

## SECTION 3.2: SOIL CONSERVATION

3.2.1 The approval holder shall conserve all topsoil from disturbed land at the landfill.

3.2.2 The topsoil in 3.2.1 shall be used for reclamation of the landfill.

3.2.3 The approval holder shall not use topsoil for cover of the working face.

3.2.4 The approval holder shall salvage all subsoil from disturbed land at the landfill.

3.2.5 The approval holder shall locate all topsoil stockpiles at the landfill.

3.2.6 When topsoil and subsoil are stockpiled, the stockpiles shall be constructed as follows:

(a) topsoil and subsoil shall be stockpiled on stable foundations;

(b) topsoil shall be stockpiled in a manner that prevents admixing with subsoil;

(c) subsoil shall be stockpiled in a manner that prevents admixing with topsoil;

(d) topsoil and subsoil shall be stockpiled separately from each other;

(e) stockpiles shall be stabilized to control wind and water erosion;

(f) stockpiles shall be accessible and retrievable; and

(g) topsoil stockpiles shall be revegetated.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

3.2.7 The approval holder shall immediately suspend topsoil and subsoil salvage when:

(a) wet or frozen field conditions will result in the admixing, degradation, or compaction of topsoil or subsoil; or

(b) high wind velocities, any other field conditions or landfill operations will result in the admixing, degradation, or loss of topsoil or subsoil.

3.2.8 The approval holder shall only recommence topsoil and subsoil salvage when suspended under 3.2.7, if field conditions referred to in 3.2.7 no longer exist.

## PART 4: LANDFILL OPERATIONS, LIMITS, MONITORING AND REPORTING

### SECTION 4.1: GENERAL

4.1.1 The approval holder shall maintain the geographical boundaries of the cells within Subdivision 4 of Section 17 and Subdivision 1 of Section 18, Township 50, Range 11, West of the 5th Meridian, as described in Plan No. 19-4807-3-2 (TEL - September 2009) submitted with the application.

4.1.2 The approval holder shall maintain the final waste elevation of the landfill to no more than the maximum designated waste elevation.

4.1.3 The approval holder shall:

(a) operate, and

(b) maintain

the following waste management facilities at the landfill:

(i) Class I waste disposal areas;

(ii) Class II waste disposal areas;

(iii) any waste storage areas; and

(iv) subject to 4.4.13(f), waste treatment areas.

4.1.4 In addition to 4.1.3 the approval holder shall operate the following infrastructure components at the landfill, at a minimum:

(a) leachate collection and removal systems;

(b) leak detection system;

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(c) run-on control systems;

(d) run-off control systems;

(e) groundwater monitoring wells;

(f) a weigh scale; and

(g) site access control

as described in the application.

4.1.5 The approval holder shall maintain the infrastructure components listed in 4.1.4.

4.1.6 The approval holder shall operate all above ground tanks to conform to the *Guideline for Secondary Containment for Above Ground Storage Tanks,* Alberta Environment, 1997, as amended, unless otherwise authorized in writing by the Director.

### LANDFILL AUDIT

4.1.7 The approval holder shall cause the landfill to be audited by an independent third-party environmental consultant or organization to assess compliance with the terms and conditions of this approval:

(a) at least once every three years; and

(b) commencing on or before August 31, 2011 for the first audit.

4.1.8 The approval holder shall submit the Audit Report specified in 4.1.7, in the Annual Landfill Operation Report as required in 4.10.11.

4.1.9 The requirements in 4.1.7 and 4.1.8 do not relieve the approval holder of any duty under the Act or its regulations or this approval.

### SECTION 4.2: OPERATIONS PLAN

4.2.1 The approval holder shall:

(a) develop;

(b) maintain; and

(c) implement

an Operations Plan that does not contravene the requirements of this approval.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.2.2 The Operations Plan shall include, at a minimum, all of the following:

(a) waste acceptance policies and procedures;

(b) policies and procedures for wastes requiring special handling, if accepted;

(c) a leachate monitoring and management program, including measures to minimize the leachate head;

(d) a leak detection liquid monitoring and management program;

(e) a run-on and run-off management program, including but not limited to inspections of the run-on control system and run-off control system;

(f) an ambient air monitoring program;

(g) operating procedures for nuisance management;

(h) an emergency response plan; and

(i) any other information requested in writing by the Director.

4.2.3 The approval holder shall:

(a) review the Operations Plan annually at a minimum; and

(b) update the Operations Plan as required.

4.2.4 The approval holder shall retain a copy of the Operations Plan at the landfill.

4.2.5 The approval holder shall submit to the Director an up-to-date Operations Plan when requested in writing by the Director.

## SECTION 4.3: AIR

## OPERATIONS

4.3.1 The approval holder shall not release any effluent streams to the atmosphere except as provided in this approval.

4.3.2 The approval holder shall only release effluent streams to the atmosphere from the following sources:

(a) the space ventilation exhaust stacks;

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(b) the space heater exhaust vents; and

(c) any other source authorized in writing by the Director or by an amendment to this approval.

4.3.3 Except as provided for by the Director in writing, the approval holder shall control fugitive emissions and any source not specified in 4.3.2 in accordance with 4.3.4 of this approval.

4.3.4 With respect to fugitive emissions and any source not specified in 4.3.2, the approval holder shall not release a substance or cause to be released a substance that causes or may cause any of the following:

(a) impairment, degradation or alteration of the quality of natural resources; or

(b) material discomfort, harm or adverse affect to the well being or health of a person; or

(c) harm to property or to plant or animal life.

4.3.5 The approval holder shall not burn any debris by means of an open fire unless authorized in writing by the Director.

4.3.6 For any waste disposed of at the landfill that is subject to wind dispersal, the approval holder shall immediately apply cover on top of the waste to minimize entrainment of particulate matter.

## AIR MONITORING AND REPORTING

4.3.7 The approval holder shall implement the ambient air monitoring program as described in the Ambient Air Monitoring Program Summary submitted as an addendum to the application and as amended.

4.3.8 The approval shall only implement revisions to the ambient air monitoring program in 4.3.7 as authorized in writing by the Director.

4.3.9 The approval holder shall submit to the Director the following Ambient Air Monitoring Reports:

(a) a monthly report

(i) by the end of each month following the month in which the information was collected, and

(ii) containing the ambient air monitoring results for that month

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

unless otherwise authorized in writing by the Director; and

(b) an annual report

  (i) by March 31 of each year following the year in which the information was collected, and

  (ii) containing a summary and evaluation of the ambient air monitoring results for that year.

## SECTION 4.4: WASTE ACCEPTANCE

4.4.1 The approval holder shall classify and characterize all wastes entering the landfill in accordance with the following:

(a) *Waste Control Regulation*, AR 192/96, as amended; and

(b) the *Alberta User Guide for Waste Managers*, May 1995, as amended.

4.4.2 Excluding inert waste, municipal solid waste, and flyash, the approval holder shall obtain, at a minimum, a detailed chemical and physical representative analysis of the wastes prior to disposal into the landfill at the following times:

(a) the first time a waste is received from a new waste generator;

(b) the first time a delivery is received from a different process associated with a known waste generator;

(c) the first time a waste is received from a different location associated with a known waste generator; and

(d) when the nature or composition of the waste that was previously characterized by the generator changes.

4.4.3 The approval holder shall not dispose of the following at the landfill:

(a) explosives (Class 1 *Transportation of Dangerous Goods Regulation* (TDGR) wastes);

(b) radioactive wastes regulated under the *Canadian Nuclear Safety Act* (Canada);

(c) radioactive wastes (Class 7 TDGR wastes);

(d) biological, biomedical and/or pathological waste (as defined in the *Waste Control Regulation, AR 192/96*, as amended);

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(e) waste containing free liquids (as determined by the US EPA Method 9095 Paint Filter Liquids Test, specified in Test Methods for Evaluating Solid Wastes Physical/Chemical Methods, US EPA Publication No. SW-846, as amended);

(f) material containing ozone depleting substances; and

(g) domestic wastewater.

4.4.4 The approval holder shall dispose of no greater than 2,000 tonnes of municipal solid waste in the landfill each year.

4.4.5 The approval holder shall not dispose of hazardous waste in any Class II cell.

4.4.6 The approval holder shall remove all waste that the landfill is not authorized to dispose of within 7 days of receiving the waste.

4.4.7 The approval holder shall remove wastes from the landfill, that the landfill is not authorized to dispose of, to a facility holding a current Approval, Registration, or as otherwise authorized under the Act, or to facilities approved by a local environmental authority outside of Alberta.

4.4.8 The approval holder shall prevent incompatible wastes from mixing.

4.4.9 All wastes shall be transferred only at designated transfer areas designed to contain spills and leaks.

4.4.10 Hazardous waste or hazardous recyclables stored in containers or tanks shall be stored in accordance with the *Hazardous Waste Storage Guidelines*, June 1988, Alberta Environment, as amended.

4.4.11 Notwithstanding 4.1.6, all tanks within the tank farm shall be equipped, at a minimum, with all of the following:

(a) sensors for detecting the level in each tank;

(b) high level alarms that activate when a tank overfill is imminent;

(c) automatic shut-off devices or sufficient free board space above the high level sensor to allow operators time to prevent overfill from occurring; and

(d) earthen dikes or equivalent secondary containment structures capable of containing 110% of the volume of the largest tank within the bermed area plus 10% of the aggregate capacity of all other tanks in the bermed area.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.4.12 The approval holder shall use the following when transferring substances to, from, or between containers, tanks, or trucks:

(a) couplings equipped with seals that are compatible with the substance transferred;

(b) the necessary precautions to prevent spills when the couplings are disconnected; and

(c) transfer areas and associated curbing, paving, catchment areas and portable secondary containment devices.

4.4.13 The approval holder shall only carry out the following activities at the landfill in relation to hazardous waste as follows:

(a) commingling of hazardous waste or hazardous recyclables shall be conducted only:

(i) to make maximum use of available container or tank capacity, and

(ii) if the resultant mixture has the same TDG hazard classification as any one of the individual components;

(b) phase separation by gravity settling shall be conducted only without the addition of any chemicals designed to accelerate settling;

(c) dispersion of solids into liquids by natural or mechanical means shall be conducted only if the resultant mixture has the same TDG hazard classification as the original waste;

(d) physical segregation of hazardous from non-hazardous articles or components from the same container shall be conducted only if, no process equipment is used;

(e) crushing of used filters, rags, absorbent materials, and empty containers shall be conducted only for the purpose of volume reduction and liquid recovery unless otherwise authorized in writing by the Director; and

(f) energy recovery or treatment of third-party hazardous waste only as authorized in writing by the Director.

4.4.14 Notwithstanding 4.4.13(f), the approval holder shall not incinerate hazardous waste at the landfill.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## SPECIAL WASTES

4.4.15 The approval holder shall dispose of asbestos wastes in accordance with the *Guidelines for the Disposal of Asbestos Waste*, Alberta Environmental Protection, as amended.

4.4.16 The approval holder shall dispose of contaminated sulphur and sulphur containing wastes in accordance with the *Guidelines for the Disposal of Sulphur Containing Solid Wastes*, Alberta Environmental Protection, as amended, unless an alternate method proposed by the approval holder is authorized in writing by the Director.

## SECTION 4.5: LEACHATE AND LEAK DETECTION LIQUID MANAGEMENT

4.5.1 The approval holder shall dispose of:

(a) leachate removed from the leachate collection system, and

(b) leak detection liquid removed from the leak detection system

only by one or more of the following methods:

(i) disposal to facilities holding a current Approval, Registration or as otherwise authorized under the Act to accept such waste;

(ii) disposal to facilities approved by a local environmental authority outside of Alberta to accept such waste;

(iii) recirculation through the cell from which it was taken; or

(iv) disposal to a deep well approved by the Alberta Energy Resources Conservation Board.

4.5.2 Subject to 4.5.3, during landfill operations, closure and post-closure, the maximum acceptable leachate head shall not exceed 300 mm.

4.5.3 Notwithstanding 4.5.2, the maximum acceptable leachate head may be exceeded during times of higher than expected precipitation events for a period of not more than 14 days from the end of the event.

4.5.4 The volume of liquid in the leak detection system, as monitored in TABLE 4.10-D, shall not exceed the action leakage rate in any cell.

## SECTION 4.6: SURFACE WATER MANAGEMENT

4.6.1 The approval holder shall not release any substances from the run-off control system to the surrounding watershed except as authorized by this approval.

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.6.2 The approval holder shall not allow run-on to enter the active landfill area.

4.6.3 The approval holder shall direct all run-off to the run-off control system as specified in the application.

4.6.4 The approval holder shall dispose of run-off collected within the tank farm berm area only to the following:

(a) a deep well approved by the Alberta Energy Resources Conservation Board;

(b) the run-off control pond(s) within the run-off control system; or

(c) as otherwise authorized in writing by the Director.

4.6.5 Releases from the run-off control system shall comply with the limits for the parameters specified in TABLE 4.6-A.

**TABLE 4.6-A: RUN-OFF LIMITS**

| **Parameter** | **Maximum Concentration or Range (in mg/L unless otherwise specified)** |
|---|---|
| Chemical Oxygen Demand | 50 mg/L |
| Total Suspended Solids | 25 mg/L |
| Chloride, dissolved | 250 mg/L |
| Ammonia, dissolved (expressed as Nitrogen) | 5 mg/L |
| pH | 6.0 – 9.5 pH units |
| Oil or other substances | Not present in amounts sufficient to create a visible film or sheen |
| 96-Hour Multiple Concentration Acute Lethality Test Using Rainbow Trout (*Oncorhynchus mykiss*) | 50% or greater survival |
| 48-Hour Static Acute Lethality Test Using *Daphnia magna* | Result must "PASS" test |

4.6.6 Subject to 4.6.5, the approval holder shall only release the run-off from the run-off control system to the Paddy Creek drainage basin.

4.6.7 The approval holder shall only use flocculants for the run-off control pond(s) within the run-off control system as authorized in writing by the Director.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.6.8 Subject to 4.6.7, the approval holder shall maintain a record of flocculants that are added to the run-off control ponds within the run-off control system including, at a minimum, the following:

(a) the location of the addition of flocculants;

(b) the type of flocculants added;

(c) the concentration of flocculants in the run-off control pond(s); and

(d) the date of addition.

## SECTION 4.7: AQUATIC AND TERRESTRIAL ECOSYSTEM

4.7.1 The approval holder shall implement the Aquatic and Terrestrial Ecosystem Monitoring Plan, subject to 4.7.2.

4.7.2 The approval holder shall only implement revisions to the Aquatic and Terrestrial Ecosystem Monitoring Plan in 4.7.1 as authorized in writing by the Director.

4.7.3 The approval holder shall submit to the Director an Annual Aquatic and Terrestrial Ecosystem Monitoring Report:

(a) by March 31 of each year following the year in which the information was collected; and,

(b) containing a summary and evaluation of the ecosystem and terrestrial monitoring results for the respective year.

## SECTION 4.8: DOMESTIC WASTEWATER

4.8.1 The approval holder shall not release any substance from the domestic wastewater system to the surrounding watershed except as authorized by this approval.

4.8.2 The approval holder shall release domestic wastewater only to a holding tank(s) with subsequent disposal to a wastewater treatment facility holding a current Approval or Registration under the Act.

4.8.3 Sludge produced by the domestic wastewater collection system shall be disposed of only at a facility holding a current Approval or Registration under the Act.

## SECTION 4.9: SPECIAL REPORTING

4.9.1 The approval holder shall report to the Director in writing on the status of the Regional Advisory Panel by March 31 of each year.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.9.2 The approval holder shall report to the Director in writing by March 31 of each year the waste type and amount received at the landfill from within the following geographic areas in Alberta:

(a) the area west of the 5th Meridian, south of Township 62, north of Township 35, and east of the Alberta/British Columbia border; and

(b) the remaining portion of Alberta that is outside the geographic area described in 4.9.2(a).

## SECTION 4.10: LANDFILL MONITORING AND REPORTING

### LANDFILL OPERATIONS

4.10.1 The approval holder shall monitor operations at the landfill as required in TABLE 4.10-A.

**TABLE 4.10-A: OPERATIONS - MONITORING AND REPORTING REQUIREMENTS**

| Monitoring/Measuring/Observing | | | | Reporting |
|---|---|---|---|---|
| **Monitoring/ Measuring Activity** | **Frequency** | **Method** | **Sampling Location** | |
| Weighing and observing type of waste received | Continuously (when operating) | Measurement | At entrance to landfill | Annually, as per 4.10.11, on or before March 31 of the year following the year in which the information was collected |
| Weighing and observing type of material removed | Continuously (when operating) | Measurement | At entrance to landfill | |
| Tracking general location of waste deposited | Daily (when operating) | By estimation | At active landfill area or GPS co-ordinates | |

4.10.2 The approval holder shall submit a monthly report to the Director within 30 days following the month in which the information was collected.

4.10.3 The monthly report referred to in 4.10.2 shall contain the following information:

(a) an opening waste inventory balance in kilograms or litres, or other units to the satisfaction of the Director, by waste class or material type;

(b) the amount and type of waste received from within the province and from outside the province;

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(c) the amount and type of waste shipped, recycled, disposed off-site and disposed on-site;

(d) any adjustments including consolidation and processing adjustments;

(e) closing balance in kilograms or litres, or other units to the satisfaction of the Director; and

(f) other information as authorized in writing by the Director.

4.10.4 Excluding the general location of waste deposited, the approval holder shall compile all the information required by 4.4.1 and Table 4.10-A in an Annual Waste Management Summary report:

(a) as specified in TABLE 4.10-B; and

(b) pursuant to or in compliance with *Industrial Waste Identification and Management Options*, May 1996 as amended, and the *Alberta User Guide for Waste Managers*, May 1995, as amended.

**TABLE 4.10-B: ANNUAL WASTE MANAGEMENT SUMMARY**

| **Waste Name** | **Uniform Waste Code** | | | | **Quantity (e.g. kg or L)** | | **Stored** | **Recycled** | | **Disposed** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **WC** | **PIN** | **Class** | **Mgmt** | **Hazardous** | **Non-hazardous** | **On-Site** | **On-site** | **Off-site** | **On-site** | **Off-site** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | TOTAL | | | | | | | |

## LEACHATE AND LEAK DETECTION LIQUID

4.10.5 Subject to TABLE 4.10-C, the approval holder shall monitor:

(a) leachate; and

(b) leak detection liquid

at the landfill as required in TABLE 4.10-D.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## TABLE 4.10-C: LEACHATE AND LEAK DETECTION LIQUID MONITORING PARAMETERS

| PARAMETERS | |
|---|---|
| **List A** | **List B** |
| pH (laboratory) | pH (laboratory) |
| Electrical Conductivity (laboratory) | Electrical Conductivity (laboratory) |
| Major Ions | Major Ions |
| Trace Metals (dissolved) | Petroleum Hydrocarbon Fractions |
| Nutrients | |
| Chemical Oxygen Demand | |
| Petroleum Hydrocarbon Fractions | |

## TABLE 4.10-D: LEACHATE AND LEAK DETECTION LIQUID MONITORING AND REPORTING REQUIREMENTS

| MONITORING | | | | REPORTING |
|---|---|---|---|---|
| **Monitoring Activity** | **Frequency** | **Method** | **Sampling Location** | |
| Leachate head | At least once every three working days and immediately prior to leachate removal | Measurement | At leachate collection system sump(s) of each cell | Annually, as per 4.10.11, on or before March 31 of the year following the year in which the information was collected |
| Leachate analysis, as per TABLE 4.10-C | At least four times per year, each in different months:<br>a) semi-annually for List A; and<br>b) semi-annually for List B | Grab sample | At each leachate collection system sump | |
| Volume of leachate removed from the leachate collection system | As removed | Measurement | At leachate collection system sump(s) | |
| Presence of any leak detection liquid | At least once every three working days and immediately prior to leak detection liquid removal | Measurement | At each leak detection system sump | |
| Leak detection liquid analysis, as per TABLE 4.10-C | At least four times per year, each in different months:<br>a) semi-annually for List A; and<br>b) semi-annually for List B | Grab sample | At each leak detection system sump | |
| Volume of leak detection liquid removed from the leak detection system | As removed | Measurement | At leak detection system sump | |

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.10.6 If the volume of liquid removed from the leak detection system exceeds the action leakage rate, in addition to reporting pursuant to 2.1.1, the approval holder shall submit a response action plan to the Director within 30 days of the excess.

## SURFACE WATER

4.10.7 The approval holder shall monitor the run-off control system as required in TABLE 4.10-E.

4.10.8 The approval holder shall report to the Director the results of the run-off control system monitoring as required in TABLE 4.10-E.

### TABLE 4.10-E: RUN-OFF RELEASE MONITORING AND REPORTING

| Parameters | Frequency | Sample Type | Sample Location | Reporting |
|---|---|---|---|---|
| Chemical Oxygen Demand | (a) prior to each release, and<br>(b) during any unanticipated release from the run-off control system | Represent-ative grab sample | Each run-off pond from which a release<br>(a) is to occur, or<br>(b) is occurring | Annually, on or before March 31 of the year following the year in which the information was collected |
| Total Suspended Solids | | | | |
| Chloride, dissolved | | | | |
| Ammonia, dissolved (expressed as Nitrogen) | | | | |
| pH | | | | |
| Oil or other substances | | | | |
| 96-Hour Multiple Concentration Acute Lethality Test Using Rainbow Trout (*Oncorhynchus mykiss*) | Prior to the first release of each month | | | |
| 48-Hour Static Acute Lethality Test Using *Daphnia magna* | | | | |
| Volume | When released | Estimated | Discharge Point | |

4.10.9 The approval holder shall analyze a representative grab sample from each run-off pond of the run-off control system at least once per year for the parameters outlined in TABLE 4.10-F.

4.10.10 The approval holder shall submit the results of the analyses in 4.10.9 to the Director on or before March 31 of the following year.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## TABLE 4.10-F: RUN-OFF ANNUAL MONITORING PARAMETERS

| **PARAMETERS** | | | |
|---|---|---|---|
| Biochemical Oxygen Demand | Chemical Oxygen Demand | Chromium (hexavalent) | pH |
| Phenol (Total) | Polychlorinated Biphenyls | Total Suspended Solids | Cyanide (Total) |
| Major Ions | Nutrients | Petroleum Hydrocarbon Fractions | Trace Metals (dissolved) |

## ANNUAL LANDFILL OPERATION REPORT

4.10.11 The approval holder shall submit to the Director, an Annual Landfill Operation Report which shall include, at a minimum, all of the following information:

(a) a summary of the information monitored as required in TABLE 4.10-A and TABLE 4.10-D;

(b) a summary of landfill inspections conducted by the approval holder;

(c) a summary of the performance of the surface water management systems;

(d) a summary of any operational problems and emergencies related to this approval and how they were handled;

(e) a summary of the performance of the leachate collection system, including a comparison to the maximum acceptable leachate head;

(f) a summary of the performance of the leak detection system, including a comparison to the action leakage rate;

(g) an up-to-date financial security estimate in accordance with 4.13.2;

(h) the results of any audit conducted in accordance with 4.1.8 for a given year;

(i) a record of public complaints and the approval holder's responses;

(j) a summary of the cell closures and operation commencements during the reporting year;

(k) a summary of contraventions reported pursuant to 2.1.1 related to landfill operations; and

(l) any other information requested in writing by the Director.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## SECTION 4.11: GROUNDWATER

4.11.1 The approval holder shall operate the groundwater monitoring system for the landfill in accordance with the groundwater monitoring program titled Groundwater Monitoring Plan, dated January 26, 2010, submitted with the application and as amended.

4.11.2 The approval holder shall only implement revisions to the groundwater monitoring program in 4.11.1 as authorized in writing by the Director.

4.11.3 The approval holder shall:

(a) collect a representative groundwater sample from each of the groundwater monitor wells designated as points of compliance in the groundwater monitoring program; and

(b) analyze the sample for the parameters listed in the groundwater monitoring program, unless otherwise authorized in writing by the Director.

4.11.4 The groundwater quality in the monitoring wells, designated as points of compliance in the groundwater monitoring program, shall not exceed the higher of:

(a) the objectives established in the *Guidelines for Canadian Drinking Water Quality*, Health Canada, as amended; or,

(b) the limits established in the *Alberta Tier 1 or Tier 2 Soil and Groundwater Remediation Guidelines*, Alberta Environment, 2009, as amended;

unless the representative background level for any parameter naturally exceeds the objective established in the guidelines referred to in (a) and (b).

4.11.5 The approval holder shall implement the remediation or risk management program as described in the Operations Plan, when groundwater quality exceeds the groundwater performance criteria in 4.11.4 (a) and (b).

4.11.6 The samples extracted from the groundwater monitor wells shall be collected using scientifically acceptable purging, sampling and preservation procedures so that a representative groundwater sample is obtained.

4.11.7 All groundwater monitor wells shall be:

(a) protected from damage; and

(b) locked except when being sampled, unless otherwise authorized in writing by the Director.

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.11.8 If a representative groundwater sample cannot be collected because the groundwater monitoring well is damaged or is no longer capable of producing a representative groundwater sample:

(a) the groundwater monitoring well shall be cleaned, repaired or replaced; and

(b) a representative groundwater sample shall be collected and analyzed during the next scheduled sampling event

unless otherwise authorized in writing by the Director.

4.11.9 In addition to the sampling information recorded in 2.2.1, the approval holder shall record the following sampling information for all groundwater samples collected:

(a) a description of purging and sampling procedures;

(b) the static elevations, above sea level, of fluid phases in the groundwater monitoring well prior to purging;

(c) the temperature of each sample at the time of sampling;

(d) the pH of each sample at the time of sampling; and

(e) the specific conductance of each sample at the time of sampling.

4.11.10 The approval holder shall compile an Annual Groundwater Monitoring Program Report which shall include, at a minimum, all of the following information:

(a) a legal description of the landfill and a map illustrating the landfill boundaries;

(b) a topographic map of the landfill;

(c) a description of the landfill activity and processes;

(d) a map showing the location of all surface and groundwater users, and, a listing describing surface water and water well use details, within at least a three kilometre radius of the landfill;

(e) a general hydrogeological characterization of the region within a five kilometre radius of the landfill;

(f) a detailed hydrogeological characterization of the landfill;

(g) a geological cross-section(s) of the landfill;

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(h) a map of surface drainage patterns located within the landfill;

(i) a map of groundwater monitoring well locations and a description of the existing groundwater monitoring program for the landfill;

(j) a summary of any changes to the groundwater monitoring program made since the last groundwater monitoring program report;

(k) analytical data recorded as required in 4.11.6 and 4.11.9;

(l) a summary of fluid elevations recorded as required in 4.11.9(b) and an interpretation of changes in fluid elevations;

(m) an interpretation of groundwater flow patterns;

(n) an interpretation of the analytical results including the following:

  (i) diagrams indicating the location of any contamination identified,

  (ii) probable sources of contamination, and

  (iii) the extent of contamination identified;

(o) a summary and interpretation of the data collected since the groundwater monitoring program began including:

  (i) control charts which indicate trends in contaminant concentrations, and

  (ii) the migration of contaminants;

(p) a description of the following:

  (i) contaminated groundwater remediation techniques employed,

  (ii) source elimination measures employed,

  (iii) risk assessment studies undertaken, and

  (iv) risk management studies undertaken;

(q) a sampling schedule for the following year;

(r) recommendations, as follows:

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(i) for changes to the groundwater monitoring program to make it more effective, and

(ii) for remediation, risk assessment or risk management of contamination identified.

4.11.11 The Annual Groundwater Monitoring Program Report shall be signed and stamped by a professional registered with APEGGA, or signed by another professional as authorized in writing by the Director.

4.11.12 The approval holder shall submit two copies of the Annual Groundwater Monitoring Program Report to the Director on or before March 31 of the year following the year in which the information on which the report is based was collected, unless otherwise authorized in writing by the Director.

## SECTION 4.12 : SOIL MONITORING

4.12.1 The approval holder shall develop and document proposals for the Soil Monitoring Program in accordance with the *Soil Monitoring Directive*, Alberta Environment, May 1996, as amended.

4.12.2 The approval holder shall submit the Soil Monitoring Program proposals to the Director according to the following schedule:

(a) for the first soil monitoring proposal, no later than November 30, 2010; and

(b) for the second soil monitoring proposal, no later than November 30, 2015; or

unless otherwise authorized in writing by the Director.

4.12.3 If the Soil Monitoring Program proposals are found deficient by the Director, the approval holder shall correct all the deficiencies as outlined by the Director within 120 days of the deficiency letter.

4.12.4 The approval holder shall implement the Soil Monitoring Program proposals as authorized in writing by the Director.

4.12.5 The approval holder shall implement QA/QC provisions in accordance with the *CCME Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites, Volume I*, Report CCME EPC-NCS62E, Winnipeg, Manitoba, December 1993, as amended.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

## STANDARDS

4.12.6 For sampling locations which meet the conditions in C.1 of the *Soil Monitoring Directive*, May 1996, as amended, the concentration of substances in soil shall be compared to values in the following:

(a) for petroleum hydrocarbons, *Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities*, Alberta Environment, 2001, as amended;

(b) for salt, *Salt Contamination Assessment and Remediation Guidelines,* Alberta Environment, 2001, as amended;

(c) for substances not included in 4.12.6 (a) or (b), *Canadian Environmental Quality Guidelines,* Canadian Council of Ministers of the Environment, PN1299, 1999, as amended, excluding values determined before 1997;

(d) for substances not found in 4.12.6 (a) to (c), for soil which will be remediated to an agricultural, residential, or parkland land use, *Alberta Tier I Criteria for Contaminated Soil Assessment and Remediation*, Alberta Environmental Protection, March 1994, as amended; and

(e) for substances not found in 4.12.6 (a) to (c), for soil which will be remediated to a commercial or industrial land use, the *Interim Canadian Environmental Quality Criteria for Contaminated Sites*, Canadian Council of Ministers of the Environment, EPC-CS34, September 1991, as amended.

4.12.7 For sampling locations which do not meet the conditions in C.1 of the *Soil Monitoring Directive*, May 1996, as amended, or if substances are present that are not listed in the standards referred to in 4.12.6 (a) to 4.12.6 (e), the concentrations of substances in soil shall be compared to values derived using methods in C.2 of the *Soil Monitoring Directive*.

## REPORTING

4.12.8 The approval holder shall submit two copies of each Soil Monitoring Program Report to the Director summarizing the data obtained from the soil monitoring referred to in 4.12.4 according to the following schedule:

(a) for the first soil monitoring report, no later than October 31, 2011; and

(b) for the second soil monitoring report, no later than October 31, 2016; or

unless otherwise authorized in writing by the Director.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.12.9 The Soil Monitoring Program reports shall be as prescribed in the reporting requirements of the *Soil Monitoring Directive*, May 1996, as amended.

## SOIL MANAGEMENT PROGRAM

4.12.10 If the Soil Monitoring Program, or any other soil monitoring, reveals that there are substances present in the soil at concentrations greater than the applicable concentrations in 4.12.6 or 4.12.7, the approval holder shall develop and document a Soil Management Program Proposal in accordance with the *Guideline for Monitoring and Management of Soil Contamination Under EPEA Approvals*, Chemicals Assessment and Management Division, May 1996, as amended, or as otherwise authorized in writing by the Director.

4.12.11 If required pursuant to 4.12.10, the approval holder shall submit a Soil Management Program Proposal to the Director within six months after the date that the Soil Monitoring Report referred to in 4.12.8 is due.

4.12.12 The Soil Management Program Proposal shall include, at a minimum, all of the following:

(a) steps to be taken to control sources of contamination;

(b) remediation objectives for substances identified by soil monitoring as exceeding the applicable maximum standards in 4.12.6 or 4.12.7;

(c) proposed steps for management of soil contamination; and

(d) a schedule for implementing the Soil Management Program.

4.12.13 If the Soil Management Program Proposal is found deficient by the Director, the approval holder shall correct all the deficiencies as outlined by the Director by the date specified in the deficiency letter.

4.12.14 The approval holder shall implement the Soil Management Program as authorized in writing by the Director.

4.12.15 If the approval holder must implement a Soil Management Program pursuant to 4.12.14, the approval holder shall submit a written Soil Management Program Report to the Director on or before March 31 of each year, unless otherwise authorized in writing by the Director.

4.12.16 The Soil Management Program Report shall include, at a minimum, all of the following information:

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(a) a summary of actions taken under the Soil Management Program during the previous year;

(b) a description and interpretation of results obtained, including any soil testing, from the Soil Management Program; and

(c) events planned for the current year including any deviations from the program authorized in writing by the Director

## SECTION 4.13: FINANCIAL SECURITY REQUIREMENTS

4.13.1 The approval holder shall annually review and revise the cost estimate for reclamation of the landfill including decommissioning, reclamation, closure and post-closure.

4.13.2 The approval holder shall:

(a) adjust the financial security of the landfill based on the review in 4.13.1 or due to inflation; and

(b) submit to the Director for review the revised estimate of financial security as part of the Annual Landfill Operation Report in 4.10.11.

4.13.3 The approval holder shall provide additional financial security as required in writing by the Director.

4.13.4 The approval holder shall ensure the required financial security is maintained and renewed for the landfill at least 30 days prior to the date it expires.

4.13.5 The approval holder shall renew the financial security for the waste landfill 30 days prior to the date of expiry of the financial security.

## PART 5: FINAL CLOSURE, RECLAMATION AND POST-CLOSURE

## SECTION 5.1: FINAL CLOSURE AND RECLAMATION

5.1.1 The approval holder shall submit a Final Closure Plan to the Director at least 180 days prior to permanently ceasing the landfill operation.

5.1.2 The Final Closure Plan shall include, at a minimum, all of the following:

(a) a schedule for completion of the final closure;

(b) a plan for completion of the final cover system;

(c) a drawing that shows the proposed slopes of the final cover;

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

(d) a plan for replacement of soil;

(e) a plan for remediation of areas affected by subsidence and differential settlement;

(f) a plan for erosion control;

(g) a plan for restoration of surface water drainage;

(h) plans for changes to the groundwater monitoring systems, including but not limited to the addition or deletion of components of those systems;

(i) plans for changes to the leachate collection systems, including but not limited to the addition or deletion of components of those systems;

(j) plans for decommissioning and removal of buildings, storage areas, processing areas or any other property that will no longer be required; and

(k) a Quality Assurance/Quality Control Program.

5.1.3 The Final Closure Plan shall be signed and stamped by a professional registered with APEGGA, or signed by another professional as authorized in writing by the Director.

5.1.4 If the Final Closure Plan is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within 60 days of the deficiency letter.

5.1.5 The approval holder shall implement the Final Closure Plan as authorized in writing by the Director.

5.1.6 The approval holder shall commence closure of individual cells no later than 180 days following the cell reaching the maximum designated waste elevation, unless otherwise authorized in writing by the Director.

5.1.7 Within 90 days of completion of cell closure, the approval holder shall submit to the Director a Closure Report.

5.1.8 The Closure Report in 5.1.7 shall include, at a minimum, all of the following:

(a) as-built plans and details on the location of cells that have been closed;

(b) certified construction QA/QC procedures employed during cover construction and installation; and

(c) survey reports showing the final cover elevations.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

5.1.9 The approval holder shall notify the Director of the proposed date of the completion of final closure of the landfill at least 180 days prior to the proposed date.

5.1.10 The approval holder shall commence final closure of the landfill:

(a) no later than 180 days after the landfill reaches the maximum designated waste elevation; or

(b) if no waste is received at the landfill for disposal for a period of 180 days.

5.1.11 The approval holder shall notify the Director of the date of commencement of final closure of the landfill no later that 30 days following commencement of final closure.

5.1.12 The approval holder shall complete final closure of the landfill no later than 180 days following the date of commencement of final closure specified in 5.1.9 or another time authorized in writing by the Director.

5.1.13 The approval holder shall submit a Final Closure Report signed and stamped by a professional registered with APEGGA, or signed by another professional as authorized in writing by the Director, within 90 days following completion of the final closure of the landfill.

5.1.14 The Final Closure Report shall include, at a minimum, all of the following:

(a) the date of completion of the final closure;

(b) a statement including supporting evidence that the final closure has been completed in accordance with the final closure plan;

(c) a description of any deviations to the final closure plan and the reasons for the deviations;

(d) a description of the final cover system and the installation methods and procedures used;

(e) an estimate of the maximum quantity of waste placed in the landfill for disposal over the life of the landfill;

(f) a description of how the following elements have been, or will be dealt with:

(i) the final use of the closed areas;

(ii) drainage restorations;

(iii) soil replacement;

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

(iv) final cover slopes;

(v) erosion control;

(vi) re-vegetation and condition of the site; and

(vii) subsidence and differential settlement remediation; and

(g) as-built plans, signed and stamped by a professional registered with APEGGA, for the landfill showing the location of fill areas, final grades and structural components.

## SECTION 5.2: POST-CLOSURE

5.2.1 The approval holder shall submit to the Director, an up-to-date Post-Closure Plan, no less than 180 days prior to the proposed date of the completion of final closure of the landfill.

5.2.2 The approval holder shall include the following in the Post-Closure Plan at a minimum:

(a) a plan for maintaining the integrity of the final cover systems;

(b) a plan for maintaining the surface water management systems;

(c) a plan for maintaining the groundwater monitoring system;

(d) the groundwater monitoring program including performance standards and points of compliance;

(e) a plan for maintaining the leachate collection and monitoring system;

(f) a plan for maintaining the leak detection system;

(g) quality and quantity objectives of leachate that show the landfill has stabilized;

(h) a plan for remediating areas affected by subsidence and differential settlement;

(i) a plan for erosion control;

(j) a plan for maintaining vegetative cover; and

(k) any other information requested in writing by the Director.

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

5.2.3 If the Post-Closure Plan is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within 60 days of the deficiency letter.

5.2.4 The approval holder shall implement the Post-Closure Plan as authorized in writing by the Director.

## POST CLOSURE MONITORING AND REPORTING

5.2.5 The approval holder shall monitor the landfill in accordance with the Post-Closure Plan for the duration of post-closure.

5.2.6 The approval holder shall compile an Annual Post-Closure Report.

5.2.7 The Annual Post-Closure Report shall include the following at a minimum:

(a) the annual groundwater monitoring report;

(b) details on any repairs and maintenance of the final cover system and vegetation;

(c) a report of any remedial or corrective actions taken; and

(d) any other information requested in writing by the Director.

5.2.8 The approval holder shall submit one copy of the Annual Post-Closure Report to the Director on or before March 31 of the year following the year in which the information on which the report is based was collected, unless otherwise authorized in writing by the Director.

February 26, 2010
Date Signed

DESIGNATED DIRECTOR UNDER THE ACT
David Helmer, P.Eng.

Alberta Government

# AMENDING APPROVAL

## PROVINCE OF ALBERTA

## ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT R.S.A. 2000, c.E-12, as amended.

APPROVAL NO. 48516-01-02

APPLICATION NO. 0010-48516

EFFECTIVE DATE:. October 14, 2015

EXPIRY DATE: MARCH 31, 2019

APPROVAL HOLDER SECURE ENERGY SERVICES INC.

ACTIVITY: Construction, Operation and Reclamation of the Pembina Area Landfill

Consisting of a Class I and Class II Landfill, where more than 10,000 tonnes per year of hazardous waste and non-hazardous waste are disposed of.

is subject to the attached terms and conditions.

Designated Director under the Act
Todd Aasen, P.Eng.

Date Signed October 14, 2015

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

*Environmental Protection and Enhancement Act* Approval No. 48516-01-00 is hereby further amended as follows:

1. A sub-clause is added under Clause 4.5.1:

   4.5.1 (v) or as otherwise authorized in writing by the Director.

2. Clause 4.6.6 is repealed and replaced with the following:

   4.6.6 Subject to 4.6.5, the approval holder shall only release the run-off from the run-off control system to the Paddy Creek drainage basin, or as otherwise authorized in writing by the Director.

DATED October 14, 2015

DESIGNATED DIRECTOR UNDER THE ACT

Alberta Government

# AMENDING APPROVAL

## PROVINCE OF ALBERTA

## ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
## R.S.A. 2000, c.E-12, as amended.

APPROVAL NO. 48516-01-03

APPLICATION NO. 0011-48516

EFFECTIVE DATE:. November 10, 2015

EXPIRY DATE: June 1, 2020

APPROVAL HOLDER SECURE ENERGY SERVICES INC.

ACTIVITY: Construction, Operation and Reclamation of the Pembina Area Landfill

Consisting of a Class I and Class II Landfill, where more than 10,000 tonnes per year of hazardous waste and non-hazardous waste are disposed of.

is subject to the attached terms and conditions.

Designated Director under the Act
Todd Aasen, P.Eng.

Date Signed November 10, 2015

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

*Environmental Protection and Enhancement Act* Approval No. 48516-01-00-00 is hereby further amended as follows:

1. Clause 3.1.1 is repealed and replaced with the following:

   3.1.1 The approval holder shall construct the landfill as described in the applications submitted in August, 1998 and in September, 2015, unless otherwise specified in this approval.

DATED November 10, 2015

DESIGNATED DIRECTOR UNDER THE ACT

Environment
and Parks

# AMENDING APPROVAL

## PROVINCE OF ALBERTA

## *ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT*
## R.S.A. 2000, c.E-12, as amended.

APPROVAL NO.: 48516-01-04

APPLICATION NO.: 009-48516

EFFECTIVE DATE: July 14, 2016

EXPIRY DATE: March 31, 2019

APPROVAL HOLDER: Secure Energy Services Inc.

ACTIVITY: Construction, operation and reclamation of the Pembina Area Landfill

Consisting of a Class I and Class II Landfill, where more than 10,000 tonnes per year of hazardous waste and non-hazardous waste are disposed of.

is amended as per the attached terms and conditions.

Designated Director under the Act: Todd Aasen, P.Eng.

Date Signed: July 14, 2016

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

*Environmental Protection and Enhancement Act* Approval No. 48516-01-00 is hereby further amended as follows:

1. **Part 1: DEFINITIONS**, **SECTION 1.1: DEFINITIONS**, the following clauses are added:

1.1.2 (g.1) "bulk form" means NORM waste that is not packaged in a container;

(ee.1) "IAEA" means the International Atomic Energy Association;

(ee.2) "IAEA Regulations" means IAEA Regulations within the meaning of the *Packaging and Transport of Nuclear Substances Regulations, 2015* [Canada], as amended;

(tt.1) "NORM" means Naturally Occurring Radioactive Materials;

(tt.2) "NORM Waste" means any waste material with concentrations of NORM above the limits specified in Tables 5.1, 5.2, or 5.3 of the *Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, Health Canada, 2011, as amended;

(ooo.1) "type IP-1" means type IP-1 within the meaning of the *Packaging and Transport of Nuclear Substances Regulations, 2015* [Canada], as amended;

2. **PART 3: LANDFILL CONSTRUCTION, SECTION 3.1: GENERAL**, the following clauses are added:

3.1.11 The approval holder shall install a gate monitor specified in the applicant's submission dated February 19, 2016 which forms part of the application, on or before December 31, 2016, or as otherwise authorized in writing by the Director.

3.1.12 The approval holder shall notify the Director in writing within 30 days after completion of installation of the gate monitor in 3.1.11.

3. **PART 4: LANDFILL OPERTIONS, LIMITS, MONITORING AND REPORTING, SECTION 4.3: AIR**, under **AIR MONITORING AND REPORTING**, the following clause is added:

4.3.10 The approval holder shall implement the air monitoring program as described in the Operations Plan (Revision 10, dated December 1, 2015) for NORM waste handling submitted with application #009-48516.

4. **PART 4: LANDFILL OPERATIONS, LIMITS, MONITORING AND REPORTING, SECTION 4.4: WASTE ACCEPTANCE,** the clause 4.4.1 (b) is replaced by the following:

4.4.1 (b) the *Alberta User Guide for Waste Managers*, August 1996, as amended.

5. **PART 4: LANDFILL OPERATIONS, LIMITS, MONITORING AND REPORTING, SECTION 4.4: WASTE ACCEPTANCE,** under **SPECIAL WASTES**, the following clauses are added:

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.4.17 The approval holder is only permitted to receive and dispose of NORM waste into the Class I landfill cells.

4.4.18 The approval holder shall operate the landfill in accordance with the *Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, Health Canada, 2011, as amended.

4.4.19 The Class I landfill cells shall not accept NORM waste prior to installation of the gate monitor in 3.1.11.

4.4.20 All waste loads entering the Class I landfill cells shall be scanned for NORM by the gate monitor in 3.1.11.

4.4.21 If the gate monitor in 3.1.11 is not operational, the approval holder shall:

(a) notify the Director in writing;

(b) use a handheld monitor (Ludlum Model 3-97 or RadCom MSpec or Tracerco NORM IS) to scan all waste loads entering the Class I landfill cells for NORM;

(c) replace or fix the gate monitor within 15 days after notification in (a); or

(d) as otherwise authorized in writing by the Director.

4.4.22 Prior to the acceptance of NORM waste, the approval holder shall conduct background monitoring for the parameters in TABLE 4.9-A by taking a representative grab sample from each of the listed sample locations in TABLE 4.9-A.

4.4.23 The approval holder shall notify the Director in writing at least 14 days prior to commencing acceptance of NORM waste.

4.4.24 The approval holder shall implement the following with respect to NORM waste handling, submitted with application #009-48516:

(a) In-Coming Waste Monitoring-Class 1 (Gate Screening) (LF 0014, dated June 7, 2016);

(b) NORMs Secondary Screening and Detection (handheld monitoring) (LF 0022, dated June 7, 2016);

(c) NORMs Waste Rejection (LF 0023, dated on June 7, 2016);

(d) NORMs Low Level Dust Monitoring Procedure (LF 0052, dated June 7, 2016);

(e) NORMs Monthly Area and Fence Line Dose Monitoring Program (LF 0056, dated June 7, 2016);

(f) NORMs Active Area Unloading Dose Monitoring Procedure (LF 0057, dated June 7, 2016);

(g) NORMs Acceptance and Handling Procedure (LF 0073, dated June 7, 2016);

(h) NORMs Decontamination and Hygiene Procedure (LF 0080, dated June 7, 2016);

(i) Operations Plan (Revision 10, dated December 1, 2015);

(j) NORM Radiation Protection Plan (dated October 2015);

(k) NORM Radiological Monitoring Program (dated July 2014);

4.4.25 The approval holder shall only implement revisions to the plans, programs and procedures described in 4.3.10 and 4.4.24 as authorized in writing by the Director.

4.4.26 The approval holder shall not accept NORM waste that exceeds the maximum concentration limits set out in TABLE 4.4-A.

### TABLE 4.4-A: ACCEPTANCE LIMITS FOR NORM WASTE UNIFORMLY DISPERSED IN SOIL OR OTHER MEDIA

| Status of Equilibrium | Maximum Concentration of Source Material | Sum of Concentrations Parent(s) and all progeny present |
|---|---|---|
| Natural uranium in equilibrium with progeny | <500 mg/kg / 6 Bq/g ($^{238}$U activity) | ≤ 70 Bq/g<br>or<br>≤10 times the activity concentration limit for exempt material values set out in the IAEA Regulations<br>whichever is less |
| Natural thorium in equilibrium with progeny | <500 mg/kg / 2 Bq/g ($^{232}$Th activity) | |
| Any mixture of Thorium and Uranium | Sum of ratios ≤ 1 * | |
| $^{226}$Ra or $^{228}$Ra with progeny in bulk form | 18.5 Bq/g (combined radium isotopes) | |
| $^{226}$Ra or $^{228}$Ra with progeny in reinforced type IP-1 containers | 55 Bq/g (combined radium isotopes) | |
| $^{230}$Th (with no progeny) | 0.1 mg/kg / ≤70 Bq/g | not applicable |

* Sum of ratios is calculated as described in the *Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, Health Canada, 2011, as amended

4.4.27 All accepted NORM waste containing $^{226}$Ra greater than 8 Bq/g shall be disposed

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

at least 6 meters from the outer edge of the final cover.

4.4.28 Radioisotope analysis for NORM waste shall be:

(a) recorded and kept at the facility; and

(b) made available to the Director upon request.

4.4.29 The total isotope activity at the landfill at any time shall not exceed the maximum activity limits for each of the isotopes in TABLE 4.4-B.

**TABLE 4.4-B: MAXIMUM ISOTOPE ACTIVITY LEVELS PER CLASS I CELL**

| Isotope | Maximum Activity |
|---|---|
| Radium – 226 | 1080 GBq |
| Lead – 210 | 1080 GBq |
| Radium – 228 | 360 GBq |
| Thorium – 228 | 360 GBq |

4.4.30 No person working at the landfill shall receive an estimated incremental annual effective dose of 1 mSv/year or greater.

6. **PART 4: LANDFILL OPERATIONS, LIMITS, MONITORING AND REPORTING, SECTION 4.9: SPECIAL REPORTING**, the following clauses are added:

### NORM REPORTING

4.9.3 In addition to the requirements of 4.10.5, the approval holder shall monitor the following:

(a) leachate and leak detection liquids of Class I cells;

for NORM as required in TABLE 4.9-A.

4.9.4 In addition to the requirements of 4.10.7, 4.10.8 and 4.11.3(b), the approval holder shall monitor the following:

(a) surface water from the run-off control system of Class I area;

(b) groundwater from all monitoring wells;

(c) fence line; and

(d) work areas;

for NORM as required in TABLE 4.9-A, or as otherwise authorized in writing by the Director.

4.9.5 The approval holder shall report to the Director the results of the NORM monitoring as required in TABLE 4.9-A.

**TABLE 4.9-A: NORM SAMPLING AND REPORTING REQUIREMENTS**

| Parameters | Frequency | Sample Type | Sample Location | Reporting |
|---|---|---|---|---|
| Uranium-238 | Annually | Representative grab sample | Each of the following:<br>(a) Leachate and Leak Detection<br>(b) Surface Water;<br>(c) Groundwater. | Annually, on or before March 31 of the year following the year in which the information was collected |
| Thorium-230 | | | | |
| Radium-226 | | | | |
| Lead-210 | | | | |
| Thorium-232 | | | | |
| Radium-228 | | | | |
| Thorium-228 | | | | |
| Radon gas | Quarterly | Point in time sample | Each of the following:<br>(a) Fence line;<br>(b) Work area. | |
| Low level radioactive dust | | | | |

4.9.6 In addition to 2.1.1, if the monitoring results in 4.9.3 and 4.9.4 exceed the Unconditional Derived Release Limits in the *Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, 2011, as amended, the approval holder shall immediately notify the Director in writing.

4.9.7 If the monitoring results in 4.9.3 and 4.9.4 exceed the Unconditional Derived Release Limits in the *Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, 2011, as amended, the approval holder shall submit a remediation plan in writing to the Director within 30 days of providing notice to the Director in accordance with 4.9.6.

4.9.8 If the remediation plan in 4.9.7 is found deficient by the Director, the approval holder shall:

(a) correct all the deficiencies as identified in writing by the Director; and

(b) submit the revised remediation plan in a time frame identified in writing by the Director.

4.9.9 The approval holder shall implement the remediation plan in 4.9.7 as authorized in writing by the Director.

4.9.10 The approval holder shall conduct a radiation dose survey of the ground

## TERMS AND CONDITIONS ATTACHED TO APPROVAL

immediately above the portions of the cells that have received NORM wastes and include the results in the annual report.

7. **PART 4: LANDFILL OPERATIONS, LIMITS, MONITORING AND REPORTING, SECTION 4.10: LANDFILL MONITORING AND REPORTING**, under **ANNUAL LANDFILL OPERATION REPORT**, the following clauses are added:

4.10.11 (m) air monitoring data on NORM waste handling; and

(n) the total landfill isotope activity per isotope in accordance with 4.4.26.

8. **PART 5: FINAL CLOSURE, RECLAMATION AND POST-CLOSURE, SECTION 5.1: FINAL CLOSURE AND RECLAMATION**, the following clauses are added:

5.1.2 (l) plans to conduct a radiation dose survey of the final cover immediately above the portions of the cells that have received NORM wastes.

5.1.14(f) (viii) any portions of the landfill that exceed a radiation dose of 0.3 mSv/year.

5.1.14 (h) a radiation dose survey of the final cover immediately above the portions of the cells that have received NORM wastes and the results.

9. **PART 5 FINAL CLOSURE, RECLAMATION AND POST-CLOSURE, SECTION 5.2: POST CLOSURE,** the following clauses are added:

5.2.5(i) The post closure plan identified in 5.2.2 shall include isotope specific radiological monitoring including but not limited to groundwater, leachate, radon gas monitoring, surface and perimeter radiation surveys.

July 14, 2016
Date Signed

DESIGNATED DIRECTOR UNDER THE ACT
Todd Aasen, P.Eng.

Alberta Environment and Parks

# AMENDING APPROVAL

## PROVINCE OF ALBERTA

## ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
## R.S.A. 2000, c.E-12, as amended.

APPROVAL NO. 48516-01-05

APPLICATION NO. 012-48516

EFFECTIVE DATE: March 23, 2017

EXPIRY DATE: MARCH 31, 2019

APPROVAL HOLDER SECURE ENERGY SERVICES INC.

ACTIVITY: Construction, Operation and Reclamation of the Pembina Area Landfill

Consisting of a Class I and Class II Landfill, where more than 10,000 tonnes per year of hazardous waste and non-hazardous waste are disposed of.

is subject to the attached terms and conditions.

Designated Director under the Act

Todd Aasen, P.Eng.

Date Signed March 23, 2017

# TERMS AND CONDITIONS ATTACHED TO APPROVAL

*Environmental Protection and Enhancement Act* Approval No. 48516-01-00 is hereby further amended as follows:

1. **SECTION 4.6: SURFACE WATER AMAGEMENT,** TABLE 4.6-A: RUN-OFF LIMITS is repealed and replaced with the following:

**TABLE 4.6-A: RUN-OFF LIMITS**

| Parameter | Maximum Concentration or Range (in mg/L unless otherwise specified) |
|---|---|
| Chemical Oxygen Demand (COD) | 90 mg/L |
| Total Suspended Solids (TSS) | 25 mg/L |
| Total Dissolved Solids (TDS) | 2500 mg/L |
| Chloride | 250 mg/L |
| Sodium | 200 mg/L |
| Sulphate | 500 mg/L |
| Ammonia-nitrogen | 5 mg/L |
| pH | 6.0 – 9.5 pH units |
| Oil and Grease | No visible sheen |

2. **SECTION 4.10: LANDFILL MONITORING AND REPORTING**, TABLE 4.10-E: RUN-OFF RELEASE MONITORING AND REPORTING is repealed and replaced with the following:

**TABLE 4.10-E: RUN-OFF RELEASE MONITORING AND REPORTING**

| Parameter | Frequency | Sample Type | Sample Location | Reporting |
|---|---|---|---|---|
| Chemical Oxygen Demand (COD) | (a) Prior to each release, and (b) during any unanticipated release from the run-off control system | Representative grab sample | Each run-off pond from which a release (a) is to occur, or (b) is occurring | Annually, on or before March 31 of the year following the year in which the information was collected |
| Total Suspended Solids (TSS) | | | | |
| Total Dissolved Solids (TDS) | | | | |
| Chloride | | | | |
| Sodium | | | | |
| Sulphate | | | | |
| Ammonia-nitrogen | | | | |
| pH | | | | |
| Oil and grease | | | | |
| Biochemical Oxygen Demand (BOD) | When COD of sample exceeds the limit in TABLE 4.6-A. | | | |
| Volume | When released | Estimated | Discharge Point | |

# AMENDING APPROVAL

## PROVINCE OF ALBERTA

## ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
## R.S.A. 2000, c.E-12, as amended.

APPROVAL NO.: 48516-01-07

APPLICATION NO.: 015-48516

EFFECTIVE DATE: MARCH 31, 2020

EXPIRY DATE: MARCH 31, 2021

APPROVAL HOLDER: SECURE ENERGY SERVICES INC.

ACTIVITY: Construction, operation and reclamation of the SECURE Energy Services Inc. Pembina Area Landfill

Pursuant to Division 2, of Part 2, of the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c.E-12, as amended, the expiry date of Approval No. 48516-01-00 is extended to March 31, 2021.

Designated Director under the Act
Todd Aasen, P.Eng.

Date Signed March 4, 2020

SUMAS
ENVIRONMENTAL
SERVICES INC.

---

# CERTIFICATE OF DISPOSAL

Issued to: Golder Associates Ltd.
Site address: 2425 Glenview Ave, Kamloops, BC, V2B 4L5
.

Shipping Document:
- Manifest BA76176-2
- Manifest BA76154-9
- Manifest BA76157-2

This certifies that the waste originating from the above mentioned address was received by Sumas Environmental Services Inc., receiver # KIGWGP4598 on June 10, 11 and 13th, 2020.

Sumas has taken possession and ownership of the waste material upon receipt and is responsible for treatment and disposal of the waste material in British Columbia and/or in Alberta in accordance with all municipal, provincial and federal regulations.

Jeremy White
Reference No: RG040130

Date: 07/07/20

## APPENDIX F

# Laboratory Certificates of Analysis

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

| | |
|---|---|
| Date Received: | 25-MAY-20 |
| Report Date: | 03-JUN-20 12:11 (MT) |
| Version: | FINAL REV. 4 |

Client Phone: 604-297-2036

# Certificate of Analysis

| | |
|---|---|
| **Lab Work Order #:** | **L2451374** |
| Project P.O. #: | NOT SUBMITTED |
| Job Reference: | 20145856 |
| C of C Numbers: | 02903, 02904 |
| Legal Site Desc: | |

**Comments:**

29-MAY-2020 The DL for PFOS has been adjusted.
31-MAY-2020 Glycols data has been added.
1-JUN-2020 Additional VOC data is included for L2451374-11. PFAS data has been refactored to report in mg/kg.
2-JUN-2020 Additional PFAS compounds are included.
3-JUN-2020 Additional VOC data is included.

Amber Springer

Amber Springer, B.Sc
Account Manager

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2451374-1 | L2451374-3 | L2451374-5 | L2451374-7 | L2451374-9 |
|---|---|---|---|---|---|---|
| | **Description** | SOIL | SOIL | SOIL | SOIL | SOIL |
| | **Sampled Date** | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 |
| | **Sampled Time** | 10:40 | 11:10 | 11:40 | 12:00 | 12:20 |
| | **Client ID** | 02904-01 | 02904-03 | 02904-05 | 02904-07 | 02904-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | Moisture (%) | 13.9 | 14.8 | 17.0 | 11.8 | 10.5 |
| | pH (1:2 soil:water) (pH) | 7.27 | 7.73 | 7.12 | | |
| **Metals** | Aluminum (Al) (mg/kg) | 15900 | 15400 | 18800 | | |
| | Antimony (Sb) (mg/kg) | 0.23 | 0.34 | 0.16 | | |
| | Barium (Ba) (mg/kg) | 113 | 116 | 147 | | |
| | Cadmium (Cd) (mg/kg) | 0.112 | 0.210 | 0.223 | | |
| | Chromium (Cr) (mg/kg) | 38.3 | 38.5 | 42.9 | | |
| | Cobalt (Co) (mg/kg) | 14.4 | 13.0 | 14.8 | | |
| | Lead (Pb) (mg/kg) | 8.78 | 23.6 | 14.9 | | |
| | Titanium (Ti) (mg/kg) | 1360 | 1130 | 1330 | | |
| | Zinc (Zn) (mg/kg) | 62.6 | 68.3 | 79.6 | | |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | Field MeOH | Field MeOH | Field MeOH | Field MeOH |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | n-Butylbenzene (mg/kg) | | | | | |
| | sec-Butylbenzene (mg/kg) | | | | | |
| | tert-Butylbenzene (mg/kg) | | | | | |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | 1,2-Dichloroethane (mg/kg) | | | | | |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Isopropylbenzene (mg/kg) | | | | | |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | n-Propylbenzene (mg/kg) | | | | | |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Toluene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | 1,2,4-Trimethylbenzene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | 1,3,5-Trimethylbenzene (mg/kg) | | | | | |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Xylenes (mg/kg) | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 113.0 | 102.2 | 94.2 | 98.2 | 101.9 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 104.5 | 100.3 | 96.3 | 96.7 | 99.3 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | F1 (C6-C10) (mg/kg) | | | <10 | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID | L2451374-11 | L2451374-13 | L2451374-15 | L2451374-17 | L2451374-19 |
|---|---|---|---|---|---|---|
| | Description | SOIL | SOIL | SOIL | SOIL | SOIL |
| | Sampled Date | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 |
| | Sampled Time | 12:40 | 13:15 | 13:40 | | |
| | Client ID | 02904-11 | 02903-01 | 02903-03 | 02903-05 | 02903-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | Moisture (%) | 12.2 | 11.1 | 24.5 | 17.1 | 24.8 |
| | pH (1:2 soil:water) (pH) | | | 6.81 | 7.11 | 6.93 |
| **Metals** | Aluminum (Al) (mg/kg) | | | 19500 | 18700 | 18500 |
| | Antimony (Sb) (mg/kg) | | | 3.43 | 0.16 | 2.47 |
| | Barium (Ba) (mg/kg) | | | 159 | 136 | 149 |
| | Cadmium (Cd) (mg/kg) | | | 32.8 | 0.188 | 26.6 |
| | Chromium (Cr) (mg/kg) | | | 75.8 | 42.3 | 79.8 |
| | Cobalt (Co) (mg/kg) | | | 14.8 | 13.8 | 14.5 |
| | Lead (Pb) (mg/kg) | | | 11.2 | 14.6 | 11.6 |
| | Titanium (Ti) (mg/kg) | | | 1550 | 1380 | 1530 |
| | Zinc (Zn) (mg/kg) | | | 138 | 79.7 | 134 |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | Field MeOH | Field MeOH | Field MeOH | Field MeOH |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | 1.65 | <0.0050 | 3.43 |
| | n-Butylbenzene (mg/kg) | <0.050 | | DLCI <69 | | DLCI <150 |
| | sec-Butylbenzene (mg/kg) | <0.050 | | 29.5 | | 56.3 |
| | tert-Butylbenzene (mg/kg) | <0.050 | | DLHC <2.5 | | DLHC <2.5 |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | DLQ <8.5 | <0.050 | DLQ <13 |
| | 1,2-Dichloroethane (mg/kg) | <0.050 | | <0.050 | | <0.050 |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | 57.7 | <0.015 | 97.1 |
| | Isopropylbenzene (mg/kg) | <0.050 | | 29.8 | | 50.3 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | 194 | <0.050 | 557 |
| | n-Propylbenzene (mg/kg) | <0.050 | | 75.5 | | 128 |
| | Styrene (mg/kg) | <0.050 | <0.050 | DLHC <2.5 | <0.050 | DLHC <2.5 |
| | Toluene (mg/kg) | <0.050 | <0.050 | 22.1 | <0.050 | 40.8 |
| | 1,2,4-Trimethylbenzene (mg/kg) | <0.050 | <0.050 | 248 | <0.050 | 473 |
| | 1,3,5-Trimethylbenzene (mg/kg) | <0.050 | | 70.7 | | 137 |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | 112 | <0.050 | 187 |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | 257 | <0.050 | 416 |
| | Xylenes (mg/kg) | <0.075 | <0.075 | 369 | <0.075 | 603 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 98.5 | 102.0 | 95.0 | 106.5 | 128.0 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 94.0 | 101.3 | 95.0 | 127.0 | 104.5 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | 46000 | <200 | 41000 |
| | EPH19-32 (mg/kg) | <200 | <200 | 1760 | <200 | 1450 |
| | LEPH (mg/kg) | <200 | <200 | 46000 | <200 | 41000 |
| | HEPH (mg/kg) | <200 | <200 | 1760 | <200 | 1450 |
| | F1 (C6-C10) (mg/kg) | | | 5470 | <10 | 9580 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID | L2451374-1 | L2451374-3 | L2451374-5 | L2451374-7 | L2451374-9 |
|---|---|---|---|---|---|---|
| | Description | SOIL | SOIL | SOIL | SOIL | SOIL |
| | Sampled Date | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 |
| | Sampled Time | 10:40 | 11:10 | 11:40 | 12:00 | 12:20 |
| | Client ID | 02904-01 | 02904-03 | 02904-05 | 02904-07 | 02904-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Hydrocarbons** | F1-BTEX (mg/kg) | | | <10 | | |
| | F2 (C10-C16) (mg/kg) | | | <30 | | |
| | F3 (C16-C34) (mg/kg) | | | <50 | | |
| | F4 (C34-C50) (mg/kg) | | | <50 | | |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | Chrom. to baseline at nC50 | | | YES | | |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 92.0 | 92.8 | 93.4 | 89.8 | 84.5 |
| | Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%) | | | 94.2 | | |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 113.2 | 100.8 | 95.4 | 90.6 | 98.6 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(a)pyrene (mg/kg) | <0.010 | 0.011 | <0.010 | <0.010 | <0.010 |
| | Benzo(b&j)fluoranthene (mg/kg) | 0.017 | 0.015 | <0.010 | <0.010 | <0.010 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | 0.017 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Benzo(g,h,i)perylene (mg/kg) | 0.011 | 0.012 | <0.010 | <0.010 | <0.010 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Fluoranthene (mg/kg) | 0.016 | 0.012 | <0.010 | 0.011 | 0.010 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | 0.011 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Pyrene (mg/kg) | 0.014 | 0.012 | <0.010 | <0.010 | <0.010 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 106.1 | 109.7 | 106.1 | 107.3 | 99.2 |
| | Surrogate: Naphthalene d8 (%) | 95.8 | 100.1 | 97.9 | 98.5 | 91.2 |
| | Surrogate: Phenanthrene d10 (%) | 104.3 | 108.6 | 105.4 | 106.9 | 98.4 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | 0.19 | 0.18 | <0.15 | <0.15 | <0.15 |
| **Glycols** | Diethylene Glycol (mg/kg) | | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

| | Sample ID | L2451374-11 | L2451374-13 | L2451374-15 | L2451374-17 | L2451374-19 |
|---|---|---|---|---|---|---|
| | Description | SOIL | SOIL | SOIL | SOIL | SOIL |
| | Sampled Date | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 |
| | Sampled Time | 12:40 | 13:15 | 13:40 | | |
| | Client ID | 02904-11 | 02903-01 | 02903-03 | 02903-05 | 02903-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Hydrocarbons** | F1-BTEX (mg/kg) | | | 5020 | <10 | 8830 |
| | F2 (C10-C16) (mg/kg) | | | 38800 | <30 | 36100 |
| | F3 (C16-C34) (mg/kg) | | | 5360 | <50 | 4900 |
| | F4 (C34-C50) (mg/kg) | | | <250 DLHC | <50 | <250 DLHC |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | 5080 | <100 | 8900 |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | 4630 | <100 | 8200 |
| | Chrom. to baseline at nC50 | | | YES | YES | YES |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 92.7 | 86.1 | Not Reportable SMI | 94.2 | Not Reportable SMI |
| | Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%) | | | Not Reportable SMI | 95.1 | Not Reportable SMI |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 100.7 | 102.4 | Not Reportable | 103.8 | Not Reportable |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <4.0 DLCI | <0.0050 | <3.0 DLCI |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <2.0 DLCI | <0.0050 | <1.0 DLCI |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.20 DLCI | <0.0040 | <0.20 DLCI |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.20 DLQ | 0.011 | <0.20 DLQ |
| | Benzo(a)pyrene (mg/kg) | <0.020 DLQ | <0.010 | 0.024 | 0.017 | 0.020 |
| | Benzo(b&j)fluoranthene (mg/kg) | 0.013 | <0.010 | <0.020 DLQ | 0.023 | <0.030 DLQ |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.022 | 0.023 | <0.032 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | 0.017 | 0.014 | 0.016 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.020 DLCI | 0.014 | <0.020 DLCI |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Fluoranthene (mg/kg) | 0.018 | <0.010 | 0.113 | 0.033 | 0.087 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | 4.52 | <0.010 | 4.06 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | 0.014 | 0.015 | 0.013 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | 49.3 | <0.010 | 42.3 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | 68.9 | <0.010 | 59.2 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <41 DLQ | <0.010 | <35 DLQ |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | <2.0 DLQ | 0.011 | <2.0 DLQ |
| | Pyrene (mg/kg) | 0.015 | <0.010 | 0.231 | 0.027 | 0.221 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <4.0 DLCI | <0.050 | <4.0 DLCI |
| | Surrogate: Chrysene d12 (%) | 103.3 | 109.2 | 94.5 | 106.8 | 101.9 |
| | Surrogate: Naphthalene d8 (%) | 95.5 | 98.3 | Not Reportable SMI | 95.5 | Not Reportable SMI |
| | Surrogate: Phenanthrene d10 (%) | 103.6 | 109.3 | 121.2 | 105.4 | 109.6 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | 0.040 | 0.025 | 0.036 |
| | IACR (CCME) | 0.17 | <0.15 | 0.49 | 0.28 | 0.51 |
| **Glycols** | Diethylene Glycol (mg/kg) | | | <10 | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2451374-1 | L2451374-3 | L2451374-5 | L2451374-7 | L2451374-9 |
| | **Description** | SOIL | SOIL | SOIL | SOIL | SOIL |
| | **Sampled Date** | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 |
| | **Sampled Time** | 10:40 | 11:10 | 11:40 | 12:00 | 12:20 |
| | **Client ID** | 02904-01 | 02904-03 | 02904-05 | 02904-07 | 02904-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Glycols** | Ethylene Glycol (mg/kg) | | | | | |
| | 1,2-Propylene Glycol (mg/kg) | | | | | |
| | Triethylene Glycol (mg/kg) | | | | | |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | | | <0.00010 | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | | | <0.00010 | | |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | | | <0.00010 | | |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | | | <0.00010 | | |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | | | <0.00050 | | |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | | | DLB<br><0.15 | | |
| | Perfluoroheptanoic acid (PFHpA) (mg/kg) | | | <0.00010 | | |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | | | 0.00010 | | |
| | Perfluorononanoic acid (PFNA) (mg/kg) | | | <0.00010 | | |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | | | 0.00035 | | |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | | | <0.00010 | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2451374-11 | L2451374-13 | L2451374-15 | L2451374-17 | L2451374-19 |
| | **Description** | SOIL | SOIL | SOIL | SOIL | SOIL |
| | **Sampled Date** | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 | 25-MAY-20 |
| | **Sampled Time** | 12:40 | 13:15 | 13:40 | | |
| | **Client ID** | 02904-11 | 02903-01 | 02903-03 | 02903-05 | 02903-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Glycols** | Ethylene Glycol (mg/kg) | | | <10 | | |
| | 1,2-Propylene Glycol (mg/kg) | | | <10 | | |
| | Triethylene Glycol (mg/kg) | | | <10 | | |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | | | 1.04 DLHC | <0.00010 | 1.57 DLHC |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | | | 8.70 DLHC | 0.00071 | 10.7 DLHC |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | | | 0.00012 | <0.00010 | <0.00010 |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | | | 0.00028 | <0.00010 | 0.00038 |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | | | 0.00086 | <0.00050 | 0.00125 |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | | | <0.24 DLB | <0.19 DLB | <0.13 DLB |
| | Perfluoroheptanoic acid (PFHpA) (mg/kg) | | | 0.00201 | <0.00010 | 0.00291 |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | | | 0.183 DLHC | 0.00013 | 0.154 DLHC |
| | Perfluorononanoic acid (PFNA) (mg/kg) | | | 0.00070 | <0.00010 | 0.00108 |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | | | 0.0154 DLHC | 0.00032 | 0.0205 DLHC |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | | | 0.0103 DLHC | <0.00010 | 0.0077 DLHC |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# Reference Information

**QC Samples with Qualifiers & Comments:**

| QC Type Description | Parameter | Qualifier | Applies to Sample Number(s) |
|---|---|---|---|
| Duplicate | Zinc (Zn) | DUP-H | L2451374-1, -15, -17, -19, -3, -5 |
| Laboratory Control Sample | Perfluorobutanoic acid (PFBA) | LCS-H | L2451374-15, -17, -19, -5 |
| Method Blank | Perfluorobutanoic acid (PFBA) | MB-LOR | L2451374-15, -17, -19, -5 |
| Matrix Spike | Perfluorobutanoic acid (PFBA) | MS-B | L2451374-15, -17, -19, -5 |

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| DLB | Detection Limit Raised. Analyte detected at comparable level in Method Blank. |
| DLCI | Detection Limit Raised: Chromatographic Interference due to co-elution. |
| DLHC | Detection Limit Raised: Dilution required due to high concentration of test analyte(s). |
| DLQ | Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria. |
| DUP-H | Duplicate results outside ALS DQO, due to sample heterogeneity. |
| LCS-H | Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified. |
| MB-LOR | Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level. |
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |
| SMI | Surrogate recovery could not be measured due to sample matrix interference. |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **EPH-TUMB-FID-VA** | Soil | EPH in Solids by Tumbler and GCFID | BC MOE EPH GCFID |

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Solids by GC/FID", v2.1, July 1999. Soil samples are extracted with a 1:1 mixture of hexane and acetone using a rotary extraction technique modified from EPA 3570 prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **F1-BTX-CALC-VA** | Soil | F1-Total BTX | CCME CWS PHC TIER 1 (2001) |

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." For F1 (C6-C10) and F1-BTEX, a subsample of the sediment/soil is extracted with methanol and analysed by purge & trap GC/FID. The F1-BTEX result is then calculated as follows:

F1-BTEX: F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **F1-HSFID-VA** | Soil | CCME F1 by headspace GCMS | CCME CWS PHC (Pub# 1310) |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. The F1 fraction concentration is measured using flame ionization detection.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **F2F4-TUMB-H/A-FID-VA** | Soil | CWS F2-F4 Hydrocarbons by Tumbler GCFID | CCME PETROLEUM HYDROCARBONS |

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." For C10 to C50 hydrocarbons (F2, F3, F4) and gravimetric heavy hydrocarbons (F4G-sg), a subsample of the sediment/soil is extracted with 1:1 hexane:acetone using a rotary extractor. The extract undergoes a silica-gel clean-up to remove polar compounds. F2, F3 & F4 are analyzed by on-column GC/FID, and F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where F4 (C34-C50) and F4G-sg results are reported for a sample, the larger of the reported values is used for comparison against the relevant CCME standard for F4.
7. The gravimetric heavy hydrocarbon results (F4G-sg), cannot be added to the C6 to C50 hydrocarbon results.
8. This method is validated for use.
9. Data from analysis of quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **FUELS-HSMS-VA** | Soil | VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **GLY-EXT-FID-VA** | Soil | Glycols in Soil by Wrist Shaker GCFID | SW-846, METHOD 8015B, EPA |

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 8015B, published by the United States Environmental Protection Agency (EPA). The procedure involves extraction of a subsample of the sediment/soil with deionized water, followed by treatment of the extract with a strong base (NaOH) and benzoyl chloride to form the corresponding benzoate esters. The benzoate esters

# Reference Information

are then extracted with iso-octane and the extract is analyzed by capillary column gas chromatography with flame ionization detection (FID).

**LEPH/HEPH-CALC-VA** Soil LEPHs and HEPHs BC MOE LEPH/HEPH

LEPHs and HEPHs are measures of Light and Heavy Extractable Petroleum Hydrocarbons in soil. Results are calculated by subtraction of applicable PAH concentrations from EPH10-19 and EPH19-32, as per the BC Lab Manual LEPH/HEPH calculation procedure.

LEPHs = EPH10-19 minus Naphthalene and Phenanthrene.

HEPHs = EPH19-32 minus Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and Pyrene.

**MET-200.2-CCMS-VA** Soil Metals in Soil by CRC ICPMS EPA 200.2/6020A (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

**MOISTURE-VA** Soil Moisture content CCME PHC in Soil - Tier 1 (mod)

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of two hours.

**PAH-TMB-H/A-MS-VA** Soil PAH - Rotary Extraction (Hexane/Acetone) EPA 3570/8270

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3570 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

Benzo(a)pyrene Total Potency Equivalents [B(a)P TPE] represents the sum of estimated cancer potency relative to B(a)P for all potentially carcinogenic unsubstituted PAHs, and is calculated as per the CCME PAH Soil Quality Guidelines reference document (2010).

**PFAS-LL-EX-LCMS-WT** Soil Perfluorinated Compounds by LC/MS-MS MOECC E3506

Soil sample was extracted with alkaline organic solvent. Dilute organic extract with water (10% organic/water) then passed through SPE. Final extract of Perfluorinated compounds are analyzed by LC/MS-MS.

**PH-1:2-VA** Soil pH in Soil (1:2 Soil:Water Extraction) BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in "pH, Electrometric in Soil and Sediment - Prescriptive Method", Rev. 2005, Section B Physical, Inorganic and Misc. Constituents, BC Environmental Laboratory Manual. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

**VH-HSFID-VA** Soil VH in soil by Headspace GCFID BC Env. Lab Manual (VH in Solids)

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999).

**VH-SURR-FID-VA** Soil VH Surrogates for Soils BC Env. Lab Manual (VH in Solids)

**VOC-M-HSMS-VA** Soil misc VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC-M2-HSMS-VA** Soil Misc VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7-L-HSMS-VA** Soil VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7/VOC-SURR-MS-VA** Soil VOC7 and/or VOC Surrogates for Soils EPA 5035A/5021A/8260C

**VPH-CALC-VA** Soil VPH is VH minus select aromatics BC MOE VPH

VPHs measures Volatile Petroleum Hydrocarbons in soil. Results are calculated by subtraction of specific Monocyclic Aromatic Hydrocarbons from VH6-10, as per the BC Lab Manual VPH calculation procedure.
VPHs = VH6-10 minus Benzene, Toluene, Ethylbenzene, Xylenes, and Styrene

# Reference Information

| | | | |
|---|---|---|---|
| **XYLENES-CALC-VA** | Soil | Sum of Xylene Isomer Concentrations | EPA 8260B & 524.2 |

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

---

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |
| VA | ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA |

**Chain of Custody Numbers:**

02903 02904

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2451374 Report Date: 03-JUN-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4
Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **EPH-TUMB-FID-VA** | **Soil** | | | | | | | |
| **Batch R5098150** | | | | | | | | |
| **WG3329533-3** | **DUP** | **L2451374-15** | | | | | | |
| EPH10-19 | | 46000 | 42500 | | mg/kg | 7.9 | 40 | 27-MAY-20 |
| EPH19-32 | | 1760 | 1620 | | mg/kg | 8.0 | 40 | 27-MAY-20 |
| **WG3329533-4** | **IRM** | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 103.9 | | % | | 70-130 | 27-MAY-20 |
| EPH19-32 | | | 104.0 | | % | | 70-130 | 27-MAY-20 |
| **WG3329533-2** | **LCS** | | | | | | | |
| EPH10-19 | | | 100.2 | | % | | 70-130 | 27-MAY-20 |
| EPH19-32 | | | 103.5 | | % | | 70-130 | 27-MAY-20 |
| **WG3329533-1** | **MB** | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 27-MAY-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 27-MAY-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 99.0 | | % | | 60-140 | 27-MAY-20 |
| **F1-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5071997** | | | | | | | | |
| **WG3329822-3** | **DUP** | **L2451374-19** | | | | | | |
| F1 (C6-C10) | | 9580 | 10400 | | mg/kg | 7.9 | 40 | 29-MAY-20 |
| **Batch R5083660** | | | | | | | | |
| **WG3329822-2** | **LCS** | | | | | | | |
| F1 (C6-C10) | | | 104.0 | | % | | 70-130 | 28-MAY-20 |
| **WG3329822-1** | **MB** | | | | | | | |
| F1 (C6-C10) | | | <10 | | mg/kg | | 10 | 28-MAY-20 |
| **F2F4-TUMB-H/A-FID-VA** | **Soil** | | | | | | | |
| **Batch R5099551** | | | | | | | | |
| **WG3329533-3** | **DUP** | **L2451374-15** | | | | | | |
| F2 (C10-C16) | | 38800 | 38700 | | mg/kg | 0.2 | 40 | 27-MAY-20 |
| F3 (C16-C34) | | 5360 | 5190 | | mg/kg | 3.3 | 40 | 27-MAY-20 |
| F4 (C34-C50) | | <250 | <250 | RPD-NA | mg/kg | N/A | 40 | 27-MAY-20 |
| **WG3329533-4** | **IRM** | **ALS PHC RM3** | | | | | | |
| F2 (C10-C16) | | | 98.8 | | % | | 70-130 | 27-MAY-20 |
| F3 (C16-C34) | | | 94.6 | | % | | 70-130 | 27-MAY-20 |
| F4 (C34-C50) | | | 97.1 | | % | | 70-130 | 27-MAY-20 |
| **WG3329533-2** | **LCS** | | | | | | | |
| F2 (C10-C16) | | | 106.1 | | % | | 70-130 | 27-MAY-20 |
| F3 (C16-C34) | | | 100.2 | | % | | 70-130 | 27-MAY-20 |
| F4 (C34-C50) | | | 99.8 | | % | | 70-130 | 27-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **F2F4-TUMB-H/A-FID-VA** | **Soil** | | | | | | | |
| **Batch R5099551** | | | | | | | | |
| **WG3329533-1 MB** | | | | | | | | |
| F2 (C10-C16) | | | <30 | | mg/kg | | 30 | 27-MAY-20 |
| F3 (C16-C34) | | | <50 | | mg/kg | | 50 | 27-MAY-20 |
| F4 (C34-C50) | | | <50 | | mg/kg | | 50 | 27-MAY-20 |
| Surrogate: 2-Bromobenzotrifluoride, F2-F4 | | | 93.3 | | % | | 60-140 | 27-MAY-20 |
| **FUELS-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5081765** | | | | | | | | |
| **WG3329822-3 DUP** | | **L2451374-19** | | | | | | |
| Isopropylbenzene | | 50.3 | 54.0 | | mg/kg | 7.2 | 50 | 28-MAY-20 |
| 1,2,4-Trimethylbenzene | | 473 | 474 | | mg/kg | 0.3 | 50 | 28-MAY-20 |
| 1,3,5-Trimethylbenzene | | 137 | 132 | | mg/kg | 3.1 | 50 | 28-MAY-20 |
| 1,2-Dibromoethane | | <13 | <13 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| 1,2-Dichloroethane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| n-Propylbenzene | | 128 | 137 | | mg/kg | 7.1 | 50 | 28-MAY-20 |
| **WG3329822-2 LCS** | | | | | | | | |
| Isopropylbenzene | | | 114.8 | | % | | 70-130 | 27-MAY-20 |
| 1,2,4-Trimethylbenzene | | | 116.4 | | % | | 70-130 | 27-MAY-20 |
| 1,3,5-Trimethylbenzene | | | 118.4 | | % | | 70-130 | 27-MAY-20 |
| 1,2-Dibromoethane | | | 91.9 | | % | | 70-130 | 27-MAY-20 |
| 1,2-Dichloroethane | | | 88.7 | | % | | 70-130 | 27-MAY-20 |
| n-Propylbenzene | | | 115.9 | | % | | 70-130 | 27-MAY-20 |
| **WG3329822-1 MB** | | | | | | | | |
| Isopropylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| 1,2,4-Trimethylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| 1,3,5-Trimethylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| 1,2-Dichloroethane | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| n-Propylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| **GLY-EXT-FID-VA** | **Soil** | | | | | | | |
| **Batch R5102449** | | | | | | | | |
| **WG3332028-3 DUP** | | **L2451374-15** | | | | | | |
| 1,2-Propylene Glycol | | <10 | <10 | RPD-NA | mg/kg | N/A | 40 | 31-MAY-20 |
| Ethylene Glycol | | <10 | <10 | RPD-NA | mg/kg | N/A | 40 | 31-MAY-20 |
| Diethylene Glycol | | <10 | <10 | RPD-NA | mg/kg | N/A | 40 | 31-MAY-20 |
| Triethylene Glycol | | <10 | <10 | RPD-NA | mg/kg | N/A | 40 | 31-MAY-20 |
| **WG3332028-2 LCS** | | | | | | | | |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **GLY-EXT-FID-VA** | **Soil** | | | | | | | |
| **Batch R5102449** | | | | | | | | |
| **WG3332028-2 LCS** | | | | | | | | |
| 1,2-Propylene Glycol | | | 103.6 | | % | | 70-130 | 31-MAY-20 |
| Ethylene Glycol | | | 99.3 | | % | | 70-130 | 31-MAY-20 |
| Diethylene Glycol | | | 101.5 | | % | | 70-130 | 31-MAY-20 |
| Triethylene Glycol | | | 103.0 | | % | | 70-130 | 31-MAY-20 |
| **WG3332028-1 MB** | | | | | | | | |
| 1,2-Propylene Glycol | | | <10 | | mg/kg | | 10 | 31-MAY-20 |
| Ethylene Glycol | | | <10 | | mg/kg | | 10 | 31-MAY-20 |
| Diethylene Glycol | | | <10 | | mg/kg | | 10 | 31-MAY-20 |
| Triethylene Glycol | | | <10 | | mg/kg | | 10 | 31-MAY-20 |
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5099955** | | | | | | | | |
| **WG3329538-4 CRM** | | **VA-CANMET-TILL2** | | | | | | |
| Aluminum (Al) | | | 92.6 | | % | | 70-130 | 27-MAY-20 |
| Antimony (Sb) | | | 93.4 | | % | | 70-130 | 27-MAY-20 |
| Barium (Ba) | | | 98.5 | | % | | 70-130 | 27-MAY-20 |
| Cadmium (Cd) | | | 103.4 | | % | | 70-130 | 27-MAY-20 |
| Chromium (Cr) | | | 93.6 | | % | | 70-130 | 27-MAY-20 |
| Cobalt (Co) | | | 94.7 | | % | | 70-130 | 27-MAY-20 |
| Lead (Pb) | | | 97.5 | | % | | 70-130 | 27-MAY-20 |
| Titanium (Ti) | | | 91.3 | | % | | 70-130 | 27-MAY-20 |
| Zinc (Zn) | | | 94.0 | | % | | 70-130 | 27-MAY-20 |
| **WG3329538-2 DUP** | | **L2451374-15** | | | | | | |
| Aluminum (Al) | | 19500 | 20100 | | mg/kg | 3.0 | 40 | 27-MAY-20 |
| Antimony (Sb) | | 3.43 | 3.28 | | mg/kg | 4.6 | 30 | 27-MAY-20 |
| Barium (Ba) | | 159 | 161 | | mg/kg | 1.1 | 40 | 27-MAY-20 |
| Cadmium (Cd) | | 32.8 | 28.2 | | mg/kg | 15 | 30 | 27-MAY-20 |
| Chromium (Cr) | | 75.8 | 79.8 | | mg/kg | 5.1 | 30 | 27-MAY-20 |
| Cobalt (Co) | | 14.8 | 14.8 | | mg/kg | 0.5 | 30 | 27-MAY-20 |
| Lead (Pb) | | 11.2 | 11.2 | | mg/kg | 0.0 | 40 | 27-MAY-20 |
| Titanium (Ti) | | 1550 | 1540 | | mg/kg | 0.7 | 40 | 27-MAY-20 |
| Zinc (Zn) | | 138 | 220 | DUP-H | mg/kg | 46 | 30 | 27-MAY-20 |
| **WG3329538-3 LCS** | | | | | | | | |
| Aluminum (Al) | | | 94.8 | | % | | 80-120 | 27-MAY-20 |
| Antimony (Sb) | | | 99.2 | | % | | 80-120 | 27-MAY-20 |
| Barium (Ba) | | | 96.9 | | % | | 80-120 | 27-MAY-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5099955** | | | | | | | | |
| **WG3329538-3 LCS** | | | | | | | | |
| Cadmium (Cd) | | | 99.0 | | % | | 80-120 | 27-MAY-20 |
| Chromium (Cr) | | | 94.7 | | % | | 80-120 | 27-MAY-20 |
| Cobalt (Co) | | | 94.3 | | % | | 80-120 | 27-MAY-20 |
| Lead (Pb) | | | 97.8 | | % | | 80-120 | 27-MAY-20 |
| Titanium (Ti) | | | 92.6 | | % | | 80-120 | 27-MAY-20 |
| Zinc (Zn) | | | 94.9 | | % | | 80-120 | 27-MAY-20 |
| **WG3329538-1 MB** | | | | | | | | |
| Aluminum (Al) | | | <50 | | mg/kg | | 50 | 27-MAY-20 |
| Antimony (Sb) | | | <0.10 | | mg/kg | | 0.1 | 27-MAY-20 |
| Barium (Ba) | | | <0.50 | | mg/kg | | 0.5 | 27-MAY-20 |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 27-MAY-20 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 27-MAY-20 |
| Cobalt (Co) | | | <0.10 | | mg/kg | | 0.1 | 27-MAY-20 |
| Lead (Pb) | | | <0.50 | | mg/kg | | 0.5 | 27-MAY-20 |
| Titanium (Ti) | | | <1.0 | | mg/kg | | 1 | 27-MAY-20 |
| Zinc (Zn) | | | <2.0 | | mg/kg | | 2 | 27-MAY-20 |
| **MOISTURE-VA** | **Soil** | | | | | | | |
| **Batch R5098972** | | | | | | | | |
| **WG3329540-3 DUP** | | **L2451374-7** | | | | | | |
| Moisture | | 11.8 | 11.5 | | % | 1.9 | 20 | 26-MAY-20 |
| **WG3329540-2 LCS** | | | | | | | | |
| Moisture | | | 100.8 | | % | | 90-110 | 26-MAY-20 |
| **WG3329540-1 MB** | | | | | | | | |
| Moisture | | | <0.25 | | % | | 0.25 | 26-MAY-20 |
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5097416** | | | | | | | | |
| **WG3329533-3 DUP** | | **L2451374-15** | | | | | | |
| Acenaphthene | | <4.0 | <3.0 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Acenaphthylene | | <2.0 | <2.0 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Anthracene | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Benz(a)anthracene | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Benzo(a)pyrene | | 0.024 | 0.027 | | mg/kg | 12 | 50 | 28-MAY-20 |
| Benzo(b&j)fluoranthene | | <0.020 | <0.030 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Benzo(g,h,i)perylene | | 0.017 | 0.020 | | mg/kg | 12 | 50 | 28-MAY-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.020 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5097416** | | | | | | | | |
| **WG3329533-3 DUP** | | **L2451374-15** | | | | | | |
| Chrysene | | <0.020 | <0.030 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Fluoranthene | | 0.113 | 0.123 | | mg/kg | 8.4 | 50 | 28-MAY-20 |
| Fluorene | | 4.52 | 3.92 | | mg/kg | 14 | 50 | 28-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | 0.014 | 0.016 | | mg/kg | 17 | 50 | 28-MAY-20 |
| 1-Methylnaphthalene | | 49.3 | 43.4 | | mg/kg | 13 | 50 | 28-MAY-20 |
| 2-Methylnaphthalene | | 68.9 | 60.6 | | mg/kg | 13 | 50 | 28-MAY-20 |
| Naphthalene | | <41 | <37 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Phenanthrene | | <2.0 | <2.0 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| Pyrene | | 0.231 | 0.248 | | mg/kg | 7.3 | 50 | 28-MAY-20 |
| Quinoline | | <4.0 | <4.5 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| **WG3329533-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 98.2 | | % | | 60-130 | 28-MAY-20 |
| Acenaphthylene | | | 114.5 | | % | | 60-130 | 28-MAY-20 |
| Anthracene | | | 116.6 | | % | | 60-130 | 28-MAY-20 |
| Benz(a)anthracene | | | 91.6 | | % | | 60-130 | 28-MAY-20 |
| Benzo(a)pyrene | | | 102.7 | | % | | 60-130 | 28-MAY-20 |
| Benzo(b&j)fluoranthene | | | 94.5 | | % | | 60-130 | 28-MAY-20 |
| Benzo(g,h,i)perylene | | | 102.4 | | % | | 60-130 | 28-MAY-20 |
| Benzo(k)fluoranthene | | | 95.8 | | % | | 60-130 | 28-MAY-20 |
| Chrysene | | | 97.1 | | % | | 60-130 | 28-MAY-20 |
| Dibenz(a,h)anthracene | | | 100.6 | | % | | 60-130 | 28-MAY-20 |
| Fluoranthene | | | 92.7 | | % | | 60-130 | 28-MAY-20 |
| Fluorene | | | 95.0 | | % | | 60-130 | 28-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | | 98.2 | | % | | 60-130 | 28-MAY-20 |
| 1-Methylnaphthalene | | | 94.2 | | % | | 60-130 | 28-MAY-20 |
| 2-Methylnaphthalene | | | 88.9 | | % | | 60-130 | 28-MAY-20 |
| Naphthalene | | | 93.5 | | % | | 50-130 | 28-MAY-20 |
| Phenanthrene | | | 92.1 | | % | | 60-130 | 28-MAY-20 |
| Pyrene | | | 95.0 | | % | | 60-130 | 28-MAY-20 |
| **WG3329533-2 LCS** | | | | | | | | |
| Acenaphthene | | | 95.2 | | % | | 60-130 | 28-MAY-20 |
| Acenaphthylene | | | 95.0 | | % | | 60-130 | 28-MAY-20 |
| Anthracene | | | 98.6 | | % | | 60-130 | 28-MAY-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5097416** | | | | | | | | |
| **WG3329533-2 LCS** | | | | | | | | |
| Benz(a)anthracene | | | 91.9 | | % | | 60-130 | 28-MAY-20 |
| Benzo(a)pyrene | | | 96.7 | | % | | 60-130 | 28-MAY-20 |
| Benzo(b&j)fluoranthene | | | 93.8 | | % | | 60-130 | 28-MAY-20 |
| Benzo(g,h,i)perylene | | | 89.4 | | % | | 60-130 | 28-MAY-20 |
| Benzo(k)fluoranthene | | | 92.6 | | % | | 60-130 | 28-MAY-20 |
| Chrysene | | | 89.0 | | % | | 60-130 | 28-MAY-20 |
| Dibenz(a,h)anthracene | | | 92.0 | | % | | 60-130 | 28-MAY-20 |
| Fluoranthene | | | 95.3 | | % | | 60-130 | 28-MAY-20 |
| Fluorene | | | 93.8 | | % | | 60-130 | 28-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | | 90.6 | | % | | 60-130 | 28-MAY-20 |
| 1-Methylnaphthalene | | | 96.7 | | % | | 60-130 | 28-MAY-20 |
| 2-Methylnaphthalene | | | 92.9 | | % | | 60-130 | 28-MAY-20 |
| Naphthalene | | | 94.8 | | % | | 50-130 | 28-MAY-20 |
| Phenanthrene | | | 95.0 | | % | | 60-130 | 28-MAY-20 |
| Pyrene | | | 98.1 | | % | | 60-130 | 28-MAY-20 |
| Quinoline | | | 89.3 | | % | | 60-130 | 28-MAY-20 |
| **WG3329533-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 28-MAY-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 28-MAY-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 28-MAY-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 28-MAY-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |

# Quality Control Report

Workorder: L2451374 Report Date: 03-JUN-20

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5097416** | | | | | | | | |
| **WG3329533-1 MB** | | | | | | | | |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 28-MAY-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |
| Surrogate: Naphthalene d8 | | | 103.5 | | % | | 50-130 | 28-MAY-20 |
| Surrogate: Phenanthrene d10 | | | 111.3 | | % | | 60-130 | 28-MAY-20 |
| Surrogate: Chrysene d12 | | | 110.4 | | % | | 60-130 | 28-MAY-20 |
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5100187** | | | | | | | | |
| **WG3329893-3 DUP** | | **L2451374-5** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | <0.50 | <0.50 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | <150 | <200 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | 0.10 | 0.12 | | ug/kg | 11 | 50 | 28-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | 0.35 | 0.37 | | ug/kg | 6.2 | 50 | 28-MAY-20 |
| Perfluorononanoic acid (PFNA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 28-MAY-20 |
| **WG3329893-2 LCS** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 62.7 | | % | | 50-150 | 28-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 50.0 | | % | | 50-150 | 28-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 73.3 | | % | | 50-150 | 28-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | | N/A | LCS-H | % | | 50-150 | 28-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | | 94.7 | | % | | 50-150 | 28-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | | 101.3 | | % | | 50-150 | 28-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 61.3 | | % | | 50-150 | 28-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | | 107.3 | | % | | 50-150 | 28-MAY-20 |
| Perfluorononanoic acid (PFNA) | | | 58.7 | | % | | 50-150 | 28-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 99.3 | | % | | 50-150 | 28-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 64.7 | | % | | 50-150 | 28-MAY-20 |
| **WG3329893-1 MB** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | <0.50 | | ug/kg | | 0.5 | 28-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5100187** | | | | | | | | |
| **WG3329893-1 MB** | | | | | | | | |
| Perfluorobutanoic acid (PFBA) | | | 45 | MB-LOR | ug/kg | | 20 | 28-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| Perfluorononanoic acid (PFNA) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | <0.10 | | ug/kg | | 0.1 | 28-MAY-20 |
| **WG3329893-4 MS** | | **L2451374-5** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 62.4 | | % | | 50-150 | 28-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 50.2 | | % | | 50-150 | 28-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 80.8 | | % | | 50-150 | 28-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | | N/A | MS-B | % | | - | 28-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | | 82.1 | | % | | 50-150 | 28-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | | 90.7 | | % | | 50-150 | 28-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 62.3 | | % | | 50-150 | 28-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | | 91.1 | | % | | 50-150 | 28-MAY-20 |
| Perfluorononanoic acid (PFNA) | | | 67.8 | | % | | 50-150 | 28-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 93.7 | | % | | 50-150 | 28-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 70.0 | | % | | 50-150 | 28-MAY-20 |
| **PH-1:2-VA** | **Soil** | | | | | | | |
| **Batch R5099555** | | | | | | | | |
| **WG3329538-2 DUP** | | **L2451374-15** | | | | | | |
| pH (1:2 soil:water) | | 6.81 | 6.80 | J | pH | 0.01 | 0.2 | 27-MAY-20 |
| **VH-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5071997** | | | | | | | | |
| **WG3329822-3 DUP** | | **L2451374-19** | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | 8900 | 9630 | | mg/kg | 7.9 | 40 | 29-MAY-20 |
| **Batch R5083660** | | | | | | | | |
| **WG3329822-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 109.1 | | % | | 70-130 | 28-MAY-20 |
| **WG3329822-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 28-MAY-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC-M-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5081765** | | | | | | | | |
| **WG3329822-3 DUP** | | **L2451374-19** | | | | | | |
| sec-Butylbenzene | | 56.3 | 56.0 | | mg/kg | 0.6 | 50 | 28-MAY-20 |
| tert-Butylbenzene | | <2.5 | <2.5 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| n-Butylbenzene | | <150 | <150 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| **WG3329822-2 LCS** | | | | | | | | |
| sec-Butylbenzene | | | 119.0 | | % | | 60-140 | 27-MAY-20 |
| tert-Butylbenzene | | | 120.8 | | % | | 60-140 | 27-MAY-20 |
| n-Butylbenzene | | | 139.8 | | % | | 60-140 | 27-MAY-20 |
| **WG3329822-1 MB** | | | | | | | | |
| sec-Butylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| tert-Butylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| n-Butylbenzene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5081765** | | | | | | | | |
| **WG3329822-3 DUP** | | **L2451374-19** | | | | | | |
| n-Nonane | | 557 | 562 | | mg/kg | 0.8 | 50 | 28-MAY-20 |
| **WG3329822-2 LCS** | | | | | | | | |
| n-Nonane | | | 118.7 | | % | | 70-130 | 27-MAY-20 |
| **WG3329822-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5081765** | | | | | | | | |
| **WG3329822-3 DUP** | | **L2451374-19** | | | | | | |
| Benzene | | 3.43 | 3.55 | | mg/kg | 3.5 | 40 | 28-MAY-20 |
| Ethylbenzene | | 97.1 | 101 | | mg/kg | 4.4 | 40 | 28-MAY-20 |
| Methyl t-butyl ether (MTBE) | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| Styrene | | <2.5 | <2.5 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| Toluene | | 40.8 | 42.5 | | mg/kg | 4.1 | 40 | 28-MAY-20 |
| meta- & para-Xylene | | 416 | 440 | | mg/kg | 5.6 | 40 | 28-MAY-20 |
| ortho-Xylene | | 187 | 195 | | mg/kg | 4.3 | 40 | 28-MAY-20 |
| **WG3329822-2 LCS** | | | | | | | | |
| Benzene | | | 97.9 | | % | | 70-130 | 27-MAY-20 |
| Ethylbenzene | | | 111.7 | | % | | 70-130 | 27-MAY-20 |
| Methyl t-butyl ether (MTBE) | | | 102.7 | | % | | 70-130 | 27-MAY-20 |
| Styrene | | | 108.3 | | % | | 70-130 | 27-MAY-20 |
| Toluene | | | 106.8 | | % | | 70-130 | 27-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5081765** | | | | | | | | |
| **WG3329822-2 LCS** | | | | | | | | |
| meta- & para-Xylene | | | 97.6 | | % | | 70-130 | 27-MAY-20 |
| ortho-Xylene | | | 109.7 | | % | | 70-130 | 27-MAY-20 |
| **WG3329822-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 27-MAY-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 27-MAY-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 27-MAY-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 27-MAY-20 |

# Quality Control Report

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| DUP-H | Duplicate results outside ALS DQO, due to sample heterogeneity. |
| J | Duplicate results and limits are expressed in terms of absolute difference. |
| LCS-H | Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified. |
| MB-LOR | Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level. |
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

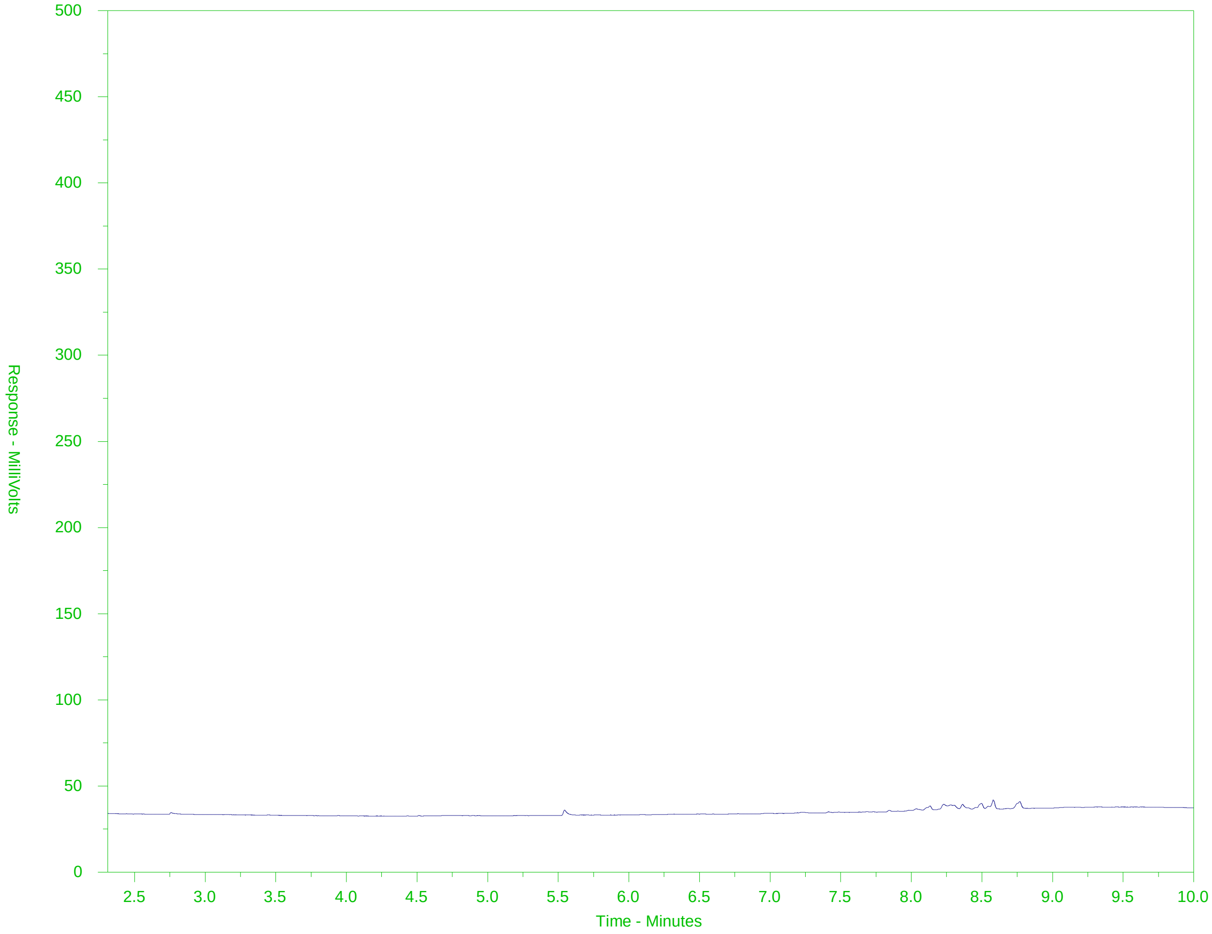
---

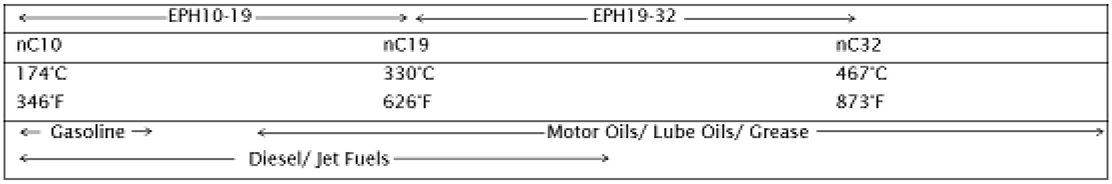
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-1
Client Sample ID: 02904-01





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

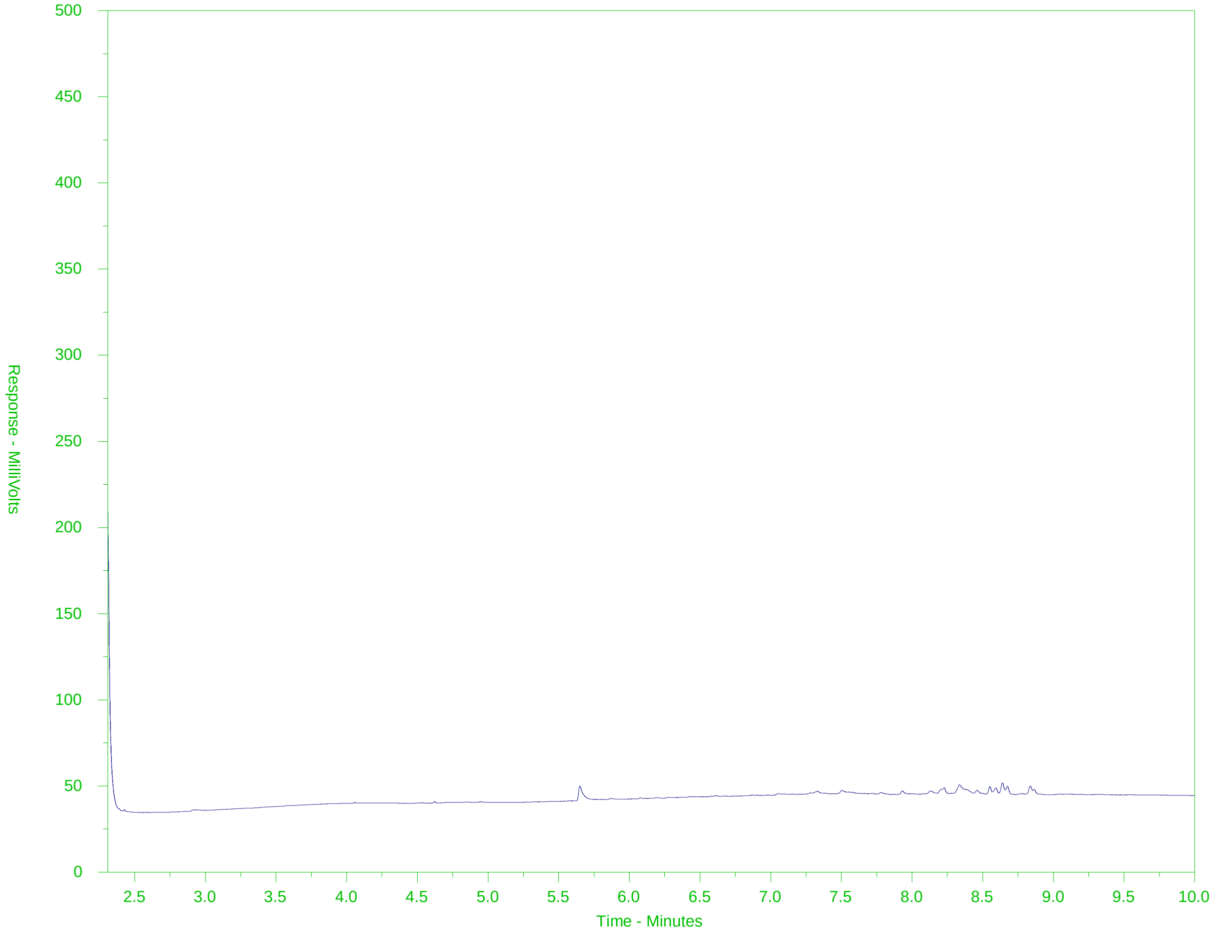
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

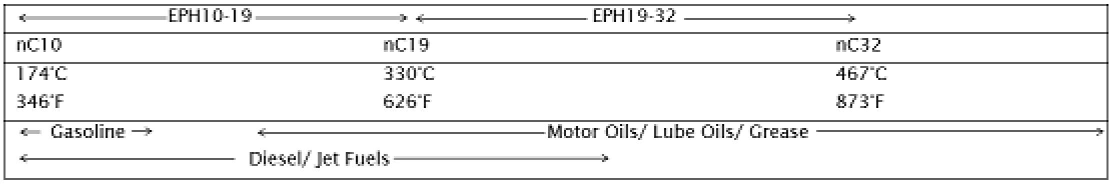
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-3
Client Sample ID: 02904-03





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

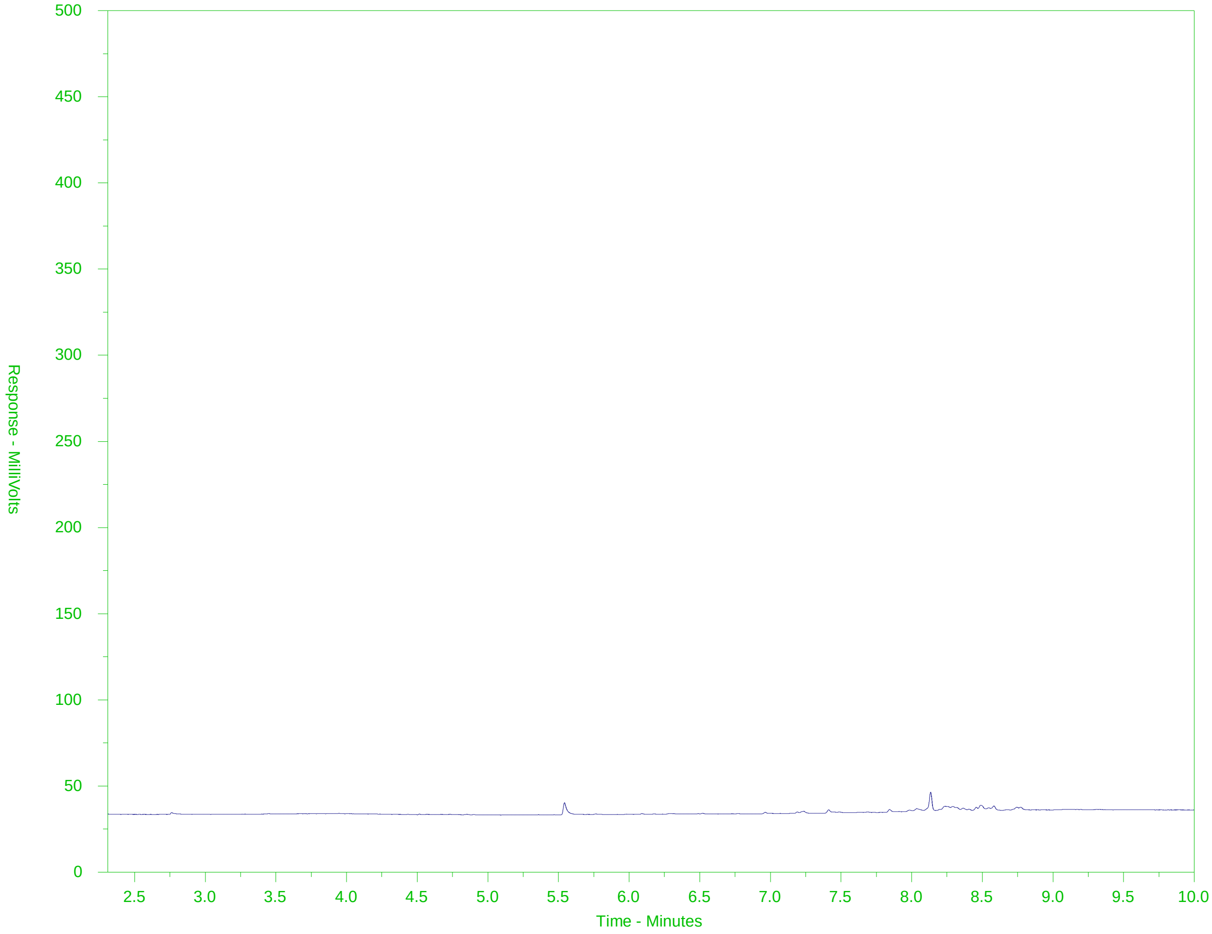
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

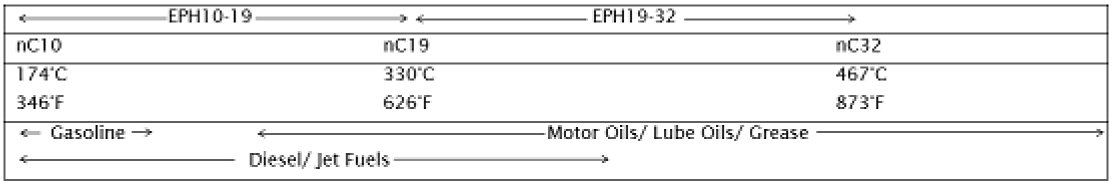
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

| | |
|---|---|
| ALS Sample ID: | L2451374-5 |
| Client Sample ID: | 02904-05 |





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

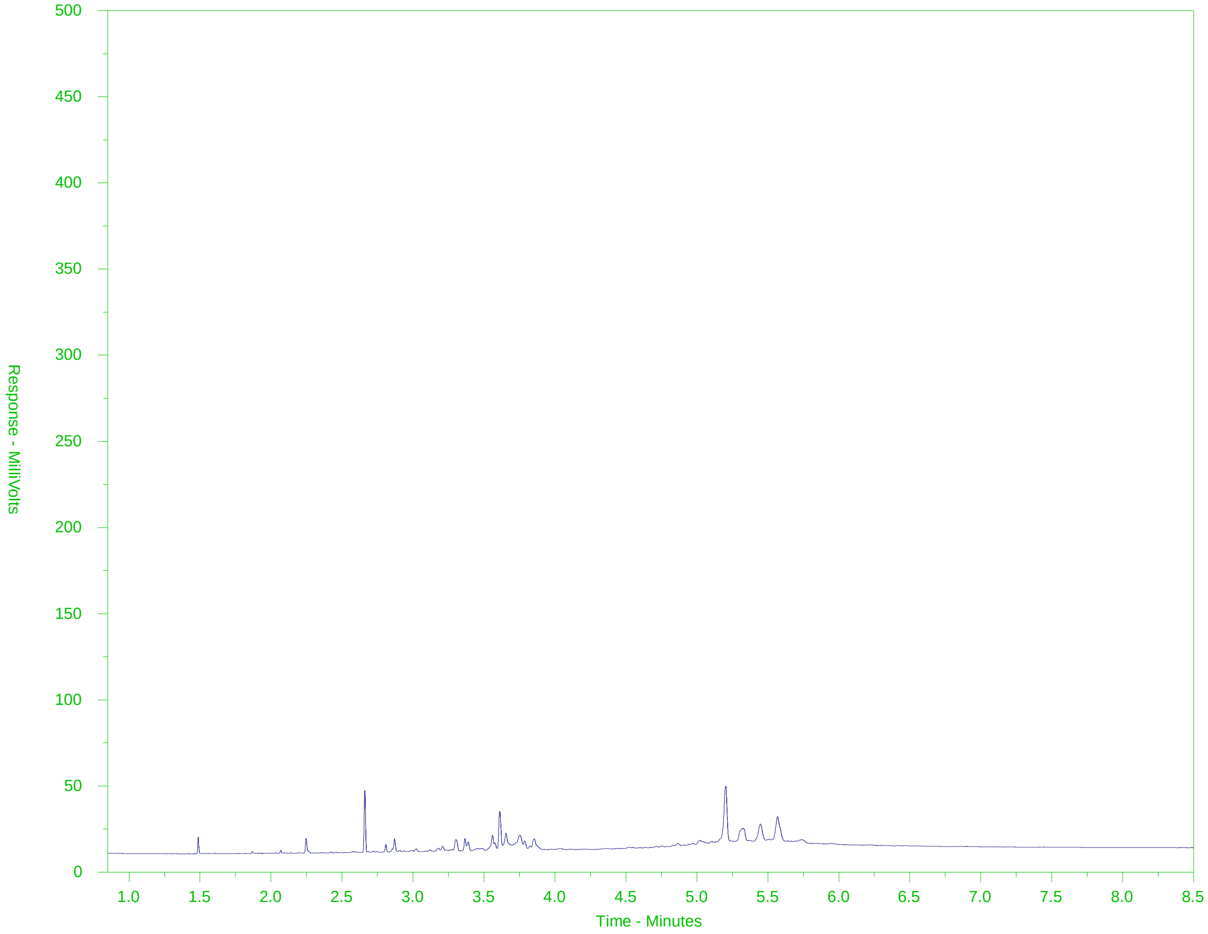
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

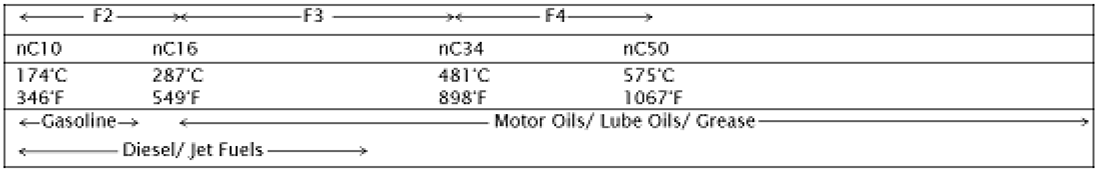
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-C-5
Client Sample ID: 02904-05





| | | | |
|---|---|---|---|
| ←— F2 —→ | ←— F3 —→ | ←— F4 —→ | |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ←Gasoline→ | ←— Motor Oils/ Lube Oils/ Grease —→ | | |
| ←— Diesel/ Jet Fuels —→ | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

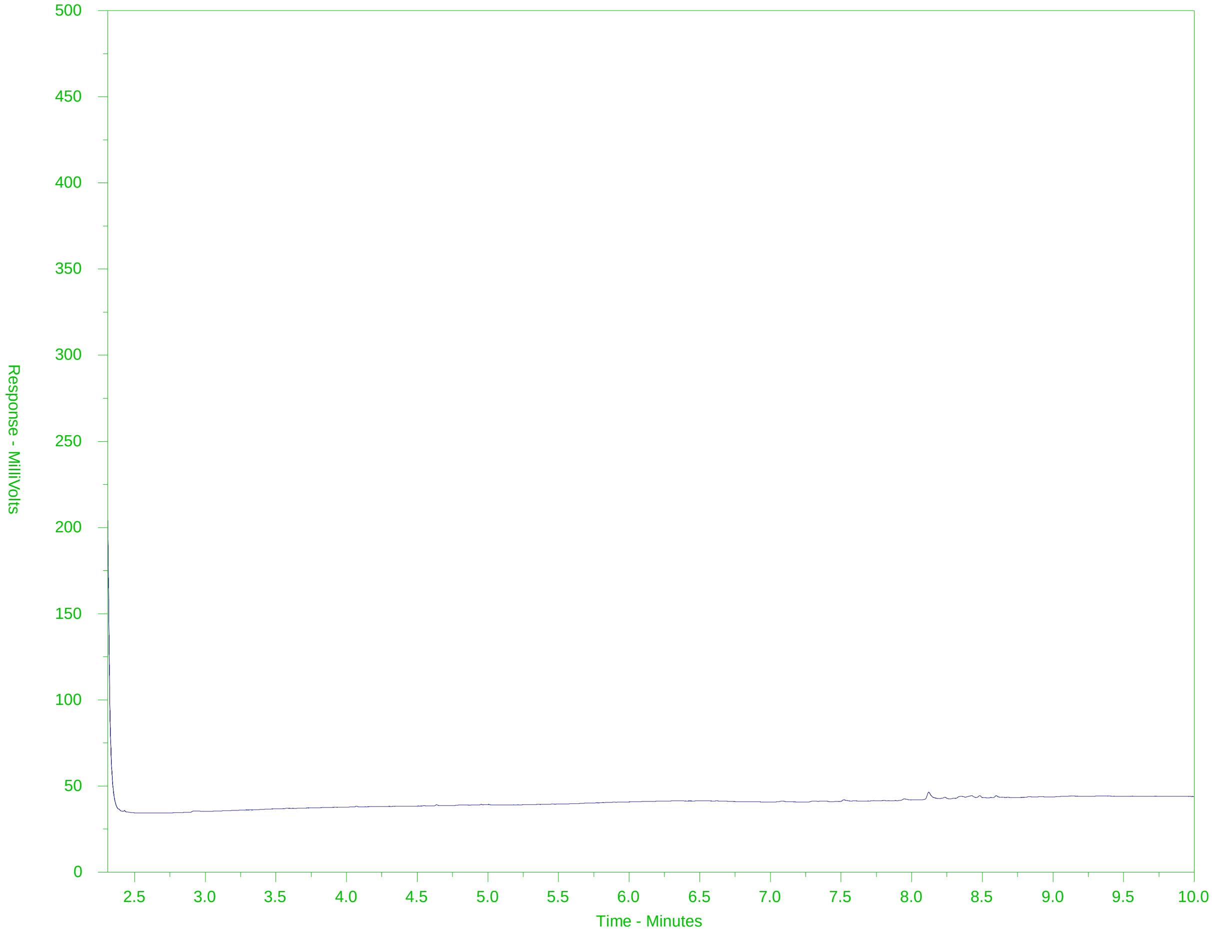
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

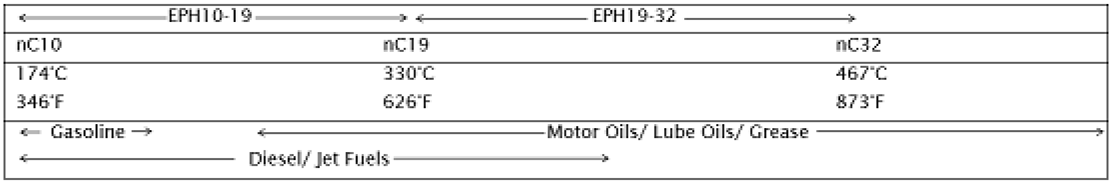
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-7
Client Sample ID: 02904-07





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

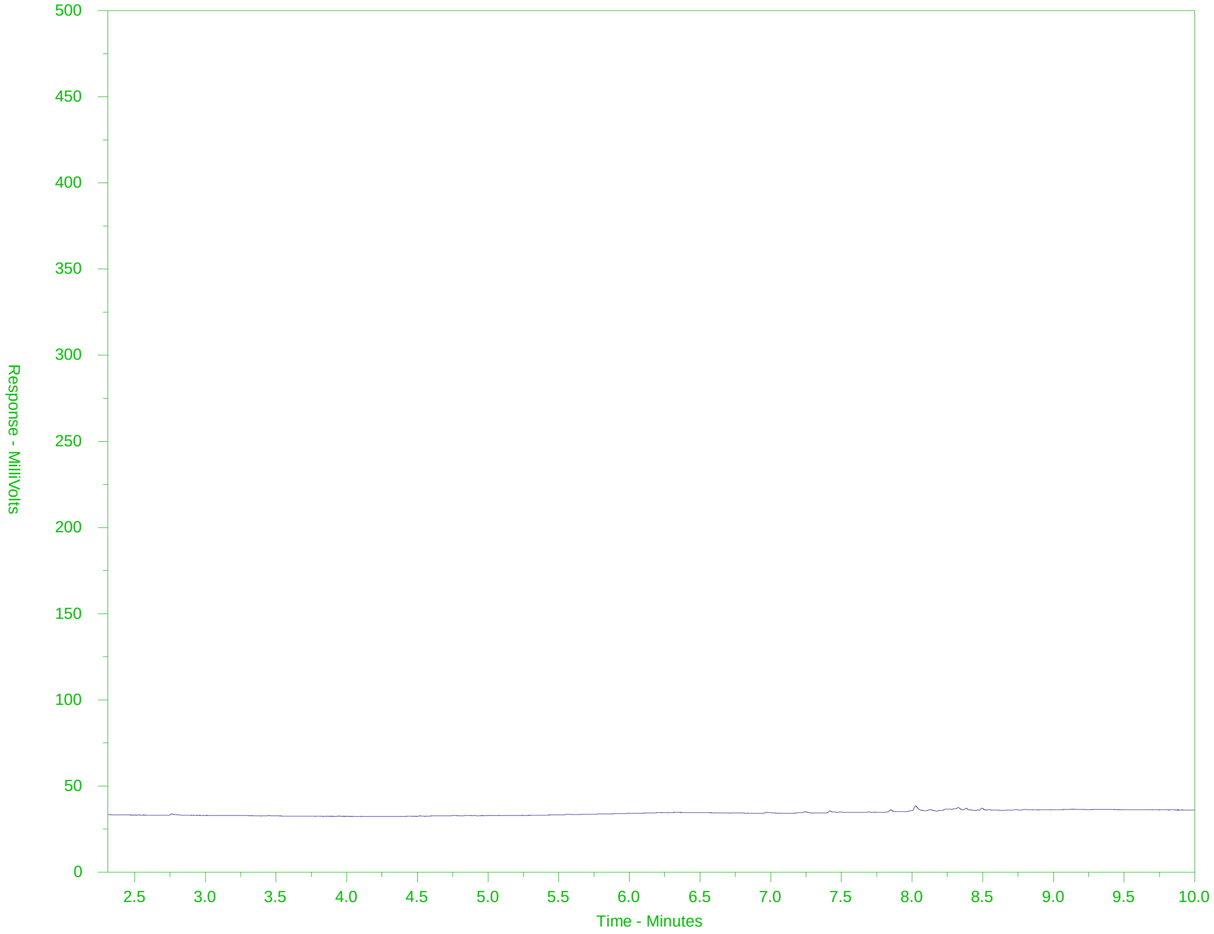
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

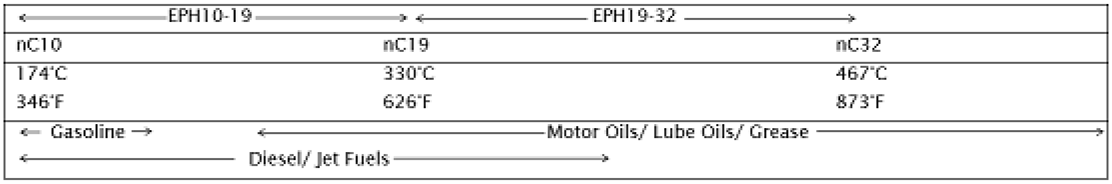
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-9
Client Sample ID: 02904-09





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

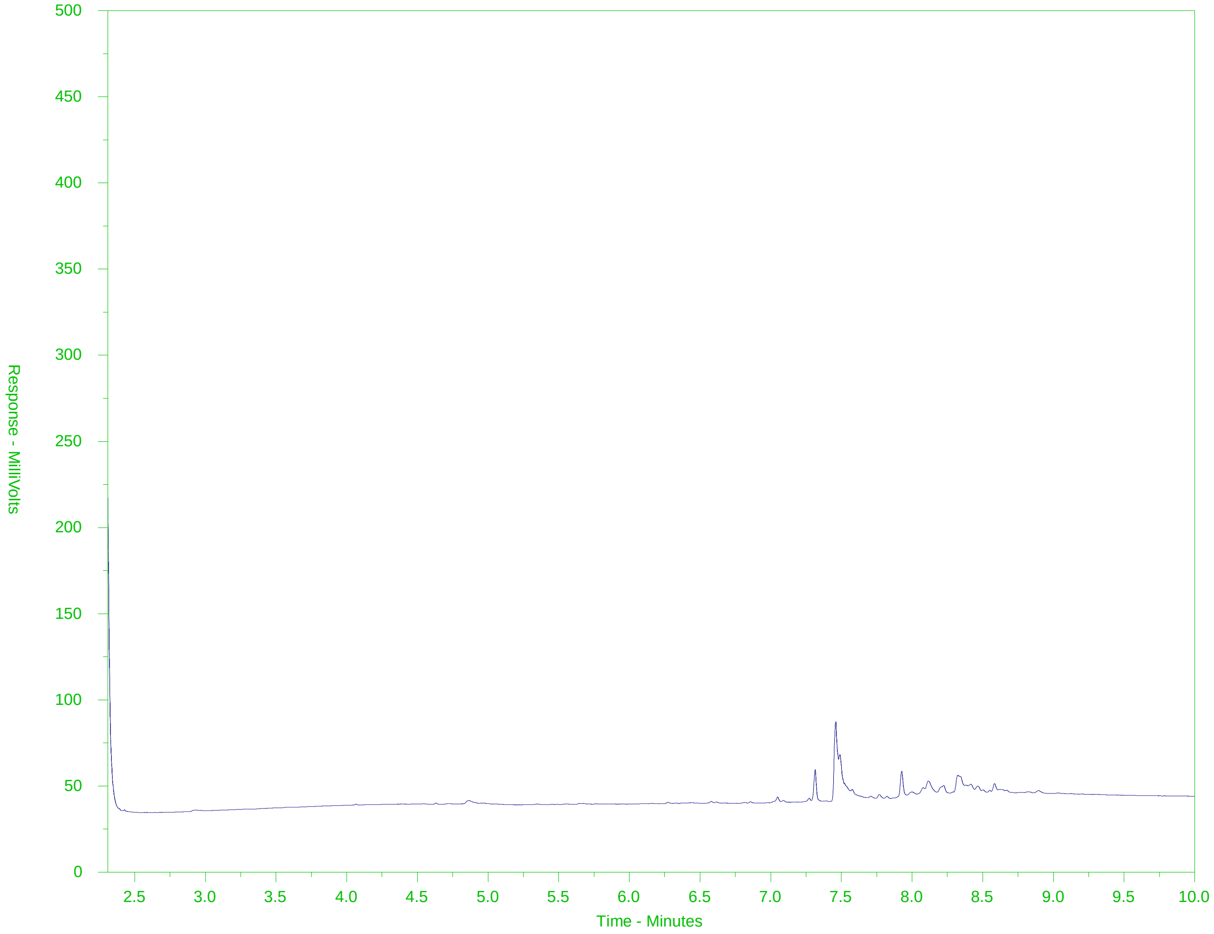
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-11
Client Sample ID: 02904-11



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

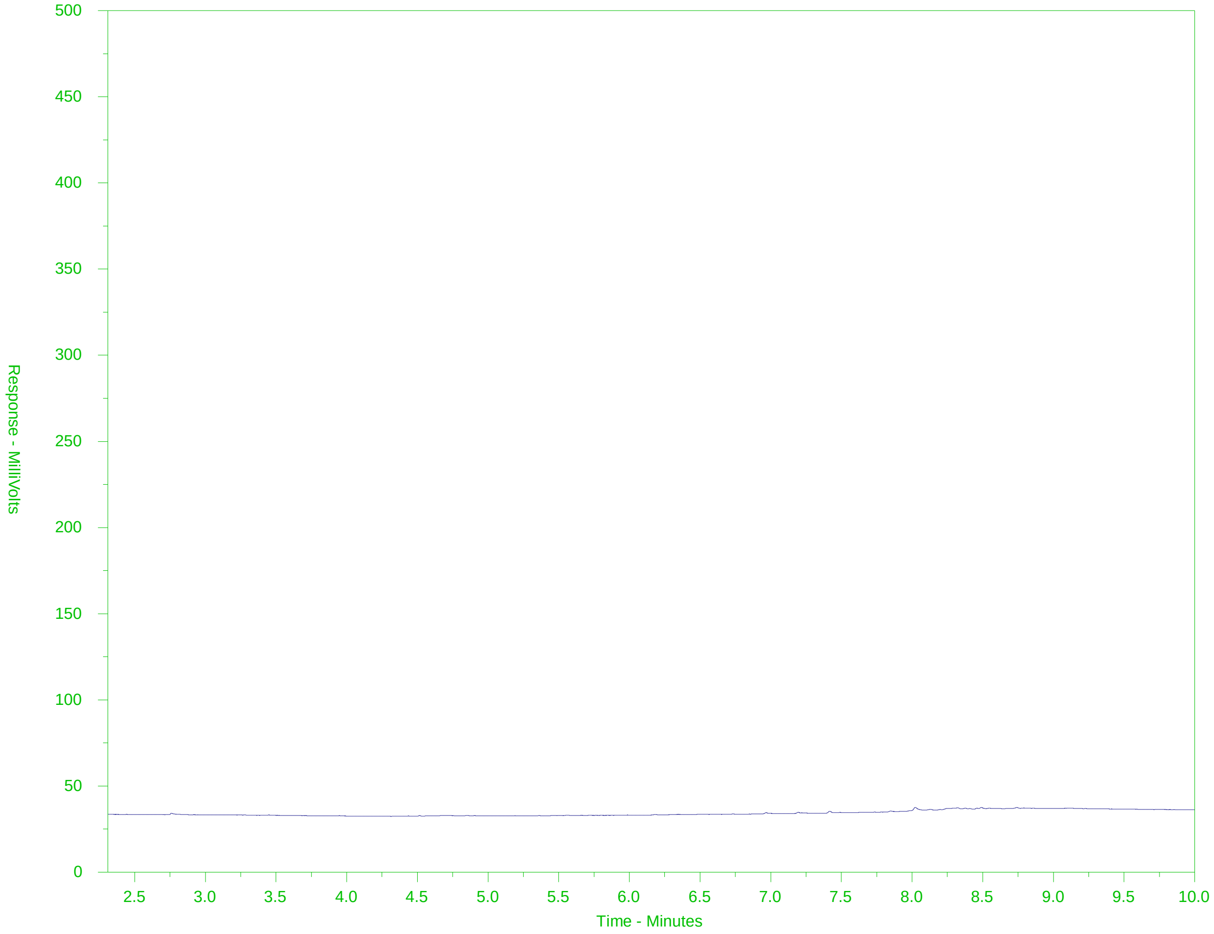
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-13
Client Sample ID: 02903-01



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

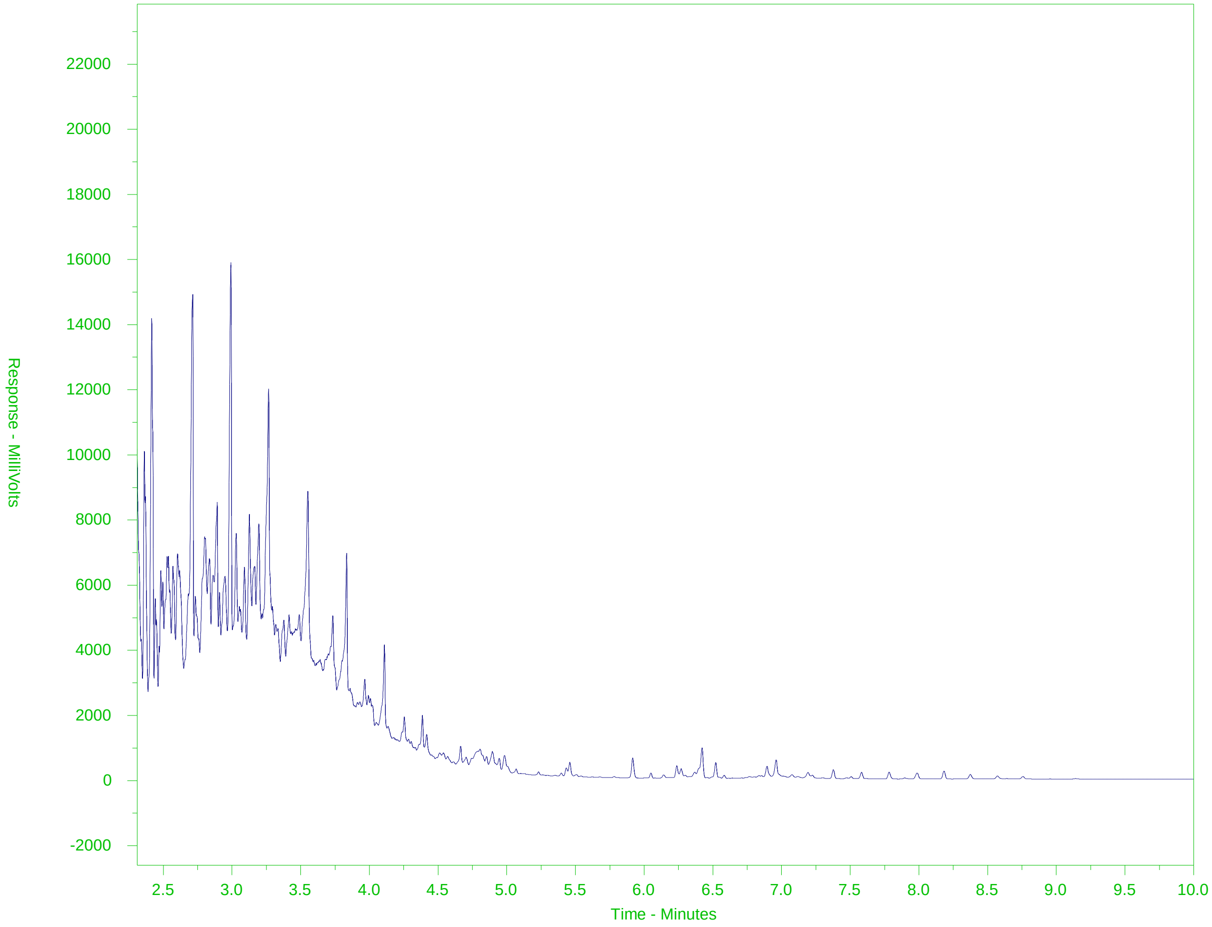
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-15
Client Sample ID: 02903-03



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

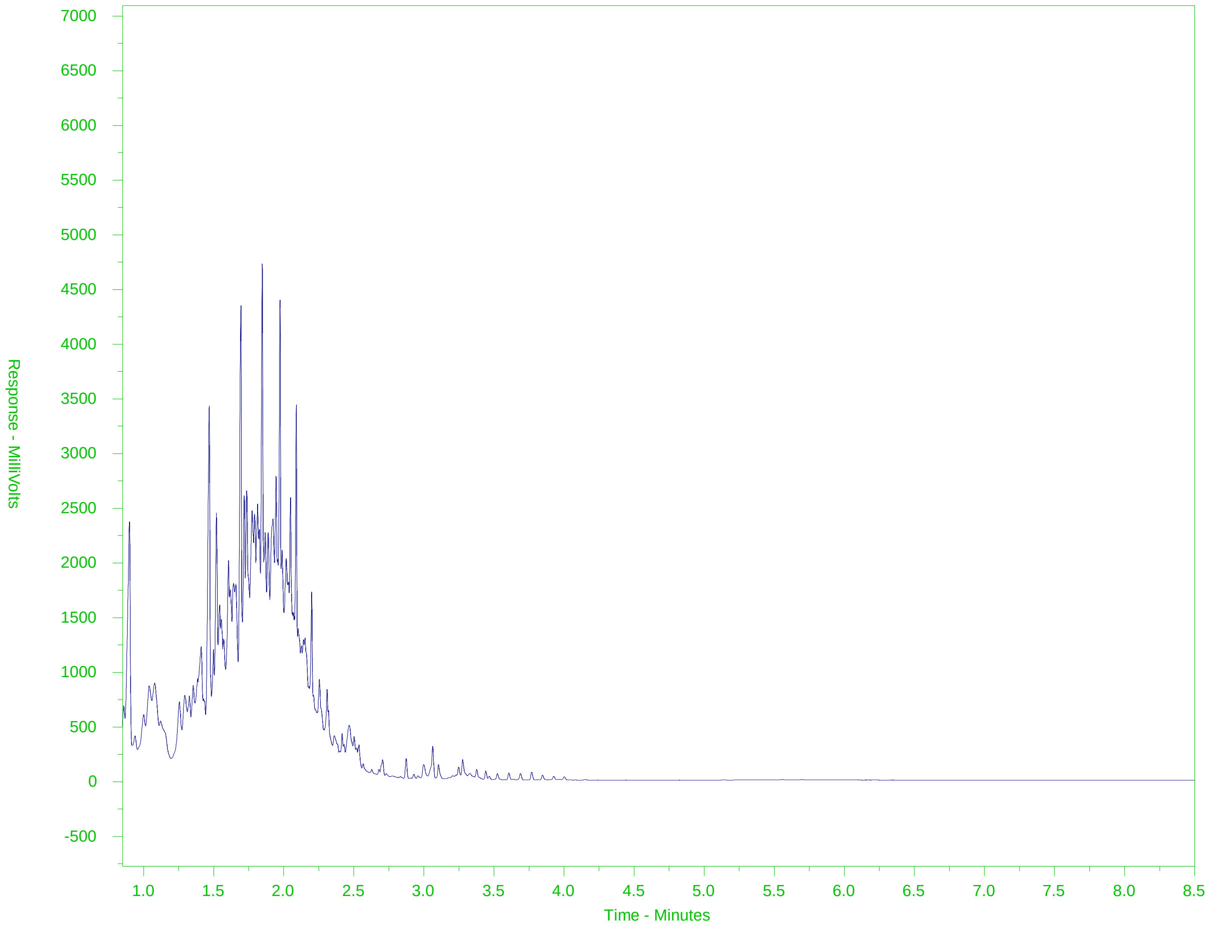
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-C-15
Client Sample ID: 02903-03



| | | | |
|---|---|---|---|
| ←— F2 —→ | ←— F3 —→ | ←— F4 —→ | |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ←Gasoline→ | ←— Motor Oils/ Lube Oils/ Grease —→ | | |
| ←— Diesel/ Jet Fuels —→ | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

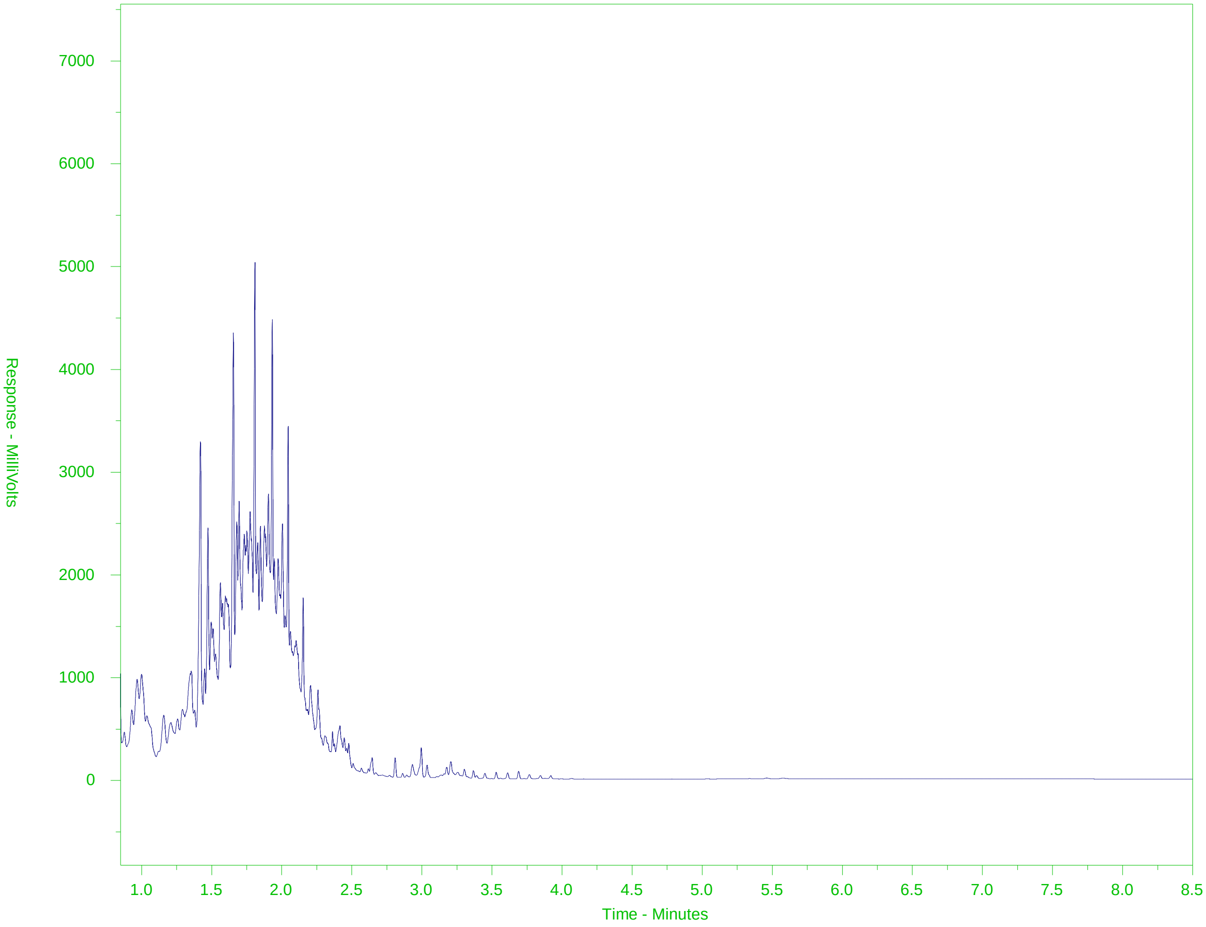
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3329533-C-3#L2451374-C-15
Client Sample ID: 02903-03



| | | | |
|---|---|---|---|
| ← F2 → | ← F3 → | ← F4 → | |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ←Gasoline→ | ← Motor Oils/ Lube Oils/ Grease → | | |
| ← Diesel/ Jet Fuels → | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

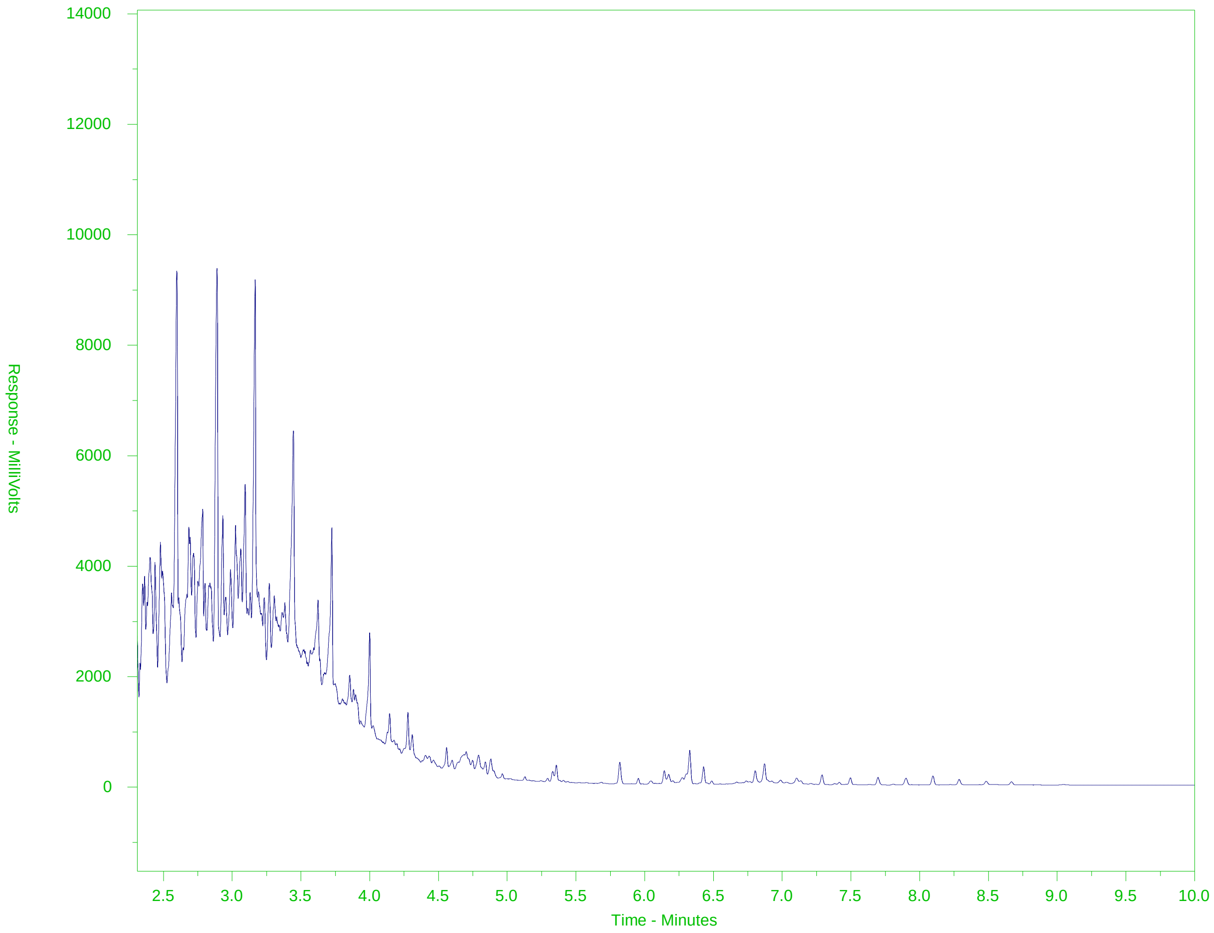
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3329533-3#L2451374-15
Client Sample ID: 02903-03



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

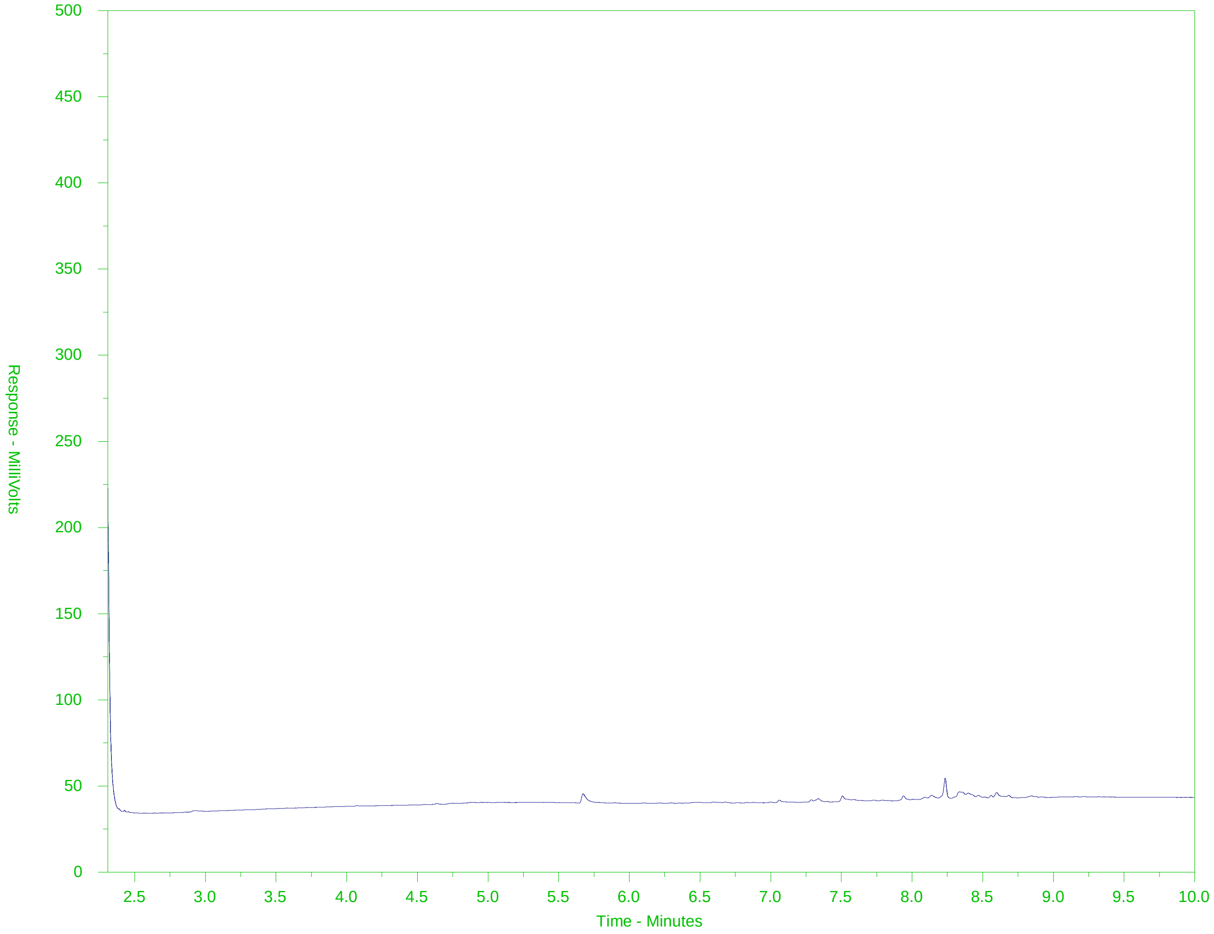
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-17
Client Sample ID: 02903-05



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline →<br>← Diesel/ Jet Fuels → | ← Motor Oils/ Lube Oils/ Grease → | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

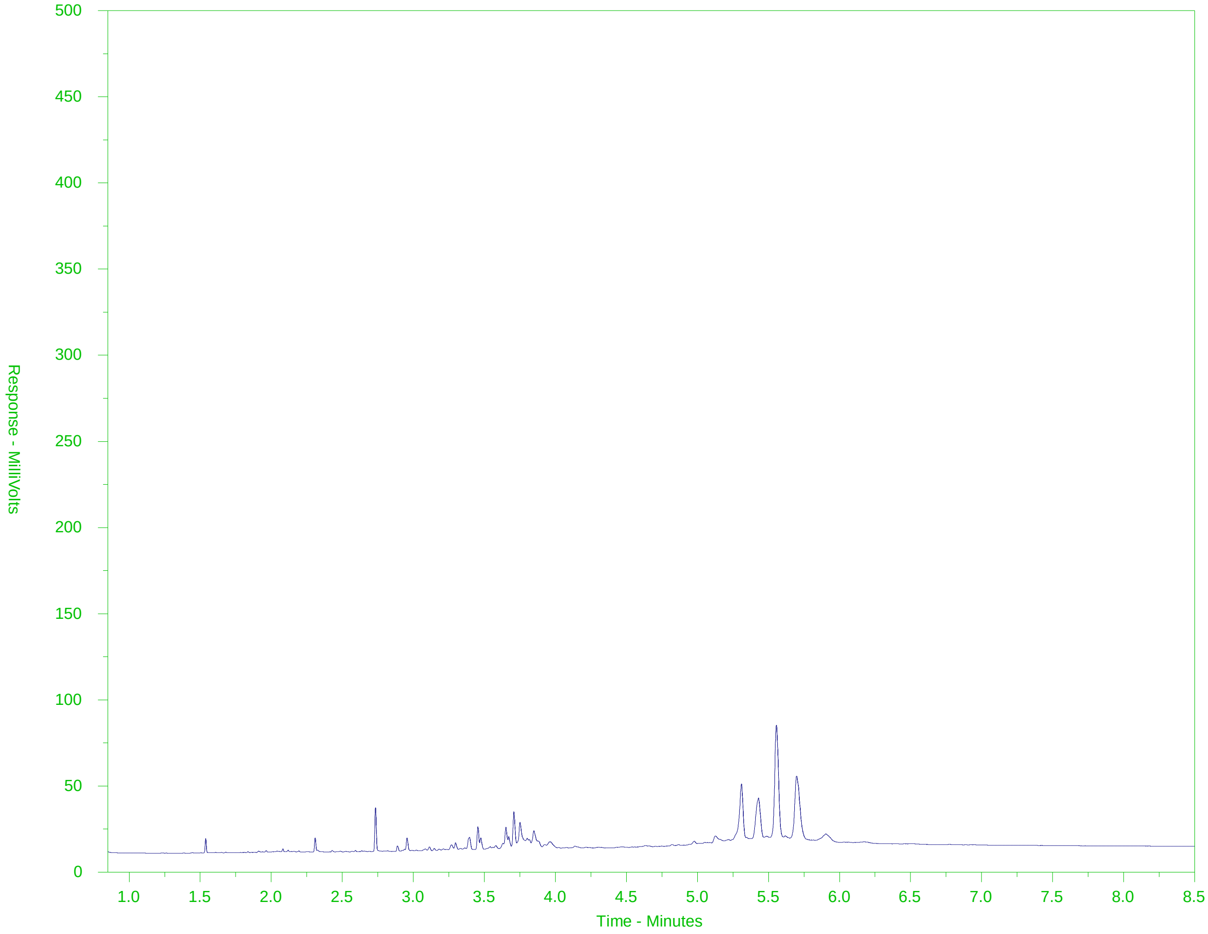
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

| | |
|---|---|
| ALS Sample ID: | L2451374-C-17 |
| Client Sample ID: | 02903-05 |



| | | | |
|---|---|---|---|
| ← F2 → | ← F3 → | | ← F4 → |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | | |
| ← Diesel/ Jet Fuels → | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

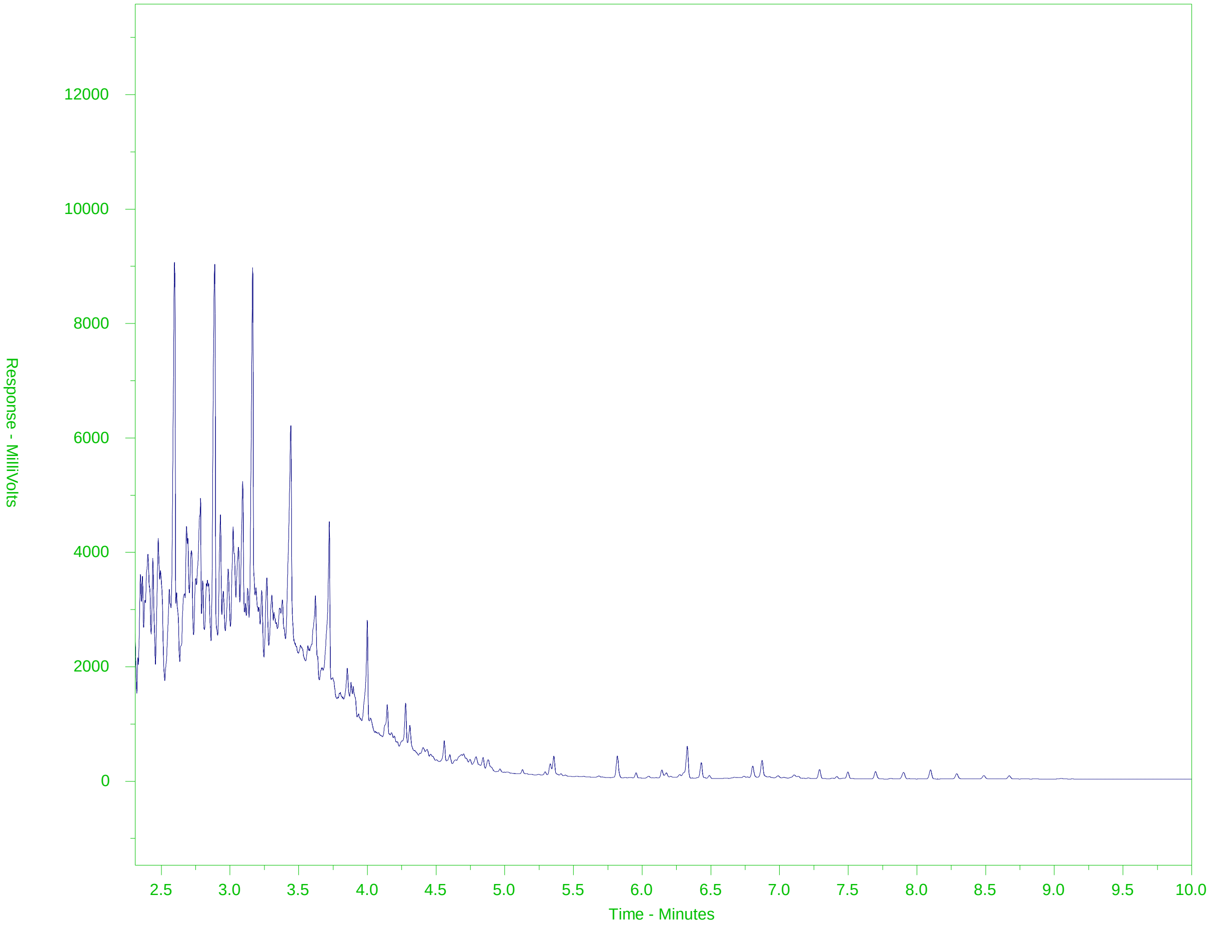
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-19
Client Sample ID: 02903-07



| | | |
|---|---|---|
| ←EPH10-19→ | ←EPH19-32→ | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline →<br>←Diesel/ Jet Fuels→ | ←Motor Oils/ Lube Oils/ Grease→ | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

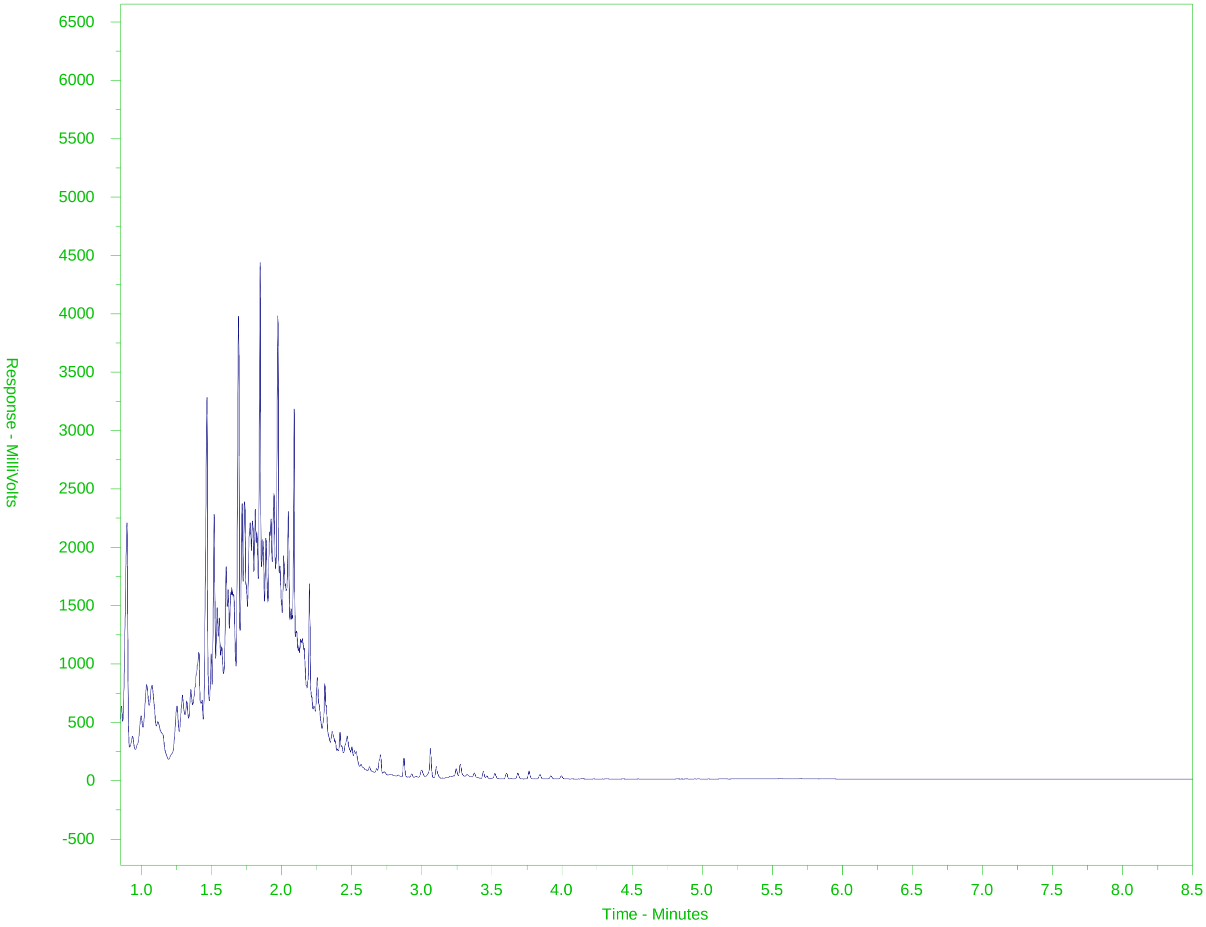
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451374-C-19
Client Sample ID: 02903-07



| | | | |
|---|---|---|---|
| ←— F2 —→ | ←— F3 —→ | ←— F4 —→ | |
| nC10 | nC16 | nC34 | nC50 |
| 174'C<br>346'F | 287'C<br>549'F | 481'C<br>898'F | 575'C<br>1067'F |
| ←Gasoline→ | ←— Motor Oils/ Lube Oils/ Grease —→ | | |
| ←— Diesel/ Jet Fuels —→ | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

L2451374-COFC

200 –
Vancouver, British Columbia, Canada
Telephone (604) 296-4200 Fax (604) 298-5253

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02904 page 1 of 2

Project Number: 20145856
Short Title: Snowbird Cleanup
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: EVONKROGH @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: AMBER SPRINGER

Office Name: Vancouver
EQuIS Facility Code: 217832270
EQuIS upload: ☒

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other 29 May 2020

Note: Final Reports to be issued by e-mail
Quote No.: Q80351

Analyses Required * see comments

| 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 | LEPH/HEPH/PAH | CCME PHC F1-4 | BTEX/VPH | 1,2,4 - trimethyl-benzene | Aluminum, antimony, barium, cadmium | Chromium, colbalt, lead, titanium, zinc | PFBS/PFOS/PFOA - Health Canada | n-nonane, isopropylbenzene, MTBE, styrene | Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02904 - 01 | SS20-02 | | 0.05-0.15 | SO | 25/05/20 | 10:40 | GRAB | | | 4 | X | | X | X | X | X | | | | X | |
| - 02 | SS20-02 | | 0.3-0.4 | | | 10:45 | | | | 4 | | | | | | | | | X | | |
| - 03 | SS20-03 | | 0.05-0.15 | | | 11:10 | | | | 4 | X | | X | X | X | X | | | | X | |
| - 04 | SS20-03 | | 0.3-0.4 | | | 11:15 | | | | 4 | | | | | | | | | X | | |
| - 05 | SS20-04 | | 0.05-0.15 | | | 11:40 | | FDA | 02902-05 | 5 | X | X | X | X | X | X | X | | | X | |
| - 06 | SS20-04 | | 0.3-0.4 | | | 11:45 | | FDA | 02902-06 | 4 | | | | | | | | | X | | |
| - 07 | SS20-05 | | 0.05-0.15 | | | 12:00 | | | | 4 | X | | X | X | | | | | | X | |
| - 08 | SS20-05 | | 0.3-0.4 | | | 12:05 | | | | 4 | | | | | | | | | X | | |
| - 09 | SS20-06 | | 0.05-0.15 | | | 12:20 | | | | 4 | X | | X | X | | | | | | X | |
| - 10 | SS20-06 | | 0.3-0.4 | | | 12:25 | | | | 4 | | | | | | | | | X | | |
| - 11 | SS20-07 | | 0.05-0.15 | | | 12:40 | | | | 4 | X | | X | X | | | | X | | X | |
| - 12 | SS20-07 | | 0.3-0.4 | | | 12:45 | | | | 4 | | | | | | | | | X | | |

Sampler's Signature: ah

Relinquished by: Signature ah
Company: GOLDER
Date: 25/05/2020
Time:
Received by: Signature
Company:

Comments: * Additional Analytes* 1-propylbenzene, 1,3,5-trimethylbenzene, butylbenzene, barium, 1,2-dibromoethane, 1,2-dichlorethane

Method of Shipment:
Waybill No.:
Received for Lab by: CT
Date: 25May2020
Time: 325PM

Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C)
Cooler opened by:
Date
Time

**WHITE: Golder Copy YELLOW: Lab Copy**

* ON ICE *

ESED

L2451374-COFC

2
V
Telephone (604) 296-4200 Fax (604) 298-5253

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02903 page 2 of 2

Project Number: 20145856
Short Title: Snowbird Cleanup
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: EVONKROGH @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: AMBER SPRINGER

Office Name: Vancouver
EQuIS Facility Code: 217832270
EQuIS upload: ☒
Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other 29 May
Note: Final Reports to be issued by e-mail
Quote No.: Q80351

| 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 | LEPH / HEPH / PAH | CCME PHC 1-4 | BTEX / VPH | 1,2,4 - trimethyl-benzene | Aluminum, antimony, barium, cadmium | Chromium, cobalt, lead, titanium, zinc | PFBS / PFOS / PFOA - Health Canada | See Comments ☆ | Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02903 - 01 | SS20-08 | | 0.05-0.15 | SO | 25/05/20 | 13:15 | GRAB | | | 4 | X | | X | X | | | | | | X | |
| - 02 | SS20-08 | | 0.3-0.4 | | | 13:20 | | | | 4 | | | | | | | | | X | | |
| - 03 | SS20-18 | | 0.05-0.15 | | | 13:40 | | FDA | 02902-07 | 5 | X | X | X | X | X | X | X | X | | X | |
| - 04 | SS20-18 | | 0.3-0.4 | | | 13:45 | | FDA | 02902-08 | 4 | | | | | | | | | X | | |
| - 05 | DUP A | | 0.05-0.15 | | | | | FD | 02904-05 | 5 | X | X | X | X | X | X | X | | | X | |
| - 06 | DUP A | | 0.3-0.4 | | | | | FD | 02904-06 | 4 | | | | | | | | | | | |
| - 07 | DUP B | | 0.05-0.15 | | | | | FD | 02902-03 | 5 | X | X | X | X | X | X | X | X | | X | |
| - 08 | DUP B | | 0.3-0.4 | | | | | FD | 02902-04 | 4 | | | | | | | | | X | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

Sampler's Signature: ah
Relinquished by: Signature ah
Company Golder
Date 25/05/2020
Time
Received by: Signature
Company
Comments: ☆ n-nonane, isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, butylbenzene, barium, MTBE, styrene, 1,2-dibromoethane, 1,2-dichloroethane
☆ ON ICE ☆
Method of Shipment:
Waybill No.:
Received for Lab by: CA
Date 25May2020
Time 325PM
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C)
Cooler opened by:
Date
Time

WHITE: Golder Copy YELLOW: Lab Copy

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

Date Received: 26-MAY-20
Report Date: 04-JUN-20 15:31 (MT)
Version: FINAL REV. 2

Client Phone: 604-297-2036

# Certificate of Analysis

**Lab Work Order #: L2451986**
Project P.O. #: NOT SUBMITTED
Job Reference: 20145856
C of C Numbers: 02905, 02906
Legal Site Desc:

**Comments:**

2-JUN-2020 Additional PFAS parameters are included.
4-JUN-2020 Additional VOC and Hydrocarbon data is included.

Amber Springer

Amber Springer, B.Sc
Account Manager

| | Sample ID | L2451986-1 | L2451986-3 | L2451986-5 | L2451986-7 | L2451986-9 |
|---|---|---|---|---|---|---|
| | Description | Soil | Soil | Soil | Soil | Soil |
| | Sampled Date | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 |
| | Sampled Time | 08:35 | 08:45 | 09:00 | 09:30 | 10:00 |
| | Client ID | 02905-01 | 02905-03 | 02905-05 | 02905-07 | 02905-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | Moisture (%) | 13.8 | 17.7 | 14.2 | 9.02 | 29.2 |
| | pH (1:2 soil:water) (pH) | | | | | |
| **Metals** | Aluminum (Al) (mg/kg) | | | | | |
| | Antimony (Sb) (mg/kg) | | | | | |
| | Barium (Ba) (mg/kg) | | | | | |
| | Cadmium (Cd) (mg/kg) | | | | | |
| | Chromium (Cr) (mg/kg) | | | | | |
| | Cobalt (Co) (mg/kg) | | | | | |
| | Lead (Pb) (mg/kg) | | | | | |
| | Titanium (Ti) (mg/kg) | | | | | |
| | Zinc (Zn) (mg/kg) | | | | | |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | Field MeOH | Field MeOH | Field MeOH | Field MeOH |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Toluene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | 1,2,4-Trimethylbenzene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Xylenes (mg/kg) | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 82.8 | 75.8 | 95.9 | 94.0 | 78.2 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 100.0 | 86.8 | 99.1 | 96.8 | 87.8 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | 300 | <200 | <200 |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | <200 | <200 | 300 | <200 | <200 |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | F1 (C6-C10) (mg/kg) | | | | | |
| | F2 (C10-C16) (mg/kg) | | | | | |
| | F3 (C16-C34) (mg/kg) | | | | | |
| | F4 (C34-C50) (mg/kg) | | | | | |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | Chrom. to baseline at nC50 | | | | | |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 82.6 | 87.2 | 81.5 | 86.0 | 87.0 |

| | **Sample ID** | L2451986-11 | L2451986-13 | L2451986-15 | L2451986-17 | L2451986-19 |
|---|---|---|---|---|---|---|
| | **Description** | Soil | Soil | Soil | Soil | Soil |
| | **Sampled Date** | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 |
| | **Sampled Time** | 10:30 | 11:10 | 11:40 | 12:10 | 12:10 |
| | **Client ID** | 02905-11 | 02906-01 | 02906-03 | 02906-05 | 02906-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | Moisture (%) | 21.4 | 15.0 | 15.8 | 18.9 | 20.9 |
| | pH (1:2 soil:water) (pH) | 6.96 | 6.61 | 6.71 | 6.11 | 5.86 |
| **Metals** | Aluminum (Al) (mg/kg) | 26800 | 20100 | 23400 | 18400 | 21500 |
| | Antimony (Sb) (mg/kg) | 0.16 | 0.22 | 0.18 | 0.26 | 0.28 |
| | Barium (Ba) (mg/kg) | 193 | 132 | 150 | 128 | 147 |
| | Cadmium (Cd) (mg/kg) | 0.266 | 0.202 | 0.147 | 0.169 | 0.173 |
| | Chromium (Cr) (mg/kg) | 58.9 | 45.4 | 50.2 | 45.1 | 49.5 |
| | Cobalt (Co) (mg/kg) | 15.5 | 13.6 | 15.4 | 14.1 | 15.0 |
| | Lead (Pb) (mg/kg) | 14.2 | 12.5 | 12.1 | 13.3 | 13.7 |
| | Titanium (Ti) (mg/kg) | 1930 | 1530 | 1630 | 1550 | 1650 |
| | Zinc (Zn) (mg/kg) | 119 | 82.8 | 85.3 | 75.4 | 81.7 |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | Field MeOH | Field MeOH | Field MeOH | Field MeOH |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | 0.0091 | 0.0089 |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.15 DLCI | <0.20 DLCI |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | <0.015 | 0.838 | 0.828 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | <0.050 | 4.29 | 5.25 |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Toluene (mg/kg) | <0.050 | <0.050 | <0.050 | 0.126 | 0.135 |
| | 1,2,4-Trimethylbenzene (mg/kg) | <0.050 | <0.050 | <0.050 | 4.51 | 4.15 |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | 2.89 | 2.18 |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | 3.45 | 3.75 |
| | Xylenes (mg/kg) | <0.075 | <0.075 | <0.075 | 6.34 | 5.93 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 75.8 | 94.3 | 100.4 | 101.7 | 84.2 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 89.0 | 98.8 | 99.7 | 99.9 | 87.0 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | 310 | <200 | 2150 | 1490 |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | <200 | 310 | <200 | 2150 | 1490 |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | F1 (C6-C10) (mg/kg) | | | | 86 | 90 |
| | F2 (C10-C16) (mg/kg) | | | | 653 | 82 |
| | F3 (C16-C34) (mg/kg) | | | | 77 | <50 |
| | F4 (C34-C50) (mg/kg) | | | | <50 | <50 |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | Chrom. to baseline at nC50 | | | | YES | YES |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 90.2 | 82.1 | 87.3 | 103.1 | 98.4 |

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2451986-1 | L2451986-3 | L2451986-5 | L2451986-7 | L2451986-9 |
|---|---|---|---|---|---|---|
| | **Description** | Soil | Soil | Soil | Soil | Soil |
| | **Sampled Date** | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 |
| | **Sampled Time** | 08:35 | 08:45 | 09:00 | 09:30 | 10:00 |
| | **Client ID** | 02905-01 | 02905-03 | 02905-05 | 02905-07 | 02905-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Hydrocarbons** | Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%) | | | | | |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 95.0 | 104.9 | 97.1 | 113.4 | 117.3 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <0.040 DLCI | <0.0050 | <0.0050 |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <0.010 DLCI | <0.0050 | <0.0050 |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.020 DLCI |
| | Benzo(a)pyrene (mg/kg) | <0.020 DLQ | <0.010 | <0.010 | <0.010 | 0.017 |
| | Benzo(b&j)fluoranthene (mg/kg) | 0.016 | <0.010 | 0.014 | <0.010 | 0.031 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | 0.016 | <0.015 | <0.015 | <0.015 | 0.031 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | 0.021 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.030 DLCI |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Fluoranthene (mg/kg) | 0.019 | <0.010 | 0.016 | <0.010 | 0.031 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | 0.044 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | 0.010 | <0.010 | <0.010 | <0.010 | 0.018 |
| | 1-Methylnaphthalene (mg/kg) | 0.024 | <0.010 | 0.314 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | 0.029 | <0.010 | 0.340 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <0.080 DLQ | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | 0.026 | <0.010 | 0.011 |
| | Pyrene (mg/kg) | 0.016 | <0.010 | 0.014 | <0.010 | 0.025 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 95.0 | 96.8 | 84.6 | 93.1 | 88.0 |
| | Surrogate: Naphthalene d8 (%) | 96.5 | 100.0 | 86.9 | 96.2 | 92.5 |
| | Surrogate: Phenanthrene d10 (%) | 95.6 | 97.5 | 86.6 | 94.5 | 91.0 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | 0.026 |
| | IACR (CCME) | 0.19 | <0.15 | 0.16 | <0.15 | 0.33 |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | | 0.00626 | | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | | 0.117 DLHC | | | |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | | <0.00010 | | | |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | | <0.00010 | | | |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | | <0.00050 | | | |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | | <0.13 DLB | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2451986-11 | L2451986-13 | L2451986-15 | L2451986-17 | L2451986-19 |
|---|---|---|---|---|---|---|
| | **Description** | Soil | Soil | Soil | Soil | Soil |
| | **Sampled Date** | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 |
| | **Sampled Time** | 10:30 | 11:10 | 11:40 | 12:10 | 12:10 |
| | **Client ID** | 02905-11 | 02906-01 | 02906-03 | 02906-05 | 02906-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Hydrocarbons** | Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%) | | | | 92.4 | 89.3 |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 115.4 | 85.3 | 108.7 | 123.0 | 89.7 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.040 DLCI | <0.0050 | <0.30 DLCI | <0.20 DLCI |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.010 DLCI | <0.0050 | <0.20 DLCI | <0.070 DLCI |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.020 DLCI | <0.0080 DLCI |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.020 DLQ | <0.010 | <0.020 DLQ | 0.012 |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | 0.013 | <0.010 | 0.015 | 0.016 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | 0.016 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | 0.011 | 0.010 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | 0.010 | <0.010 | <0.020 DLCI | 0.012 |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Fluoranthene (mg/kg) | 0.011 | 0.016 | <0.010 | 0.026 | 0.024 |
| | Fluorene (mg/kg) | <0.010 | 0.067 | <0.010 | 0.261 | 0.167 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | 0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | 0.206 | <0.010 | 3.17 | 2.07 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | 0.221 | <0.010 | 4.52 | 2.95 |
| | Naphthalene (mg/kg) | <0.010 | <0.040 DLCI | <0.010 | 2.30 | 1.61 |
| | Phenanthrene (mg/kg) | <0.010 | 0.045 | <0.010 | 0.144 | 0.096 |
| | Pyrene (mg/kg) | <0.010 | 0.016 | <0.010 | 0.033 | 0.028 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.40 DLCI | <0.30 DLCI |
| | Surrogate: Chrysene d12 (%) | 98.0 | 129.9 | 123.9 | 81.8 | 76.8 |
| | Surrogate: Naphthalene d8 (%) | 103.7 | 124.6 | 129.2 | 86.2 | 82.3 |
| | Surrogate: Phenanthrene d10 (%) | 101.7 | 122.7 | 124.9 | 86.5 | 81.3 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | <0.15 | 0.17 | <0.15 | 0.19 | 0.20 |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | | | | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | | | | | |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | | | | | |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | | | | | |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | | | | | |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sample ID** | | L2451986-1 | L2451986-3 | L2451986-5 | L2451986-7 | L2451986-9 |
| **Description** | | Soil | Soil | Soil | Soil | Soil |
| **Sampled Date** | | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 |
| **Sampled Time** | | 08:35 | 08:45 | 09:00 | 09:30 | 10:00 |
| **Client ID** | | 02905-01 | 02905-03 | 02905-05 | 02905-07 | 02905-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Perfluorinated** | Perfluoroheptanoic acid (PFHpA) (mg/kg) | | 0.00020 | | | |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | | 0.0228 DLHC | | | |
| | Perfluorononanoic acid (PFNA) (mg/kg) | | <0.00010 | | | |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | | 0.00055 | | | |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | | 0.00137 | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2451986-11 | L2451986-13 | L2451986-15 | L2451986-17 | L2451986-19 |
| | **Description** | Soil | Soil | Soil | Soil | Soil |
| | **Sampled Date** | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 | 26-MAY-20 |
| | **Sampled Time** | 10:30 | 11:10 | 11:40 | 12:10 | 12:10 |
| | **Client ID** | 02905-11 | 02906-01 | 02906-03 | 02906-05 | 02906-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Perfluorinated** | Perfluoroheptanoic acid (PFHpA) (mg/kg) | | | | | |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | | | | | |
| | Perfluorononanoic acid (PFNA) (mg/kg) | | | | | |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | | | | | |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# Reference Information

**QC Samples with Qualifiers & Comments:**

| QC Type Description | Parameter | Qualifier | Applies to Sample Number(s) |
|---|---|---|---|
| Laboratory Control Sample | Perfluorobutanoic acid (PFBA) | LCS-H | L2451986-3 |
| Method Blank | Perfluorobutanoic acid (PFBA) | MB-LOR | L2451986-3 |
| Matrix Spike | 6:2 Fluorotelomer sulfonic acid(6:2 FT | MS-B | L2451986-3 |
| Matrix Spike | 8:2 Fluorotelomer sulfonic acid(8:2 FT | MS-B | L2451986-3 |
| Matrix Spike | Perfluorobutanoic acid (PFBA) | MS-B | L2451986-3 |
| Matrix Spike | Perfluorohexanoic acid (PFHxA) | MS-B | L2451986-3 |
| Matrix Spike | Perfluoropentanoic acid (PFPeA) | MS-B | L2451986-3 |

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| DLB | Detection Limit Raised. Analyte detected at comparable level in Method Blank. |
| DLCI | Detection Limit Raised: Chromatographic Interference due to co-elution. |
| DLHC | Detection Limit Raised: Dilution required due to high concentration of test analyte(s). |
| DLQ | Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria. |
| LCS-H | Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified. |
| MB-LOR | Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level. |
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **EPH-TUMB-FID-VA** | Soil | EPH in Solids by Tumbler and GCFID | BC MOE EPH GCFID |

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Solids by GC/FID", v2.1, July 1999. Soil samples are extracted with a 1:1 mixture of hexane and acetone using a rotary extraction technique modified from EPA 3570 prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

| | | | |
|---|---|---|---|
| **F1-HSFID-VA** | Soil | CCME F1 by headspace GCMS | CCME CWS PHC (Pub# 1310) |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. The F1 fraction concentration is measured using flame ionization detection.

| | | | |
|---|---|---|---|
| **F2F4-TUMB-H/A-FID-VA** | Soil | CWS F2-F4 Hydrocarbons by Tumbler GCFID | CCME PETROLEUM HYDROCARBONS |

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." For C10 to C50 hydrocarbons (F2, F3, F4) and gravimetric heavy hydrocarbons (F4G-sg), a subsample of the sediment/soil is extracted with 1:1 hexane:acetone using a rotary extractor. The extract undergoes a silica-gel clean-up to remove polar compounds. F2, F3 & F4 are analyzed by on-column GC/FID, and F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where F4 (C34-C50) and F4G-sg results are reported for a sample, the larger of the reported values is used for comparison against the relevant CCME standard for F4.
7. The gravimetric heavy hydrocarbon results (F4G-sg), cannot be added to the C6 to C50 hydrocarbon results.
8. This method is validated for use.
9. Data from analysis of quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram.

| | | | |
|---|---|---|---|
| **FUELS-HSMS-VA** | Soil | VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| | | | |
|---|---|---|---|
| **LEPH/HEPH-CALC-VA** | Soil | LEPHs and HEPHs | BC MOE LEPH/HEPH |

LEPHs and HEPHs are measures of Light and Heavy Extractable Petroleum Hydrocarbons in soil. Results are calculated by subtraction of applicable PAH concentrations from EPH10-19 and EPH19-32, as per the BC Lab Manual LEPH/HEPH calculation procedure.

LEPHs = EPH10-19 minus Naphthalene and Phenanthrene.

HEPHs = EPH19-32 minus Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and Pyrene.

| | | | |
|---|---|---|---|
| **MET-200.2-CCMS-VA** | Soil | Metals in Soil by CRC ICPMS | EPA 200.2/6020A (mod) |

# Reference Information

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

**MOISTURE-VA** Soil Moisture content CCME PHC in Soil - Tier 1 (mod)

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of two hours.

**PAH-TMB-H/A-MS-VA** Soil PAH - Rotary Extraction (Hexane/Acetone) EPA 3570/8270

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3570 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

Benzo(a)pyrene Total Potency Equivalents [B(a)P TPE] represents the sum of estimated cancer potency relative to B(a)P for all potentially carcinogenic unsubstituted PAHs, and is calculated as per the CCME PAH Soil Quality Guidelines reference document (2010).

**PFAS-LL-EX-LCMS-WT** Soil Perfluorinated Compounds by LC/MS-MS MOECC E3506

Soil sample was extracted with alkaline organic solvent. Dilute organic extract with water (10% organic/water) then passed through SPE. Final extract of Perfluorinated compounds are analyzed by LC/MS-MS.

**PH-1:2-VA** Soil pH in Soil (1:2 Soil:Water Extraction) BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in "pH, Electrometric in Soil and Sediment - Prescriptive Method", Rev. 2005, Section B Physical, Inorganic and Misc. Constituents, BC Environmental Laboratory Manual. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

**VH-HSFID-VA** Soil VH in soil by Headspace GCFID BC Env. Lab Manual (VH in Solids)

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999).

**VH-SURR-FID-VA** Soil VH Surrogates for Soils BC Env. Lab Manual (VH in Solids)

**VOC-M2-HSMS-VA** Soil Misc VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7-L-HSMS-VA** Soil VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7/VOC-SURR-MS-VA** Soil VOC7 and/or VOC Surrogates for Soils EPA 5035A/5021A/8260C

**VPH-CALC-VA** Soil VPH is VH minus select aromatics BC MOE VPH

VPHs measures Volatile Petroleum Hydrocarbons in soil. Results are calculated by subtraction of specific Monocyclic Aromatic Hydrocarbons from VH6-10, as per the BC Lab Manual VPH calculation procedure.
VPHs = VH6-10 minus Benzene, Toluene, Ethylbenzene, Xylenes, and Styrene

**XYLENES-CALC-VA** Soil Sum of Xylene Isomer Concentrations EPA 8260B & 524.2

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |
| VA | ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA |

# Reference Information

**Chain of Custody Numbers:**

02905 02906

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2451986 Report Date: 04-JUN-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4
Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **EPH-TUMB-FID-VA** | **Soil** | | | | | | | |
| **Batch R5100246** | | | | | | | | |
| **WG3330406-3** | **DUP** | **L2451986-9** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| **WG3330406-4** | **IRM** | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 101.4 | | % | | 70-130 | 28-MAY-20 |
| EPH19-32 | | | 101.7 | | % | | 70-130 | 28-MAY-20 |
| **WG3330406-2** | **LCS** | | | | | | | |
| EPH10-19 | | | 94.7 | | % | | 70-130 | 28-MAY-20 |
| EPH19-32 | | | 93.6 | | % | | 70-130 | 28-MAY-20 |
| **WG3330406-1** | **MB** | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 28-MAY-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 28-MAY-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 87.8 | | % | | 60-140 | 28-MAY-20 |
| **F1-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5071997** | | | | | | | | |
| **WG3330714-2** | **LCS** | | | | | | | |
| F1 (C6-C10) | | | 94.9 | | % | | 70-130 | 29-MAY-20 |
| **WG3330714-1** | **MB** | | | | | | | |
| F1 (C6-C10) | | | <10 | | mg/kg | | 10 | 29-MAY-20 |
| **Batch R5083660** | | | | | | | | |
| **WG3334077-2** | **LCS** | | | | | | | |
| F1 (C6-C10) | | | 117.6 | | % | | 70-130 | 04-JUN-20 |
| **WG3334077-1** | **MB** | | | | | | | |
| F1 (C6-C10) | | | <10 | | mg/kg | | 10 | 04-JUN-20 |
| **F2F4-TUMB-H/A-FID-VA** | **Soil** | | | | | | | |
| **Batch R5107521** | | | | | | | | |
| **WG3334087-6** | **DUP** | **L2451986-17** | | | | | | |
| F2 (C10-C16) | | 653 | 866 | | mg/kg | 28 | 40 | 04-JUN-20 |
| F3 (C16-C34) | | 77 | 97 | | mg/kg | 23 | 40 | 04-JUN-20 |
| F4 (C34-C50) | | <50 | <50 | RPD-NA | mg/kg | N/A | 40 | 04-JUN-20 |
| **WG3334087-4** | **IRM** | **ALS PHC RM3** | | | | | | |
| F2 (C10-C16) | | | 99.3 | | % | | 70-130 | 04-JUN-20 |
| F3 (C16-C34) | | | 94.7 | | % | | 70-130 | 04-JUN-20 |
| F4 (C34-C50) | | | 96.1 | | % | | 70-130 | 04-JUN-20 |
| **WG3334087-2** | **LCS** | | | | | | | |
| F2 (C10-C16) | | | 103.9 | | % | | 70-130 | 04-JUN-20 |
| F3 (C16-C34) | | | 99.6 | | % | | 70-130 | 04-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **F2F4-TUMB-H/A-FID-VA** | **Soil** | | | | | | | |
| **Batch R5107521** | | | | | | | | |
| **WG3334087-2 LCS** | | | | | | | | |
| F4 (C34-C50) | | | 95.9 | | % | | 70-130 | 04-JUN-20 |
| **WG3334087-1 MB** | | | | | | | | |
| F2 (C10-C16) | | | <30 | | mg/kg | | 30 | 04-JUN-20 |
| F3 (C16-C34) | | | <50 | | mg/kg | | 50 | 04-JUN-20 |
| F4 (C34-C50) | | | <50 | | mg/kg | | 50 | 04-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride, F2-F4 | | | 91.2 | | % | | 60-140 | 04-JUN-20 |
| **FUELS-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5071978** | | | | | | | | |
| **WG3330714-3 DUP** | | **L2451986-9** | | | | | | |
| 1,2,4-Trimethylbenzene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| 1,2-Dibromoethane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| **WG3330714-2 LCS** | | | | | | | | |
| 1,2,4-Trimethylbenzene | | | 103.4 | | % | | 70-130 | 28-MAY-20 |
| 1,2-Dibromoethane | | | 109.8 | | % | | 70-130 | 28-MAY-20 |
| **WG3330714-1 MB** | | | | | | | | |
| 1,2,4-Trimethylbenzene | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5100170** | | | | | | | | |
| **WG3330407-4 CRM** | | **VA-CANMET-TILL2** | | | | | | |
| Aluminum (Al) | | | 97.6 | | % | | 70-130 | 29-MAY-20 |
| Antimony (Sb) | | | 95.9 | | % | | 70-130 | 29-MAY-20 |
| Barium (Ba) | | | 99.9 | | % | | 70-130 | 29-MAY-20 |
| Cadmium (Cd) | | | 99.2 | | % | | 70-130 | 29-MAY-20 |
| Chromium (Cr) | | | 100.1 | | % | | 70-130 | 29-MAY-20 |
| Cobalt (Co) | | | 98.2 | | % | | 70-130 | 29-MAY-20 |
| Lead (Pb) | | | 96.8 | | % | | 70-130 | 29-MAY-20 |
| Titanium (Ti) | | | 105.4 | | % | | 70-130 | 29-MAY-20 |
| Zinc (Zn) | | | 99.1 | | % | | 70-130 | 29-MAY-20 |
| **WG3330407-3 LCS** | | | | | | | | |
| Aluminum (Al) | | | 97.2 | | % | | 80-120 | 29-MAY-20 |
| Antimony (Sb) | | | 106.6 | | % | | 80-120 | 29-MAY-20 |
| Barium (Ba) | | | 101.6 | | % | | 80-120 | 29-MAY-20 |
| Cadmium (Cd) | | | 102.3 | | % | | 80-120 | 29-MAY-20 |
| Chromium (Cr) | | | 99.0 | | % | | 80-120 | 29-MAY-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5100170** | | | | | | | | |
| **WG3330407-3 LCS** | | | | | | | | |
| Cobalt (Co) | | | 96.1 | | % | | 80-120 | 29-MAY-20 |
| Lead (Pb) | | | 101.8 | | % | | 80-120 | 29-MAY-20 |
| Titanium (Ti) | | | 96.4 | | % | | 80-120 | 29-MAY-20 |
| Zinc (Zn) | | | 100.1 | | % | | 80-120 | 29-MAY-20 |
| **WG3330407-1 MB** | | | | | | | | |
| Aluminum (Al) | | | <50 | | mg/kg | | 50 | 29-MAY-20 |
| Antimony (Sb) | | | <0.10 | | mg/kg | | 0.1 | 29-MAY-20 |
| Barium (Ba) | | | <0.50 | | mg/kg | | 0.5 | 29-MAY-20 |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 29-MAY-20 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 29-MAY-20 |
| Cobalt (Co) | | | <0.10 | | mg/kg | | 0.1 | 29-MAY-20 |
| Lead (Pb) | | | <0.50 | | mg/kg | | 0.5 | 29-MAY-20 |
| Titanium (Ti) | | | <1.0 | | mg/kg | | 1 | 29-MAY-20 |
| Zinc (Zn) | | | <2.0 | | mg/kg | | 2 | 29-MAY-20 |
| **MOISTURE-VA** | **Soil** | | | | | | | |
| **Batch R5099670** | | | | | | | | |
| **WG3330408-3 DUP** | | **L2451986-9** | | | | | | |
| Moisture | | 29.2 | 29.0 | | % | 0.7 | 20 | 27-MAY-20 |
| **WG3330408-2 LCS** | | | | | | | | |
| Moisture | | | 99.4 | | % | | 90-110 | 27-MAY-20 |
| **WG3330408-1 MB** | | | | | | | | |
| Moisture | | | <0.25 | | % | | 0.25 | 27-MAY-20 |
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5100739** | | | | | | | | |
| **WG3330406-3 DUP** | | **L2451986-9** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Benz(a)anthracene | | <0.020 | <0.020 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Benzo(a)pyrene | | 0.017 | 0.021 | | mg/kg | 21 | 50 | 29-MAY-20 |
| Benzo(b&j)fluoranthene | | 0.031 | 0.033 | | mg/kg | 6.1 | 50 | 29-MAY-20 |
| Benzo(g,h,i)perylene | | 0.021 | 0.025 | | mg/kg | 19 | 50 | 29-MAY-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Chrysene | | <0.030 | <0.020 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5100739** | | | | | | | | |
| **WG3330406-3 DUP** | | **L2451986-9** | | | | | | |
| Fluoranthene | | 0.031 | 0.031 | | mg/kg | 0.6 | 50 | 29-MAY-20 |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | 0.018 | 0.021 | | mg/kg | 15 | 50 | 29-MAY-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| Phenanthrene | | 0.011 | 0.013 | | mg/kg | 11 | 50 | 29-MAY-20 |
| Pyrene | | 0.025 | 0.029 | | mg/kg | 12 | 50 | 29-MAY-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 29-MAY-20 |
| **WG3330406-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 95.7 | | % | | 60-130 | 29-MAY-20 |
| Acenaphthylene | | | 108.1 | | % | | 60-130 | 29-MAY-20 |
| Anthracene | | | 112.4 | | % | | 60-130 | 29-MAY-20 |
| Benz(a)anthracene | | | 90.0 | | % | | 60-130 | 29-MAY-20 |
| Benzo(a)pyrene | | | 94.6 | | % | | 60-130 | 29-MAY-20 |
| Benzo(b&j)fluoranthene | | | 91.4 | | % | | 60-130 | 29-MAY-20 |
| Benzo(g,h,i)perylene | | | 94.2 | | % | | 60-130 | 29-MAY-20 |
| Benzo(k)fluoranthene | | | 90.7 | | % | | 60-130 | 29-MAY-20 |
| Chrysene | | | 95.7 | | % | | 60-130 | 29-MAY-20 |
| Dibenz(a,h)anthracene | | | 90.5 | | % | | 60-130 | 29-MAY-20 |
| Fluoranthene | | | 88.6 | | % | | 60-130 | 29-MAY-20 |
| Fluorene | | | 92.9 | | % | | 60-130 | 29-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | | 88.5 | | % | | 60-130 | 29-MAY-20 |
| 1-Methylnaphthalene | | | 91.3 | | % | | 60-130 | 29-MAY-20 |
| 2-Methylnaphthalene | | | 89.3 | | % | | 60-130 | 29-MAY-20 |
| Naphthalene | | | 95.0 | | % | | 50-130 | 29-MAY-20 |
| Phenanthrene | | | 88.5 | | % | | 60-130 | 29-MAY-20 |
| Pyrene | | | 90.5 | | % | | 60-130 | 29-MAY-20 |
| **WG3330406-2 LCS** | | | | | | | | |
| Acenaphthene | | | 99.4 | | % | | 60-130 | 29-MAY-20 |
| Acenaphthylene | | | 98.3 | | % | | 60-130 | 29-MAY-20 |
| Anthracene | | | 97.7 | | % | | 60-130 | 29-MAY-20 |
| Benz(a)anthracene | | | 102.0 | | % | | 60-130 | 29-MAY-20 |
| Benzo(a)pyrene | | | 94.6 | | % | | 60-130 | 29-MAY-20 |
| Benzo(b&j)fluoranthene | | | 100.1 | | % | | 60-130 | 29-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5100739** | | | | | | | | |
| **WG3330406-2 LCS** | | | | | | | | |
| Benzo(g,h,i)perylene | | | 102.8 | | % | | 60-130 | 29-MAY-20 |
| Benzo(k)fluoranthene | | | 95.9 | | % | | 60-130 | 29-MAY-20 |
| Chrysene | | | 100.1 | | % | | 60-130 | 29-MAY-20 |
| Dibenz(a,h)anthracene | | | 93.7 | | % | | 60-130 | 29-MAY-20 |
| Fluoranthene | | | 96.1 | | % | | 60-130 | 29-MAY-20 |
| Fluorene | | | 97.6 | | % | | 60-130 | 29-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | | 98.8 | | % | | 60-130 | 29-MAY-20 |
| 1-Methylnaphthalene | | | 99.8 | | % | | 60-130 | 29-MAY-20 |
| 2-Methylnaphthalene | | | 99.8 | | % | | 60-130 | 29-MAY-20 |
| Naphthalene | | | 104.9 | | % | | 50-130 | 29-MAY-20 |
| Phenanthrene | | | 97.7 | | % | | 60-130 | 29-MAY-20 |
| Pyrene | | | 99.98 | | % | | 60-130 | 29-MAY-20 |
| Quinoline | | | 102.8 | | % | | 60-130 | 29-MAY-20 |
| **WG3330406-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 29-MAY-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 29-MAY-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 29-MAY-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 29-MAY-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 29-MAY-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 29-MAY-20 |
| Surrogate: Naphthalene d8 | | | 100.3 | | % | | 50-130 | 29-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5100739** | | | | | | | | |
| **WG3330406-1 MB** | | | | | | | | |
| Surrogate: Phenanthrene d10 | | | 100.1 | | % | | 60-130 | 29-MAY-20 |
| Surrogate: Chrysene d12 | | | 93.2 | | % | | 60-130 | 29-MAY-20 |
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5102071** | | | | | | | | |
| **WG3330882-3 DUP** | | **L2451986-3** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 29-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 29-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | <0.50 | <0.50 | RPD-NA | ug/kg | N/A | 50 | 29-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | <130 | <200 | RPD-NA | ug/kg | N/A | 50 | 29-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | 1.37 | 1.35 | | ug/kg | 1.9 | 50 | 29-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | 22.8 | 20.6 | | ug/kg | 10 | 50 | 29-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | 0.20 | 0.19 | | ug/kg | 7.9 | 50 | 29-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | 0.55 | 0.50 | | ug/kg | 11 | 50 | 29-MAY-20 |
| Perfluorononanoic acid (PFNA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 29-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | 117 | 128 | | ug/kg | 9.0 | 50 | 29-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | 6.26 | 5.71 | | ug/kg | 9.2 | 50 | 29-MAY-20 |
| **WG3330882-2 LCS** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 78.7 | | % | | 50-150 | 29-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 66.7 | | % | | 50-150 | 29-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 87.3 | | % | | 50-150 | 29-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | | N/A | LCS-H | % | | 50-150 | 29-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | | 89.3 | | % | | 50-150 | 29-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | | 102.0 | | % | | 50-150 | 29-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 90.0 | | % | | 50-150 | 29-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | | 115.3 | | % | | 50-150 | 29-MAY-20 |
| Perfluorononanoic acid (PFNA) | | | 88.0 | | % | | 50-150 | 29-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 84.0 | | % | | 50-150 | 29-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 84.0 | | % | | 50-150 | 29-MAY-20 |
| **WG3330882-1 MB** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | <0.50 | | ug/kg | | 0.5 | 29-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | | 24 | MB-LOR | ug/kg | | 20 | 29-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5102071** | | | | | | | | |
| **WG3330882-1 MB** | | | | | | | | |
| Perfluoroheptanoic acid (PFHpA) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| Perfluorononanoic acid (PFNA) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | <0.10 | | ug/kg | | 0.1 | 29-MAY-20 |
| **WG3330882-4 MS** | | **L2451986-3** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 64.8 | | % | | 50-150 | 29-MAY-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 57.6 | | % | | 50-150 | 29-MAY-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 91.9 | | % | | 50-150 | 29-MAY-20 |
| Perfluorobutanoic acid (PFBA) | | | N/A | MS-B | % | | - | 29-MAY-20 |
| Perfluoropentanoic acid (PFPeA) | | | N/A | MS-B | % | | - | 29-MAY-20 |
| Perfluorohexanoic acid (PFHxA) | | | N/A | MS-B | % | | - | 29-MAY-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 71.0 | | % | | 50-150 | 29-MAY-20 |
| Perfluorooctanoic acid (PFOA) | | | 97.5 | | % | | 50-150 | 29-MAY-20 |
| Perfluorononanoic acid (PFNA) | | | 80.4 | | % | | 50-150 | 29-MAY-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | N/A | MS-B | % | | - | 29-MAY-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | N/A | MS-B | % | | - | 29-MAY-20 |
| **VH-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5071997** | | | | | | | | |
| **WG3330714-3 DUP** | | **L2451986-9** | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | <100 | <100 | RPD-NA | mg/kg | N/A | 40 | 29-MAY-20 |
| **WG3330714-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 93.4 | | % | | 70-130 | 29-MAY-20 |
| **WG3330714-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 29-MAY-20 |
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5071978** | | | | | | | | |
| **WG3330714-3 DUP** | | **L2451986-9** | | | | | | |
| n-Nonane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 28-MAY-20 |
| **WG3330714-2 LCS** | | | | | | | | |
| n-Nonane | | | 105.6 | | % | | 70-130 | 28-MAY-20 |
| **WG3330714-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5081765** | | | | | | | | |
| **WG3334077-2 LCS** | | | | | | | | |
| n-Nonane | | | 99.8 | | % | | 70-130 | 03-JUN-20 |
| **WG3334077-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 03-JUN-20 |
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5071978** | | | | | | | | |
| **WG3330714-3 DUP** | | **L2451986-9** | | | | | | |
| Benzene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| Ethylbenzene | | <0.015 | <0.015 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| Methyl t-butyl ether (MTBE) | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| Styrene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| Toluene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| meta- & para-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| ortho-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 28-MAY-20 |
| **WG3330714-2 LCS** | | | | | | | | |
| Benzene | | | 103.0 | | % | | 70-130 | 28-MAY-20 |
| Ethylbenzene | | | 108.4 | | % | | 70-130 | 28-MAY-20 |
| Methyl t-butyl ether (MTBE) | | | 103.8 | | % | | 70-130 | 28-MAY-20 |
| Styrene | | | 89.7 | | % | | 70-130 | 28-MAY-20 |
| Toluene | | | 95.9 | | % | | 70-130 | 28-MAY-20 |
| meta- & para-Xylene | | | 113.6 | | % | | 70-130 | 28-MAY-20 |
| ortho-Xylene | | | 92.3 | | % | | 70-130 | 28-MAY-20 |
| **WG3330714-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 28-MAY-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 28-MAY-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 28-MAY-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 28-MAY-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| LCS-H | Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified. |
| MB-LOR | Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level. |
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

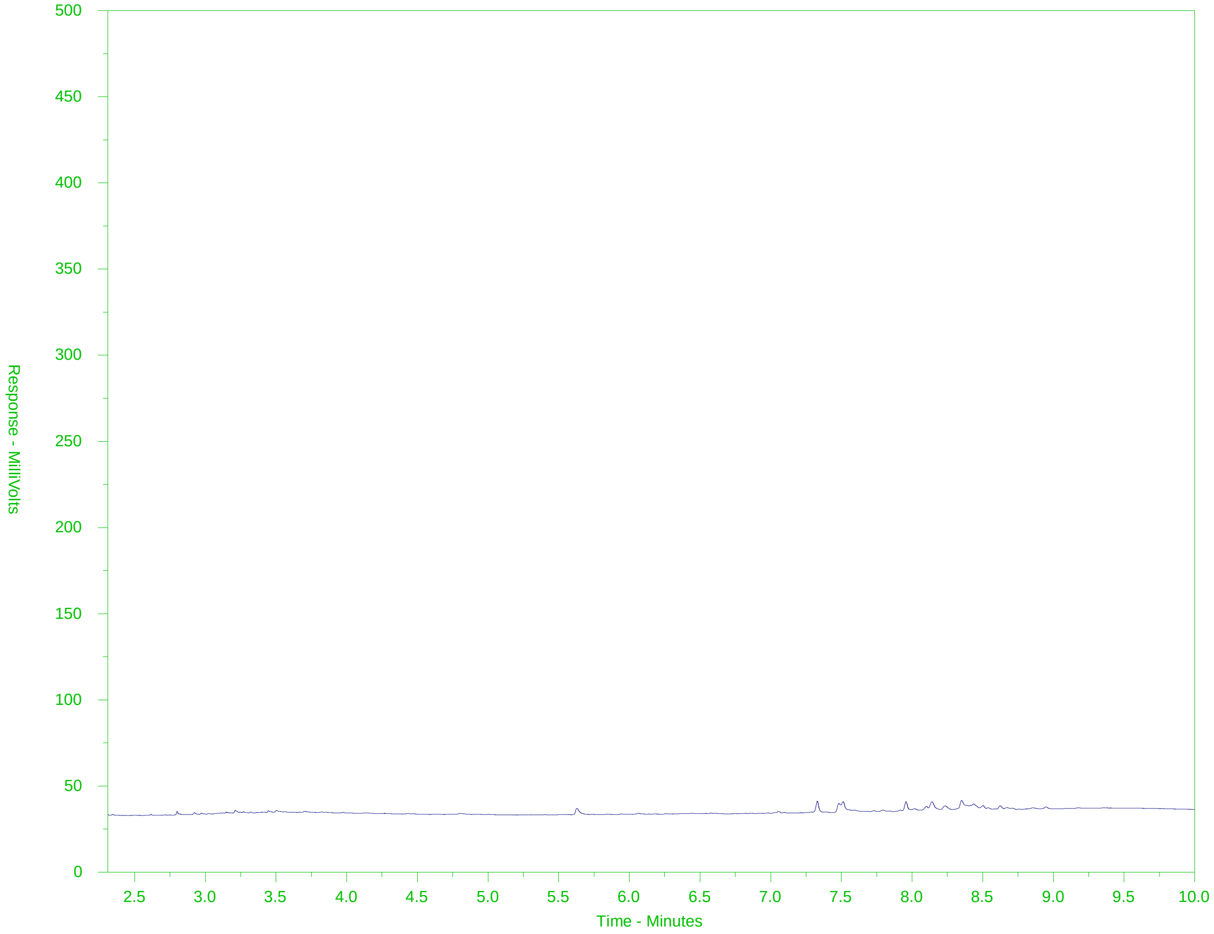
---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-1
Client Sample ID: 02905-01



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

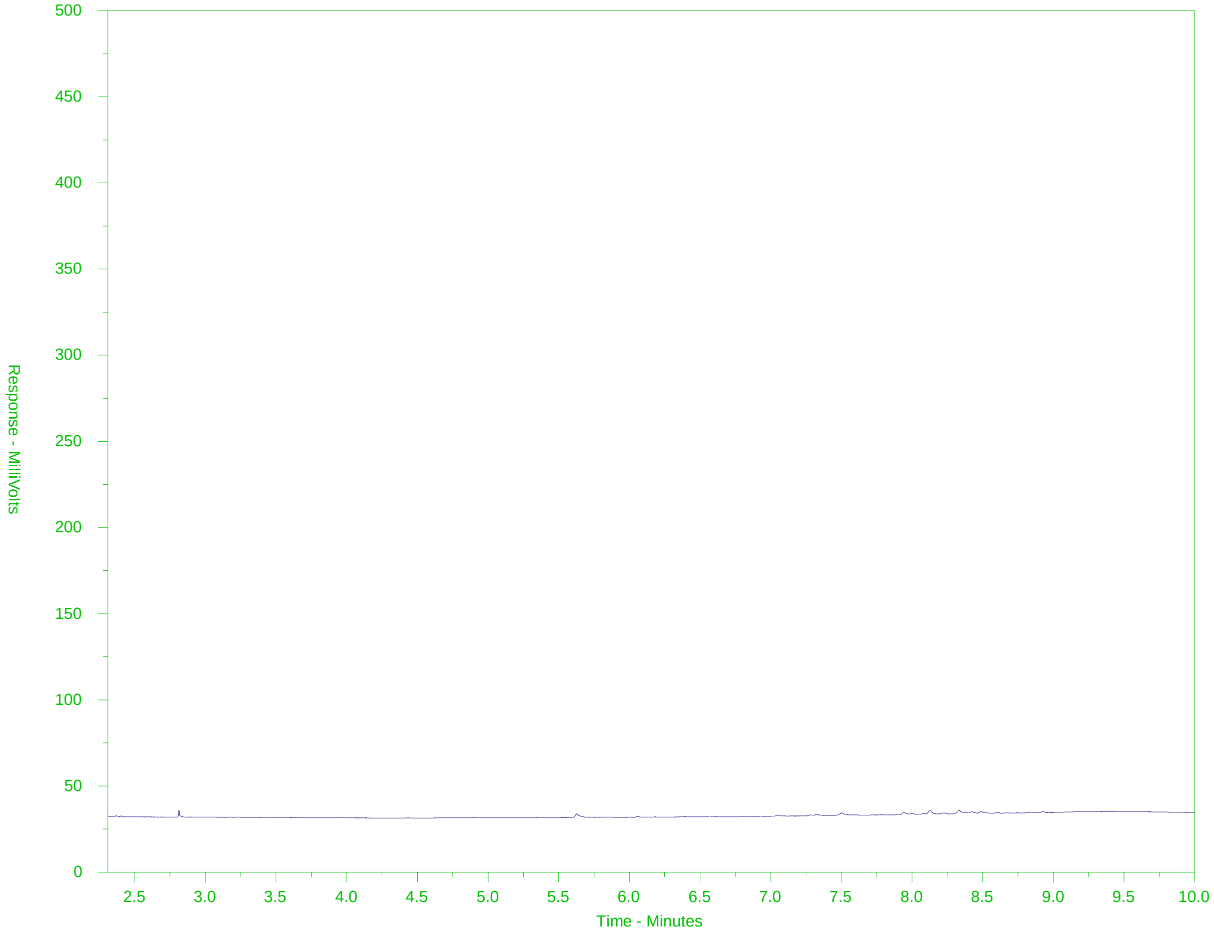
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

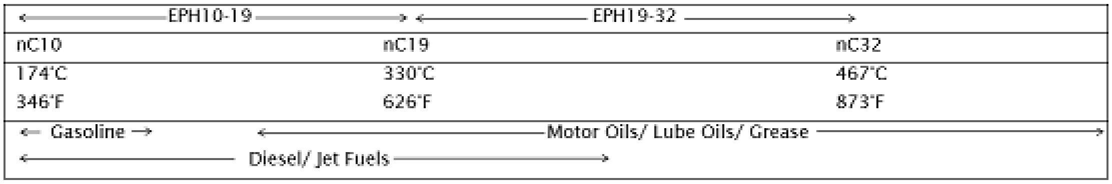
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-3
Client Sample ID: 02905-03





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

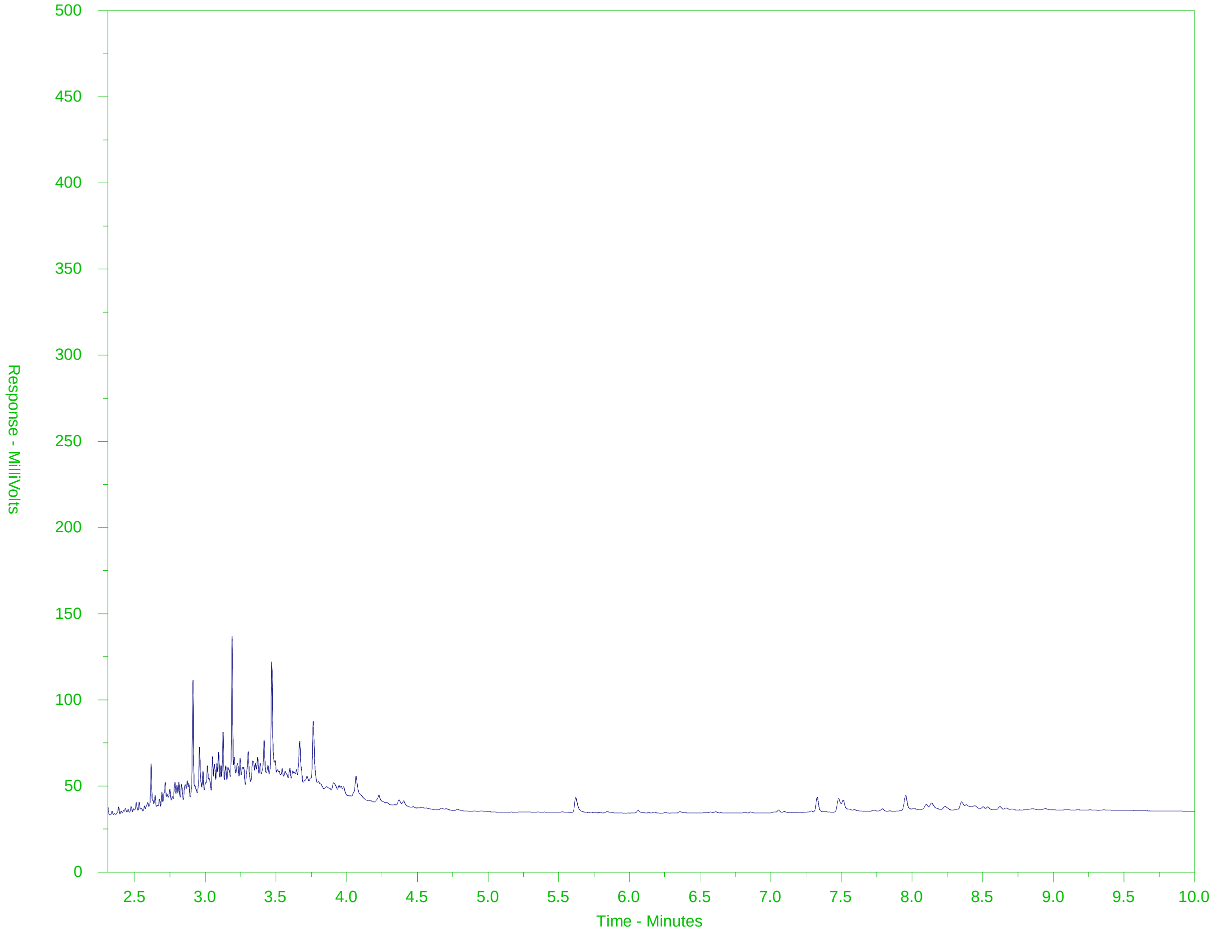
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-5
Client Sample ID: 02905-05



← EPH10-19 → ← EPH19-32 →

| | | |
|---|---|---|
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |

← Gasoline → ← Motor Oils/ Lube Oils/ Grease →
← Diesel/ Jet Fuels →

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

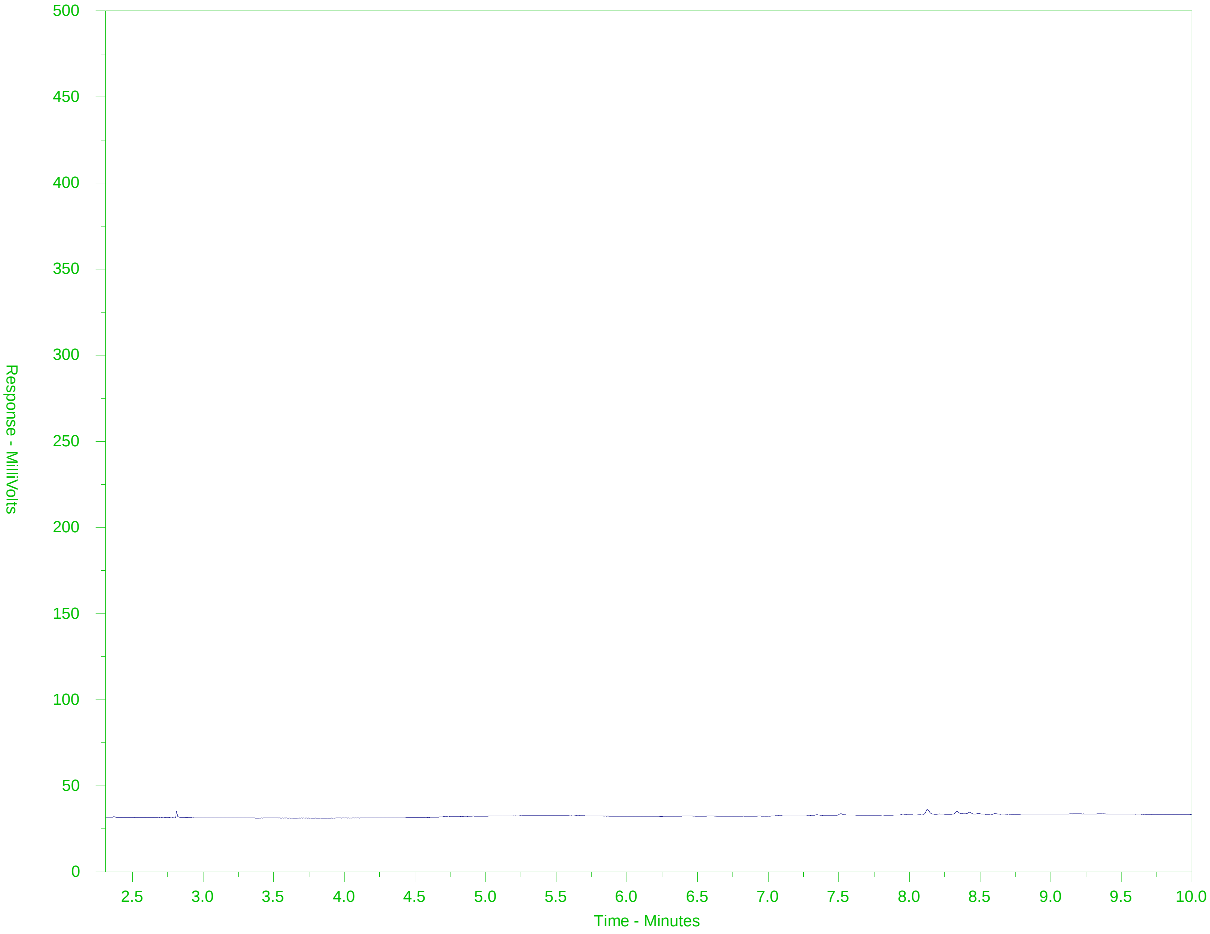
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-7
Client Sample ID: 02905-07



← EPH10-19 → ← EPH19-32 →

| | | |
|---|---|---|
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |

← Gasoline → ← Motor Oils/ Lube Oils/ Grease →
← Diesel/ Jet Fuels →

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

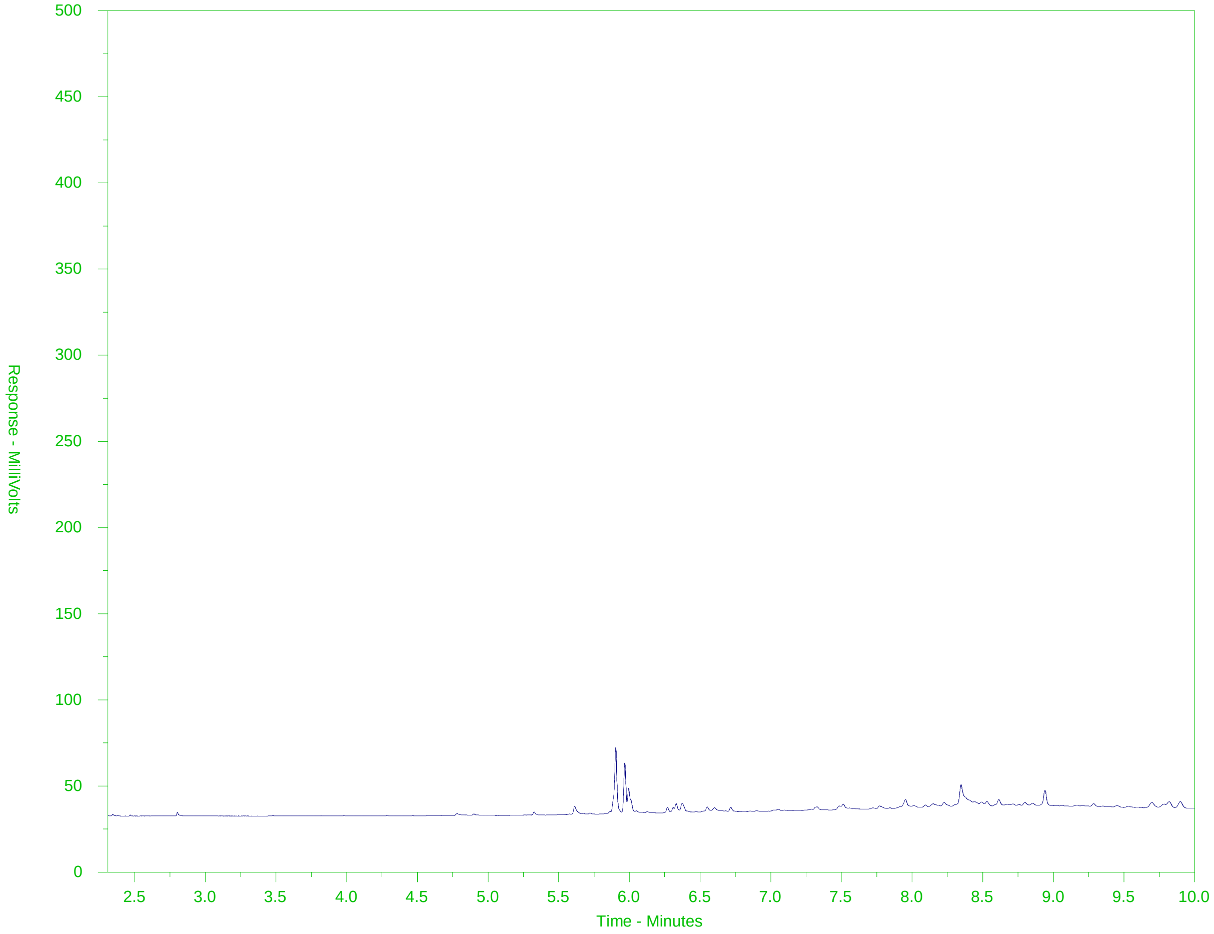
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

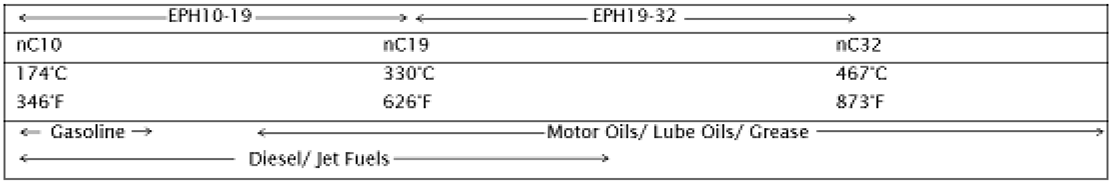
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-9
Client Sample ID: 02905-09





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

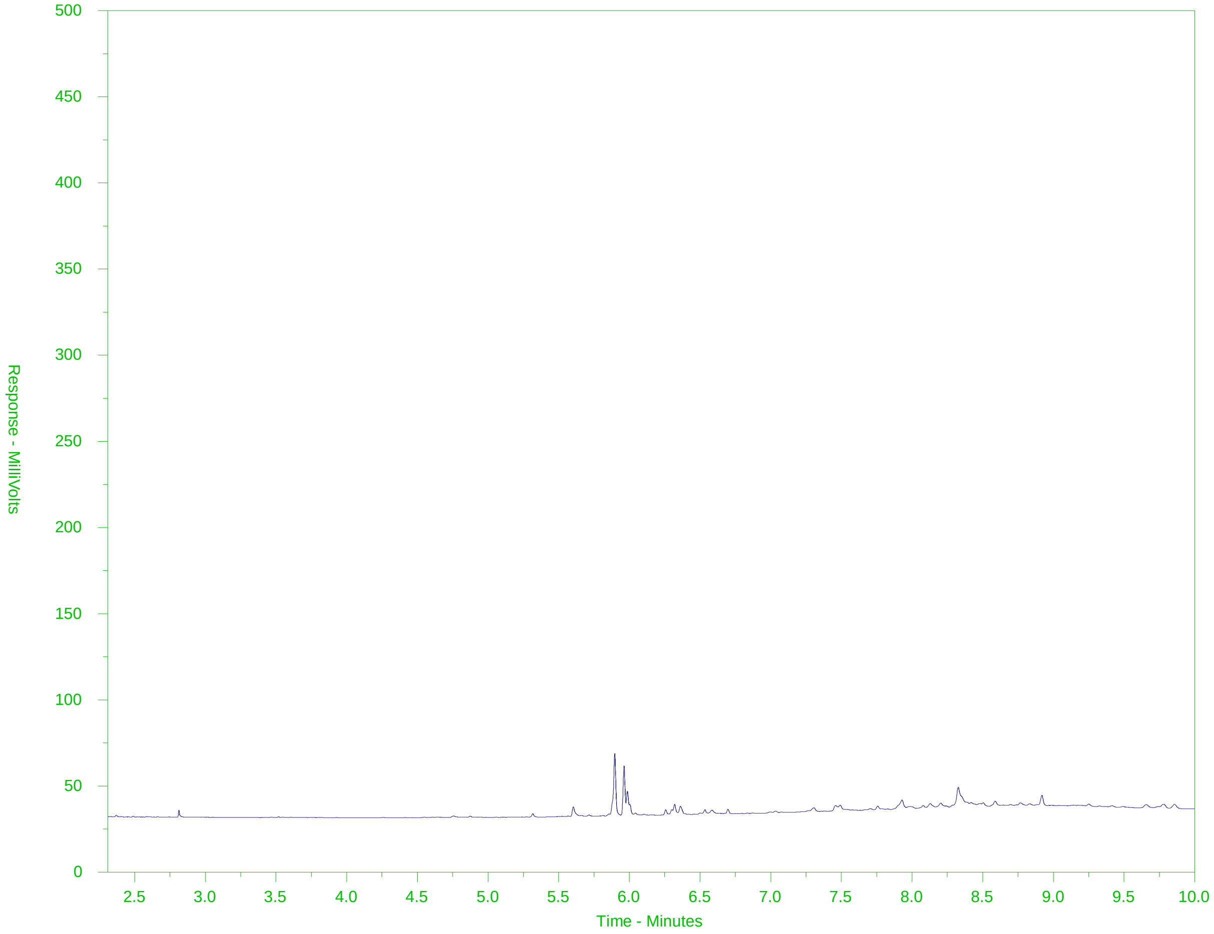
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

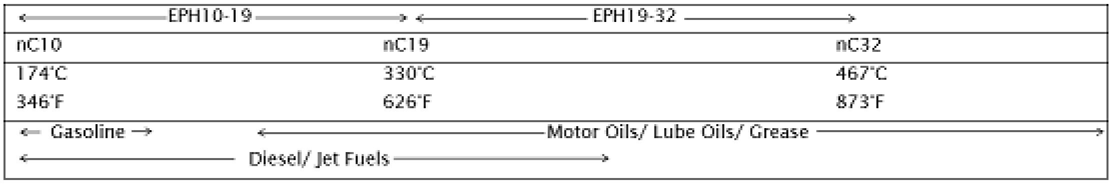
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3330406-3#L2451986-9
Client Sample ID: 02905-09





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

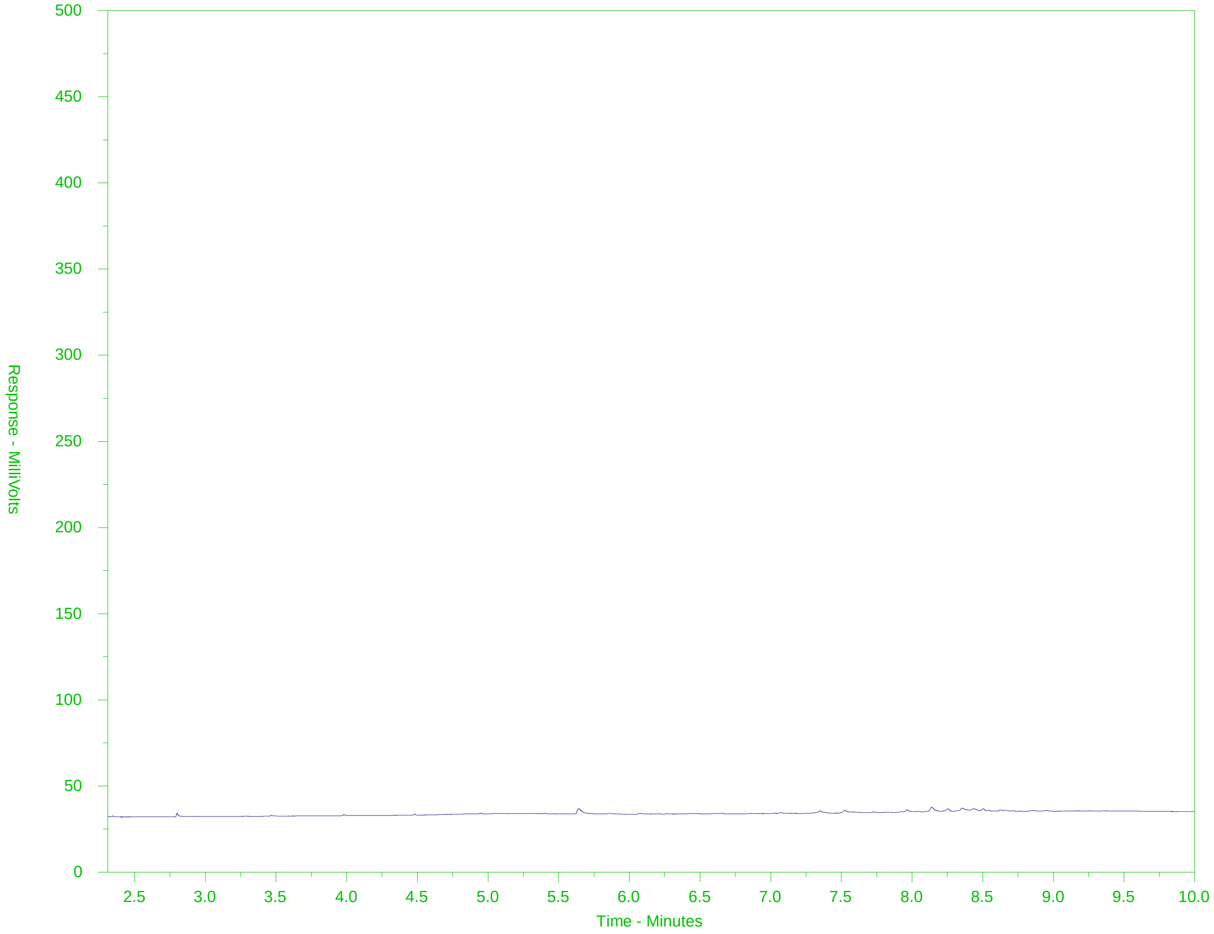
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-11
Client Sample ID: 02905-11



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

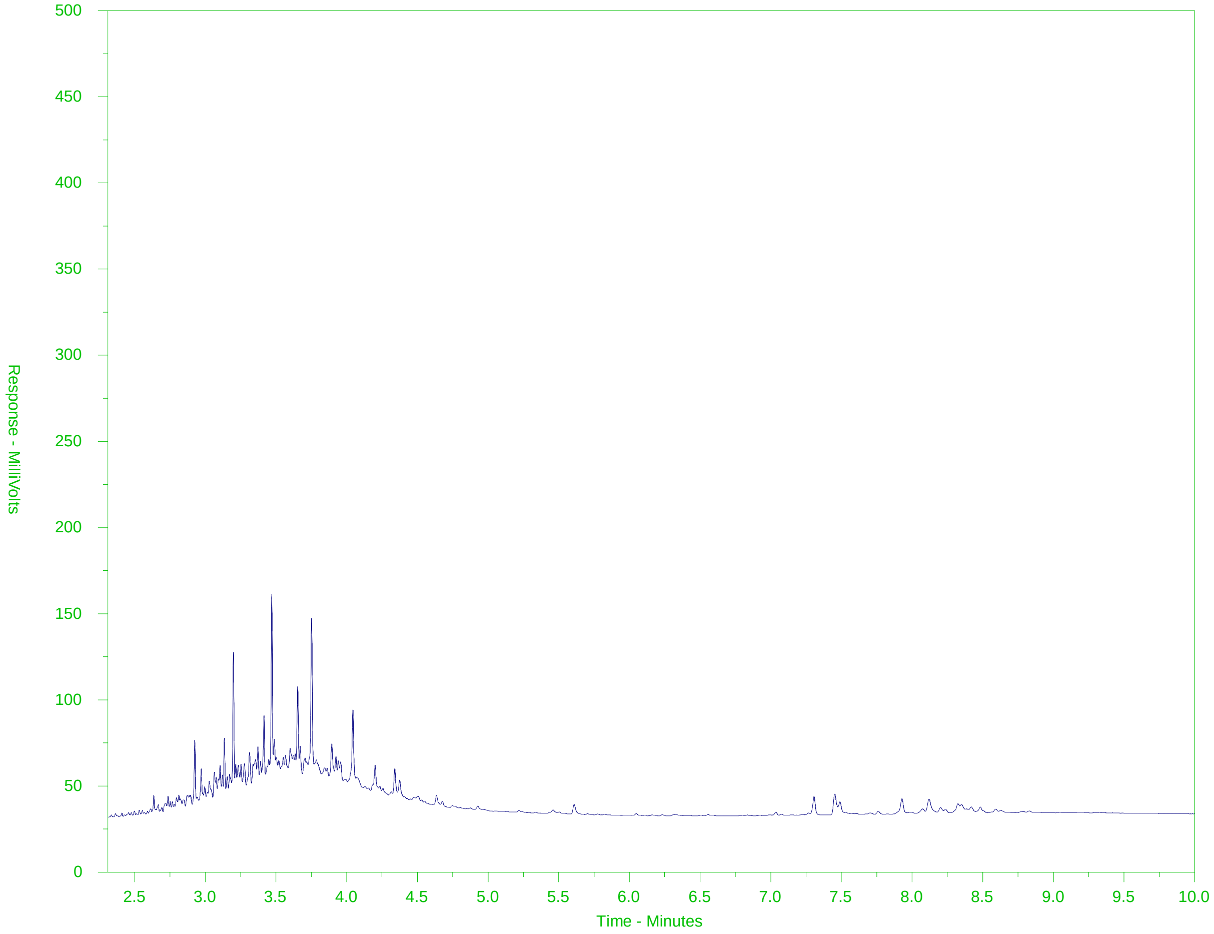
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-13
Client Sample ID: 02906-01



←EPH10-19→ ←EPH19-32→

| | | |
|---|---|---|
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |

← Gasoline → ←Motor Oils/ Lube Oils/ Grease→
←Diesel/ Jet Fuels→

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

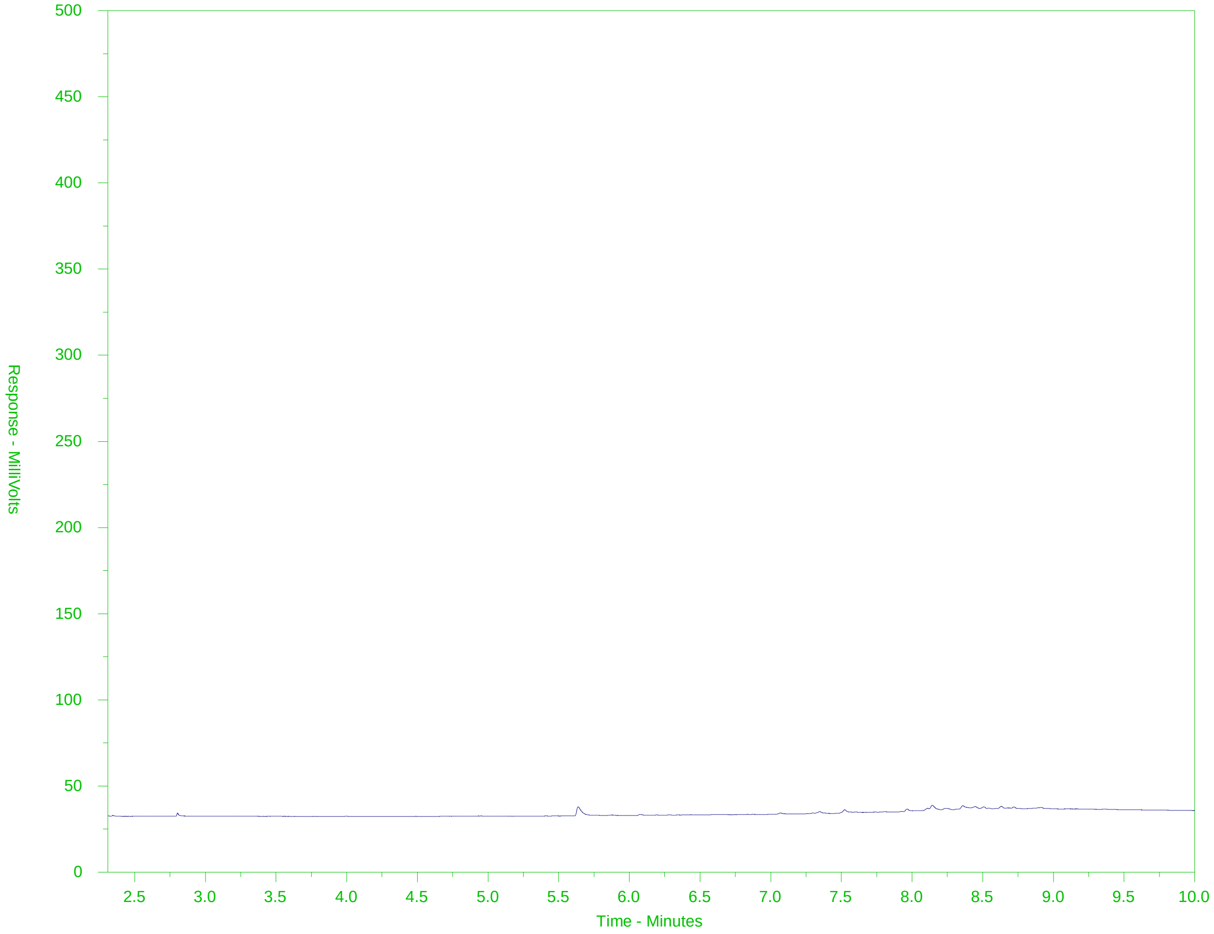
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

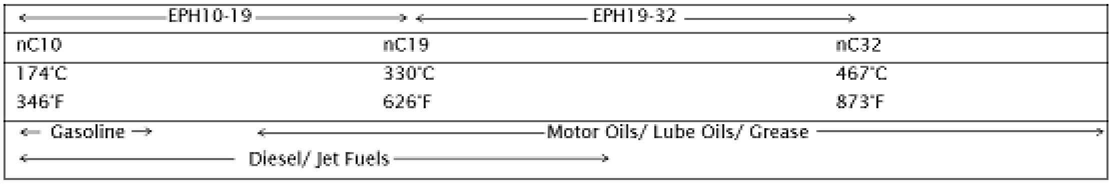
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-15
Client Sample ID: 02906-03





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

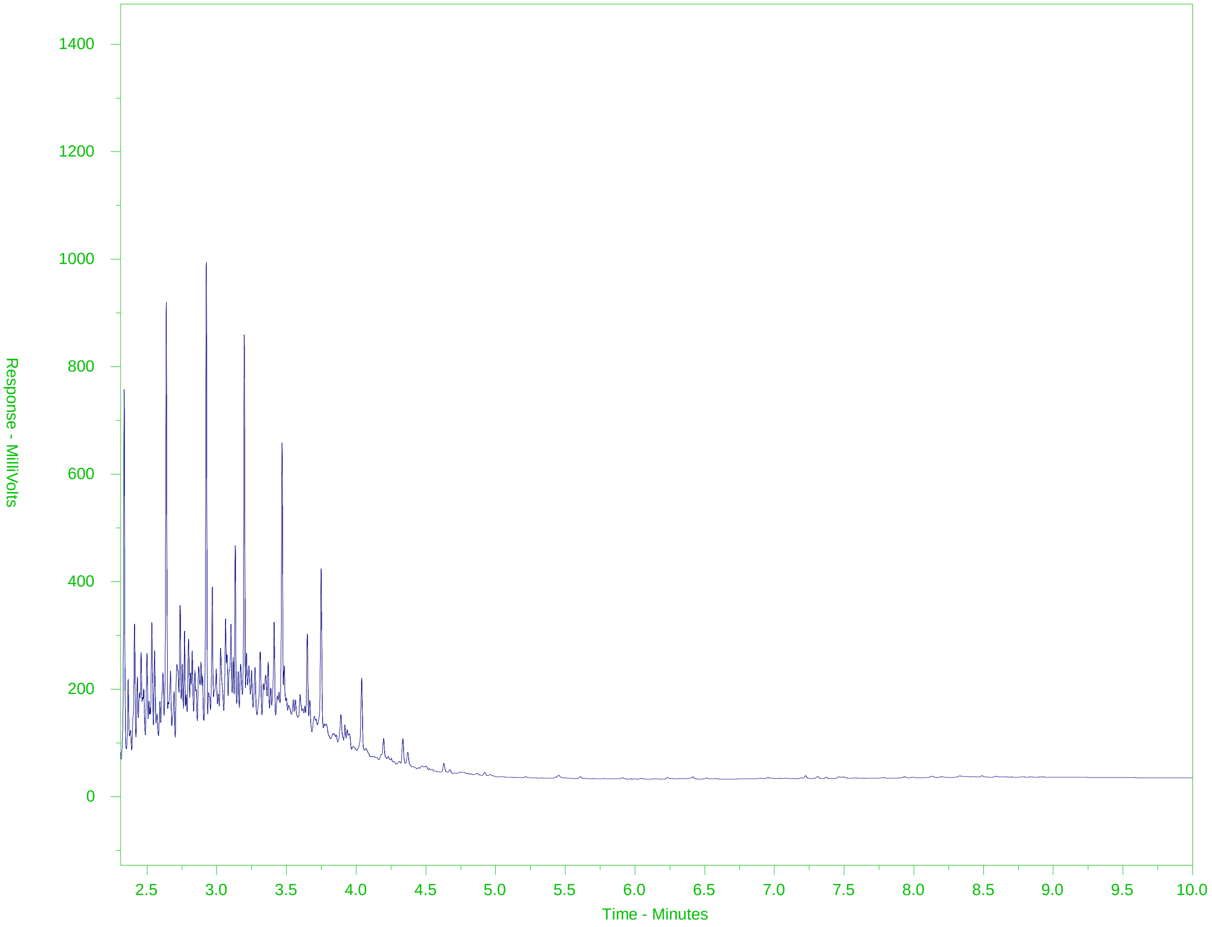
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-17
Client Sample ID: 02906-05



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |

← Gasoline → ← Motor Oils/ Lube Oils/ Grease →
← Diesel/ Jet Fuels →

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

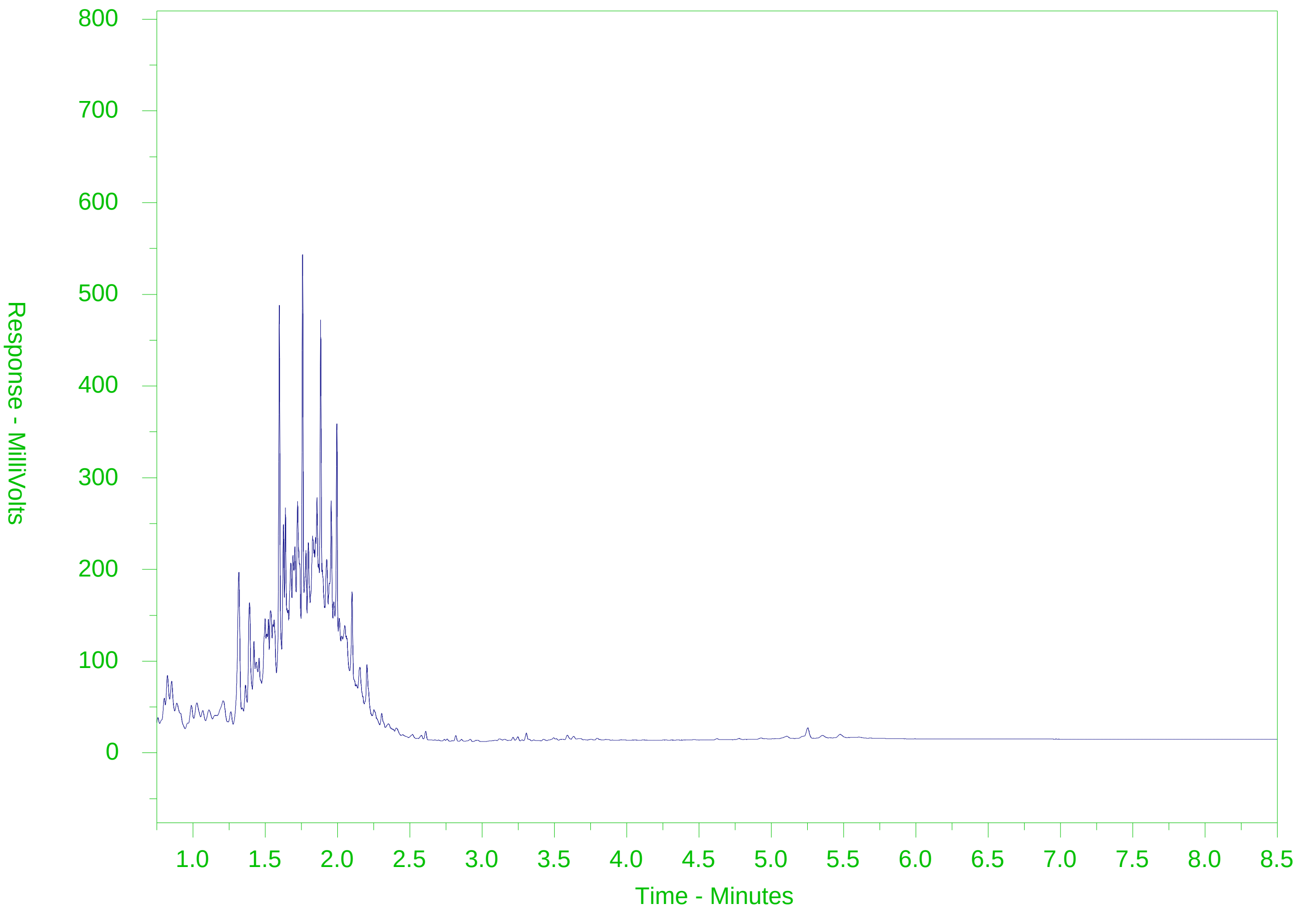
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-C-17
Client Sample ID: 02906-05



| | | | |
|---|---|---|---|
| ← F2 → | ← F3 → | ← F4 → | |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ←Gasoline→ | ← Motor Oils/ Lube Oils/ Grease → | | |
| ← Diesel/ Jet Fuels → | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

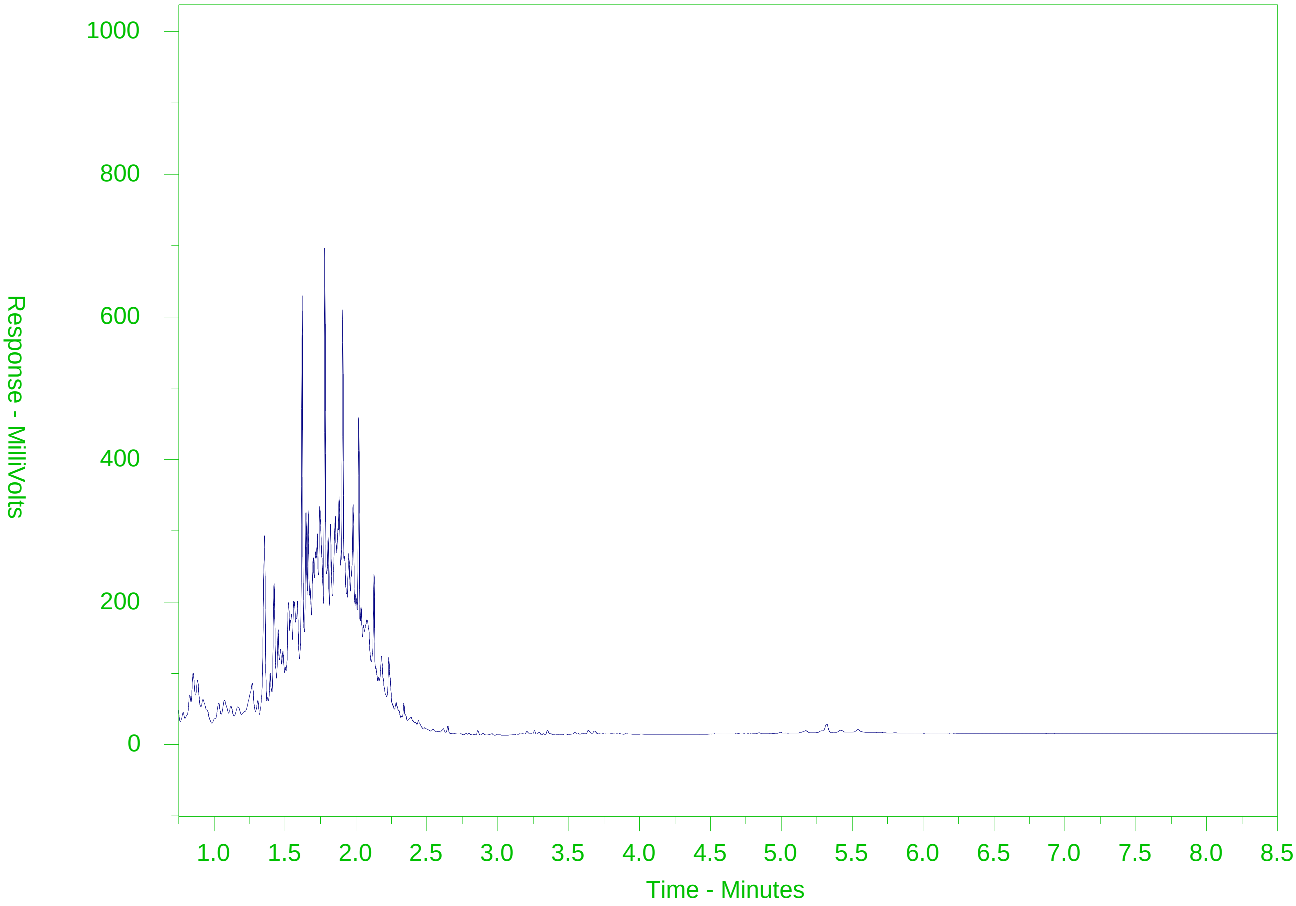
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3334087-C-6#L2451986-C-17
Client Sample ID: 02906-05



| | | | |
|---|---|---|---|
| ← F2 → | ← F3 → | ← F4 → | |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | | |
| ← Diesel/ Jet Fuels → | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

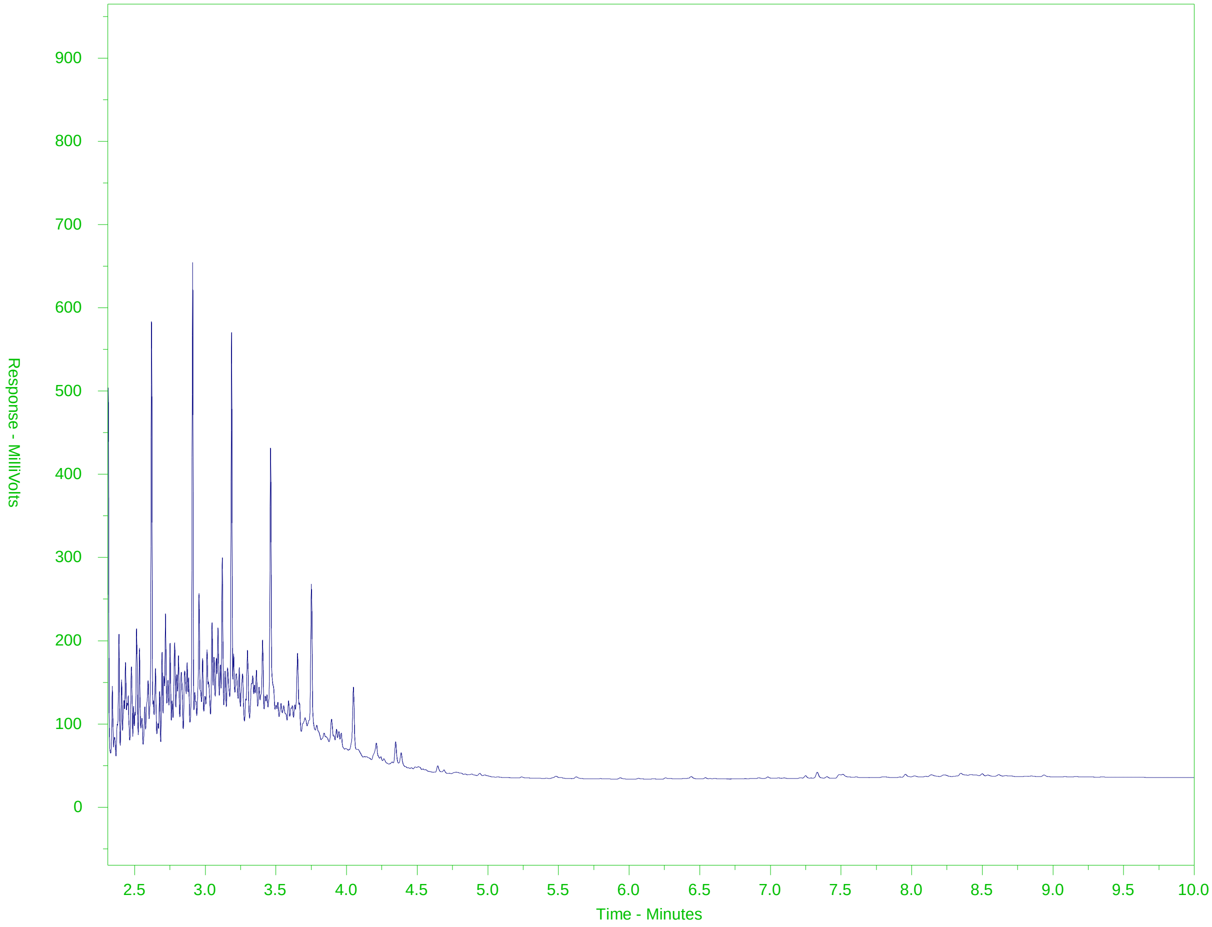
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-19
Client Sample ID: 02906-07



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

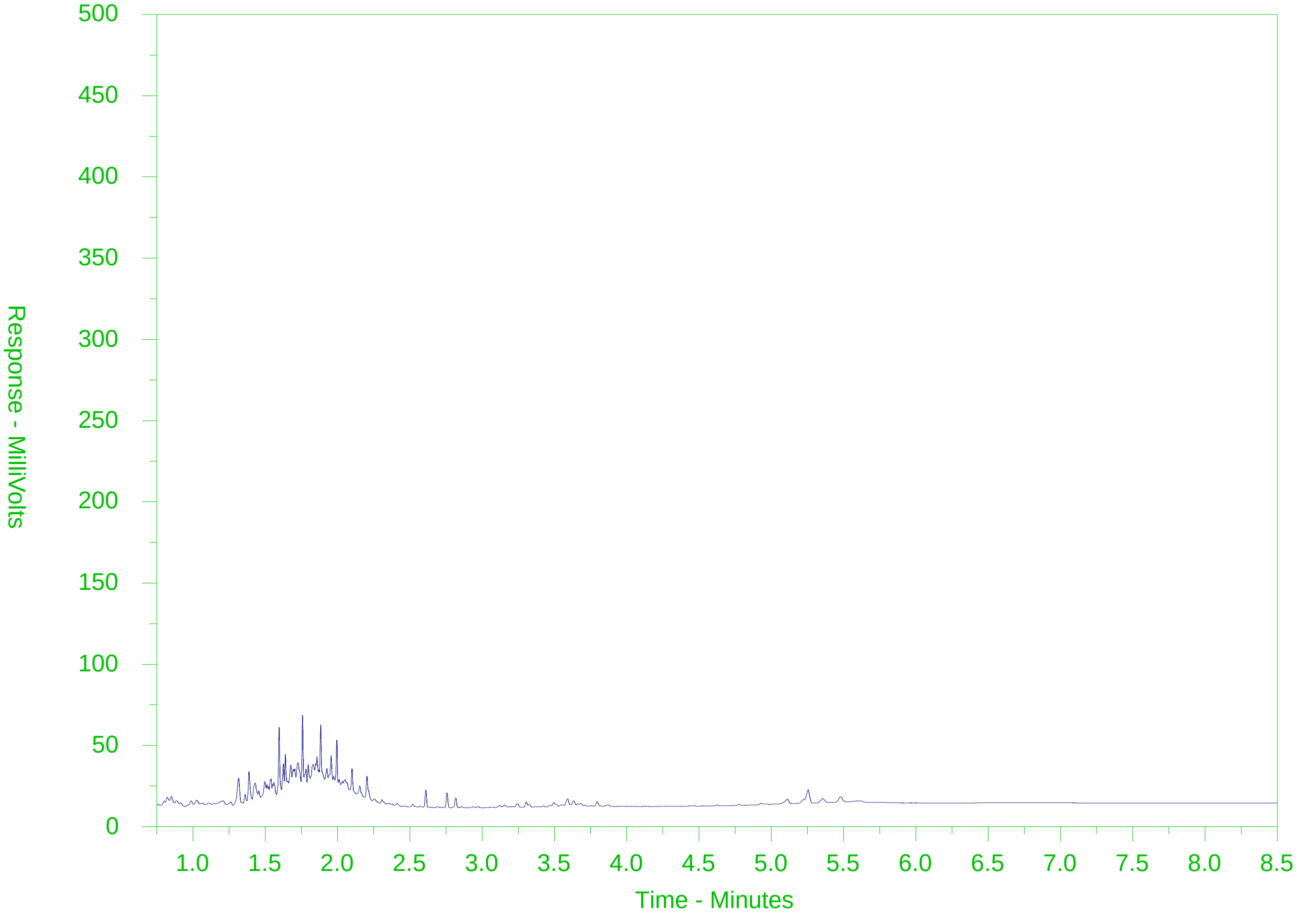
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2451986-C-19
Client Sample ID: 02906-07



| | | | |
|---|---|---|---|
| ← F2 → | ← F3 → | ← F4 → | |
| nC10 | nC16 | nC34 | nC50 |
| 174°C<br>346°F | 287°C<br>549°F | 481°C<br>898°F | 575°C<br>1067°F |
| ←Gasoline→ | ← Motor Oils/ Lube Oils/ Grease → | | |
| ← Diesel/ Jet Fuels → | | | |

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

L2451986-COFC

## AIN OF CUSTODY RECORD/ANALYSIS REQUEST

**No.** 02905 page 1 of 2

2
Vancouver, British Columbia, Canada V5M 0C4
Telephone (604) 296-4200 Fax (604) 298-5253

| | | | |
|---|---|---|---|
| Project Number: 20145856 | | Laboratory Name: ALS Burnaby | |
| Short Title: Snowbird Cleanup | Golder Contact: Alison Verde | Address: 8081 Lougheed Hwy | |
| Golder E-mail Address 1: AVERDE @golder.com | Golder E-mail Address 2: JOLSEN @golder.com | Telephone/Fax: 604-253-4188 | Contact: AMBER SPRINGER |

Office Name: Vancouver

**EQuIS Facility Code:** 2178322270
**EQuIS upload:** ☒

**Turnaround Time:** ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
**Criteria:** ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other 29 May 2020

**Note:** Final Reports to be issued by e-mail

**Quote No.:** Q80351

**Analyses Required**

| 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 | LEPH / HEPH / PAH | CCME PHC 1-4 | BTEX / VPH | 1, 2, 4 - trimethyl-benzene | Aluminum, Antimony, Barium, Cadmium | Chromium, Cobalt, Lead, Titanium, Zinc | PFBS / PFOS / PFOA - Health Canada | See Comments * | Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02905 - 01 | SS20-09 | | 0.05-0.15 | SO | 26/05/20 | 8:35 | GRAB | | | 4 | X | | X | X | | | | | | X | |
| - 02 | SS20-09 | | 0.3-0.4 | | | 8:40 | | | | 4 | | | | | | | | | X | | |
| - 03 | SS20-10 | | 0.05-0.15 | | | 8:45 | | | | 5 | X | | X | X | | | X | | | X | RUSH |
| - 04 | SS20-10 | | 0.3-0.4 | | | 8:50 | | | | 4 | | | | | | | | | X | | |
| - 05 | SS20-11 | | 0.05-0.15 | | | 9:00 | | | | 4 | X | | X | X | | | | | | X | |
| - 06 | SS20-11 | | 0.3-0.4 | | | 9:10 | | | | 4 | | | | | | | | | X | | |
| - 07 | SS20-12 | | 0.05-0.15 | | | 9:30 | | | | 4 | X | | X | X | | | | | | X | |
| - 08 | SS20-12 | | 0.3-0.4 | | | 9:35 | | | | 4 | | | | | | | | | X | | |
| - 09 | SS20-13 | | 0.05-0.15 | | | 10:00 | | | | 4 | X | | X | X | | | | | | X | |
| - 10 | SS20-13 | | 0.3-0.4 | | | 10:05 | | | | 4 | | | | | | | | | X | | |
| - 11 | SS20-14 | | 0.05-0.15 | | | 10:30 | | | | 4 | X | | X | X | X | X | | | | | |
| - 12 | SS20-14 | | 0.3-0.4 | | | 10:35 | | | | 4 | | | | | | | | | X | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sampler's Signature: | Relinquished by: Signature | Company GOLDER | Date 26/05/2020 | Time | Received by: Signature | Company |
| Comments: * n - nonane, isopropylbenzene, 1 - propylbenzene, 1,3,5 - trimethylbenzene, butylbenzene, boron, MTBE, styrene, 1,2 - dibromoethane, 1,2 - dichlor-oethane | Method of Shipment: | Waybill No.: | Received for Lab by: 07 | | Date 26may2020 | Time 233pm |
| | Shipped by: | Shipment Condition: Seal Intact: | Temp (°C) 21 | Cooler opened by: JG | Date 27May | Time 9:10AM |

**WHITE: Golder Copy** **YELLOW: Lab Copy** 21 2, 3, 3, 3°C

20 Ice cubes

* ON ICE *

ESED

L2451986-COFC

Telephone (604) 296-4200 Fax (604) 298-5253

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02906 page 2 of 2

Project Number: 20145856

Short Title: Snowbird Cleanup

Golder Contact: Alison Verde

Golder E-mail Address 1: AVERDE @golder.com

Golder E-mail Address 2: JOLSEN @golder.com

Laboratory Name: ALS Burnaby

Address: 8081 Lougheed Hwy

Telephone/Fax: 604-253-4188

Contact: AMBER SPRINGER

Office Name: Vancouver

**EQuIS Facility Code:** 217832270

**EQuIS upload:** ☒

**Turnaround Time:** ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)

**Criteria:** ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other 29 May 2020

**Note:** Final Reports to be issued by e-mail

**Quote No.:** Q80351

Analyses Required

| 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 | LEPH/HEPH/PAH | CCME PHC 1-4 | BTEX / VPH | 1,2,4 trimethyl-benzene | Aluminum, Antimony, Barium, Cadmium | Chromium, Cobalt, Lead, Titanium, Zinc | PFBS / PFOS / PFOA - Health Canada | See Comments * | Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02906 - 01 | SS20-15 | | 0.05-0.15 | SO | 26/5/20 | 11:10 | GRAB | | | 4 | X | | X | X | X | X | | | | X | |
| ↓ - 02 | SS20-15 | | 0.3-0.4 | ↓ | ↓ | 11:15 | ↓ | | | 4 | | | | | | | | | X | | |
| - 03 | SS20-16 | | 0.05-0.15 | | | 11:40 | | | | 4 | X | | X | X | X | X | | | | X | R |
| - 04 | SS20-16 | | 0.3-0.4 | | | 11:45 | | | | 4 | | | | | | | | | X | | |
| - 05 | SS20-17 | | 0.05-0.15 | | | 12:10 | | FDA | 02906-07 | 5 | X | | X | X | X | X | | | | X | U |
| - 06 | SS20-17 | | 0.3-0.4 | | | 12:15 | | FDA | 02906-08 | 4 | | | | | | | | | X | | |
| - 07 | SS20-17 | | 0.05-0.15 | | | 12:10 | | FD | 02906-05 | 5 | X | | X | X | X | X | | | | X | S |
| - 08 | SS20-17 | | 0.3-0.4 | | | 12:15 | | FD | 02906-06 | 4 | | | | | | | | | X | | |
| - 09 | ~~SS20-01~~ | | ~~0.05-0.15~~ | | | ~~13:00~~ | | | | | ~~X~~ | | ~~X~~ | ~~X~~ | | | ~~X~~ | | | ~~X~~ | H |
| - 10 | ~~SS20-01~~ | | ~~0.3-0.4~~ | | | ~~13:05~~ | | | | | | | | | | | | | X | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Sampler's Signature: | Relinquished by: Signature | Company Golder | Date 26/05/2020 | Time | Received by: Signature | Company |

Comments: * n-nonane, isopropylbenzene, 1-propylbenzene, 1,3,5-trimethylbenzene, barium, MTBE, butylbenzene, styrene, 1,2-dibromoethane, 1,2-dichloroethane

Method of Shipment:

Waybill No.:

Received for Lab by: OA

Date 26May2020

Time 233 pm

Shipped by:

Shipment Condition:

Seal Intact:

Temp (°C) 21 21 20

Cooler opened by: JG

Date 27May

Time 9:10 AM

2,3,3,3°C ICE

**WHITE: Golder Copy YELLOW: Lab Copy**

* ON ICE *

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

| | |
|---|---|
| Date Received: | 03-JUN-20 |
| Report Date: | 05-JUN-20 11:38 (MT) |
| Version: | FINAL |

Client Phone: 604-297-2036

# Certificate of Analysis

| | |
|---|---|
| **Lab Work Order #:** | **L2455588** |
| Project P.O. #: | NOT SUBMITTED |
| Job Reference: | 20145856 |
| C of C Numbers: | |
| Legal Site Desc: | |

Amber Springer

Amber Springer, B.Sc
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID | L2455588-1 | | | | |
|---|---|---|---|---|---|---|
| | Description | WG | | | | |
| | Sampled Date | 02-JUN-20 | | | | |
| | Sampled Time | 15:30 | | | | |
| | Client ID | 02915-01 | | | | |
| **Grouping** | **Analyte** | | | | | |
| **WATER** | | | | | | |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (ug/L) | <0.010 | | | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (ug/L) | <0.010 | | | | |
| | Perfluorobutane sulfonic acid (PFBS) (ug/L) | <0.020 | | | | |
| | Perfluorohexane sulfonic acid (PFHxS) (ug/L) | <0.020 | | | | |
| | Perfluorooctane sulfonic acid (PFOS) (ug/L) | <0.010 | | | | |
| | Perfluorobutanoic acid (PFBA) (ug/L) | <0.80 | | | | |
| | Perfluoroheptanoic acid (PFHpA) (ug/L) | <0.020 | | | | |
| | Perfluorohexanoic acid (PFHxA) (ug/L) | <0.020 | | | | |
| | Perfluorononanoic acid (PFNA) (ug/L) | <0.020 | | | | |
| | Perfluorooctanoic acid (PFOA) (ug/L) | <0.010 | | | | |
| | Perfluoropentanoic acid (PFPeA) (ug/L) | <0.020 | | | | |

# Reference Information

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **PFAS-DI-EX-LCMS-WT** | Water | PFC’s by Direct Injection LC/MS-MS | MOECC E3533 and E3457 |

An aliquot of water is analyzed for PFCs by direct injection LC/MS/MS

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |

**Chain of Custody Numbers:**

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2455588 Report Date: 05-JUN-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4

Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-DI-EX-LCMS-WT** | **Water** | | | | | | | |
| **Batch R5109629** | | | | | | | | |
| **WG3335554-3 DUP** | | **L2455588-1** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | <0.020 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | <0.020 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | <0.010 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | <0.80 | <0.10 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | <0.020 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | <0.020 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | <0.020 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | <0.010 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| Perfluorononanoic acid (PFNA) | | <0.020 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | <0.010 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | <0.010 | <0.010 | RPD-NA | ug/L | N/A | 20 | 05-JUN-20 |
| **WG3335554-2 LCS** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 87.3 | | % | | 50-150 | 05-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 92.0 | | % | | 50-150 | 05-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 97.3 | | % | | 50-150 | 05-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | 63.2 | | % | | 50-150 | 05-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | 110.7 | | % | | 50-150 | 05-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | 112.0 | | % | | 50-150 | 05-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 106.7 | | % | | 50-150 | 05-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | 103.3 | | % | | 50-150 | 05-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | 106.7 | | % | | 50-150 | 05-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 90.7 | | % | | 50-150 | 05-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 87.3 | | % | | 50-150 | 05-JUN-20 |
| **WG3335554-1 MB** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | <0.10 | | ug/L | | 0.1 | 05-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | <0.010 | | ug/L | | 0.01 | 05-JUN-20 |

# Quality Control Report

Workorder: L2455588 Report Date: 05-JUN-20

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-DI-EX-LCMS-WT** | **Water** | | | | | | | |
| **Batch R5109629** | | | | | | | | |
| **WG3335554-4 MS** | | **L2455588-1** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 77.3 | | % | | 50-150 | 05-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 80.0 | | % | | 50-150 | 05-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 86.0 | | % | | 50-150 | 05-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | 68.0 | | % | | 50-150 | 05-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | 100.7 | | % | | 50-150 | 05-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | 103.3 | | % | | 50-150 | 05-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 96.0 | | % | | 50-150 | 05-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | 94.7 | | % | | 50-150 | 05-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | 99.3 | | % | | 50-150 | 05-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 96.0 | | % | | 50-150 | 05-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 97.3 | | % | | 50-150 | 05-JUN-20 |

# Quality Control Report

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Golder Associates

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02915 page 1 of 1

Project Number: 20145856
Short Title: Snowbird Cleanup
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: Amber Springer

Office Name: Vancouver
EQuIS Facility Code: 2178322270
EQuIS upload: ☒

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 5th, 2020

Note: Final Reports to be issued by e-mail
Quote No.: Q80351

Analyses Required

| 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 | PFAS/PFOS/PFOA - Health Canada | | | | | | | | | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02915 - 01 | CDK-01 | | | WS | 2/6/20 | 15:30 | Grab | | | 1 | X | | | | | | | | | | |
| - 02 | | | | | | | | | | | | | | | | | | | | | |
| - 03 | | | | | | | | | | | | | | | | | | | | | |
| - 04 | | | | | | | | | | | | | | | | | | | | | |
| - 05 | | | | | | | | | | | | | | | | | | | | | |
| - 06 | | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2455588-COFC

RUSH

Sampler's Signature:
Relinquished by: Signature
Company: Golder
Date: 2/6/20
Time:
Received by: Signature
Company:
Comments:
Method of Shipment:
Waybill No.:
Received for Lab by:
Date: JUN 03 2020
Time: 840am
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): 3,4
Cooler opened by: TG
Date: 4 June
Time: 10:25AM

**WHITE: Golder Copy YELLOW: Lab Copy**

Ice cubes

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

Date Received: 11-JUN-20
Report Date: 18-JUN-20 13:08 (MT)
Version: FINAL REV. 2

Client Phone: 604-297-2036

# Certificate of Analysis

**Lab Work Order #:** **L2459618**
Project P.O. #: NOT SUBMITTED
Job Reference: 20145856
C of C Numbers: 02925, 02929
Legal Site Desc:

**Comments:**

18-JUN-2020 TCLP BETX data is included for L2459618-11.

Amber Springer

Amber Springer, B.Sc
Account Manager

| | **Sample ID** | L2459618-2 | L2459618-4 | L2459618-5 | L2459618-8 | L2459618-9 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 |
| | **Sampled Time** | 12:52 | 12:52 | 12:52 | 12:52 | 12:52 |
| | **Client ID** | 02925-02 | 02925-04 | 02925-05 | 02925-08 | 02925-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | % Moisture (%) | | | | | |
| | Moisture (%) | 23.5 | 15.5 | 16.3 | 15.9 | 18.7 |
| | pH (1:2 soil:water) (pH) | | 6.51 | 6.93 | | |
| **Metals** | Cadmium (Cd) (mg/kg) | | 0.203 | 0.116 | | |
| | Chromium (Cr) (mg/kg) | | 45.6 | 52.6 | | |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | | | | |
| | Benzene (mg/kg) | | <0.0050 | 0.0074 | <0.0050 | <0.0050 |
| | 1,2-Dibromoethane (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | Ethylbenzene (mg/kg) | | <0.015 | <0.015 | <0.015 | <0.015 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Styrene (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | Toluene (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | ortho-Xylene (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | meta- & para-Xylene (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | Xylenes (mg/kg) | | <0.075 | <0.075 | <0.075 | <0.075 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 91.3 | 85.6 | 93.3 | 94.4 | 80.6 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 90.8 | 88.2 | 93.3 | 98.8 | 81.4 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | | <100 | <100 | <100 | <100 |
| | VPH (C6-C10) (mg/kg) | | <100 | <100 | <100 | <100 |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 85.5 | 86.5 | 86.7 | 82.5 | 83.3 |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | | 107.0 | 110.8 | 72.7 | 96.4 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2459618-10 | L2459618-11 | L2459618-12 | L2459618-13 | L2459618-14 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 |
| | **Sampled Time** | 12:52 | 12:52 | 12:52 | 12:52 | 12:52 |
| | **Client ID** | 02925-10 | 02925-11 | 02925-12 | 02929-01 | 02929-02 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | % Moisture (%) | | | | 18.6 | 21.3 |
| | Moisture (%) | 25.2 | 21.8 | 21.8 | | |
| | pH (1:2 soil:water) (pH) | 7.13 | 7.20 | 7.50 | | |
| **Metals** | Cadmium (Cd) (mg/kg) | 0.227 | 0.121 | 0.218 | | |
| | Chromium (Cr) (mg/kg) | 58.2 | 53.8 | 45.0 | | |
| **Volatile Organic Compounds** | VOC Sample Container | | | | | |
| | Benzene (mg/kg) | 0.818 | 1.93 | 0.0115 | | |
| | 1,2-Dibromoethane (mg/kg) | <0.60 DLQ | <0.90 DLQ | <0.050 | | |
| | Ethylbenzene (mg/kg) | 25.5 | 49.5 | 0.270 | | |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | | |
| | n-Nonane (mg/kg) | 233 | 304 | 1.25 | | |
| | Styrene (mg/kg) | 0.057 | 0.173 | <0.050 | | |
| | Toluene (mg/kg) | 15.1 | 28.3 | 0.145 | | |
| | ortho-Xylene (mg/kg) | 50.9 | 97.3 | 0.615 | | |
| | meta- & para-Xylene (mg/kg) | 103 | 200 | 1.16 | | |
| | Xylenes (mg/kg) | 154 | 298 | 1.78 | | |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 92.0 | 116.0 | 116.1 | | |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 80.0 | 104.0 | 103.7 | | |
| **Hydrocarbons** | EPH10-19 (mg/kg) | 11300 | 24000 | 1510 | | |
| | EPH19-32 (mg/kg) | 270 | 310 | <200 | | |
| | LEPH (mg/kg) | 11300 | 24000 | 1510 | | |
| | HEPH (mg/kg) | 270 | 310 | <200 | | |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | 2440 | 3910 | <100 | | |
| | VPH (C6-C10) (mg/kg) | 2240 | 3530 | <100 | | |
| | Surrogate: 2-Bromobenzotrifluoride (%) | Not Reportable | Not Reportable | 102.4 | | |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | Not Reportable SMI | Not Reportable SMI | 108.2 | | |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.60 DLCI | <2.0 DLCI | <0.20 DLCI | | |
| | Acenaphthylene (mg/kg) | <0.20 DLCI | <0.40 DLCI | <0.030 DLCI | | |
| | Anthracene (mg/kg) | <0.030 DLQ | <0.090 DLQ | <0.0070 DLQ | | |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.040 DLQ | <0.010 | | |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | | |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | | |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | | |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | | |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | | |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2459618-15 | | | | |
| | **Description** | SO | | | | |
| | **Sampled Date** | 10-JUN-20 | | | | |
| | **Sampled Time** | 12:52 | | | | |
| | **Client ID** | 02929-03 | | | | |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | % Moisture (%) | 23.8 | | | | |
| | Moisture (%) | | | | | |
| | pH (1:2 soil:water) (pH) | | | | | |
| **Metals** | Cadmium (Cd) (mg/kg) | | | | | |
| | Chromium (Cr) (mg/kg) | | | | | |
| **Volatile Organic Compounds** | VOC Sample Container | | | | | |
| | Benzene (mg/kg) | | | | | |
| | 1,2-Dibromoethane (mg/kg) | | | | | |
| | Ethylbenzene (mg/kg) | | | | | |
| | Methyl t-butyl ether (MTBE) (mg/kg) | | | | | |
| | n-Nonane (mg/kg) | | | | | |
| | Styrene (mg/kg) | | | | | |
| | Toluene (mg/kg) | | | | | |
| | ortho-Xylene (mg/kg) | | | | | |
| | meta- & para-Xylene (mg/kg) | | | | | |
| | Xylenes (mg/kg) | | | | | |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | | | | | |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | | | | | |
| **Hydrocarbons** | EPH10-19 (mg/kg) | | | | | |
| | EPH19-32 (mg/kg) | | | | | |
| | LEPH (mg/kg) | | | | | |
| | HEPH (mg/kg) | | | | | |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | | | | | |
| | VPH (C6-C10) (mg/kg) | | | | | |
| | Surrogate: 2-Bromobenzotrifluoride (%) | | | | | |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | | | | | |
| | Acenaphthylene (mg/kg) | | | | | |
| | Anthracene (mg/kg) | | | | | |
| | Benz(a)anthracene (mg/kg) | | | | | |
| | Benzo(a)pyrene (mg/kg) | | | | | |
| | Benzo(b&j)fluoranthene (mg/kg) | | | | | |
| | Benzo(b+j+k)fluoranthene (mg/kg) | | | | | |
| | Benzo(g,h,i)perylene (mg/kg) | | | | | |
| | Benzo(k)fluoranthene (mg/kg) | | | | | |
| | Chrysene (mg/kg) | | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2459618-2 | L2459618-4 | L2459618-5 | L2459618-8 | L2459618-9 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 |
| | **Sampled Time** | 12:52 | 12:52 | 12:52 | 12:52 | 12:52 |
| | **Client ID** | 02925-02 | 02925-04 | 02925-05 | 02925-08 | 02925-09 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 106.4 | 110.7 | 107.6 | 100.0 | 99.1 |
| | Surrogate: Naphthalene d8 (%) | 98.7 | 104.1 | 99.6 | 95.2 | 95.1 |
| | Surrogate: Phenanthrene d10 (%) | 100.8 | 105.9 | 102.7 | 96.4 | 95.2 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | | | | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | | | | | |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | | | | | |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | | | | | |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | | | | | |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | | | | | |
| | Perfluoroheptanoic acid (PFHpA) (mg/kg) | | | | | |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | | | | | |
| | Perfluorononanoic acid (PFNA) (mg/kg) | | | | | |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | | | | | |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | | | | | |

| | **Sample ID** | L2459618-10 | L2459618-11 | L2459618-12 | L2459618-13 | L2459618-14 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 | 10-JUN-20 |
| | **Sampled Time** | 12:52 | 12:52 | 12:52 | 12:52 | 12:52 |
| | **Client ID** | 02925-10 | 02925-11 | 02925-12 | 02929-01 | 02929-02 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | | |
| | Fluoranthene (mg/kg) | <0.010 | <0.020 DLQ | <0.010 | | |
| | Fluorene (mg/kg) | 1.00 | 2.65 | 0.169 | | |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | | |
| | 1-Methylnaphthalene (mg/kg) | 9.46 | 23.9 | 1.66 | | |
| | 2-Methylnaphthalene (mg/kg) | 13.6 | 34.3 | 2.44 | | |
| | Naphthalene (mg/kg) | <9.0 DLQ | <30 DLQ | <2.0 DLQ | | |
| | Phenanthrene (mg/kg) | 0.328 | 0.862 | 0.061 | | |
| | Pyrene (mg/kg) | 0.023 | 0.044 | <0.010 | | |
| | Quinoline (mg/kg) | <2.0 DLCI | <4.0 DLCI | <0.30 DLCI | | |
| | Surrogate: Chrysene d12 (%) | 86.0 | 106.4 | 102.8 | | |
| | Surrogate: Naphthalene d8 (%) | 80.5 | 120.0 | 101.7 | | |
| | Surrogate: Phenanthrene d10 (%) | 85.0 | 106.0 | 101.2 | | |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | | |
| | IACR (CCME) | <0.15 | <0.15 | <0.15 | | |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | | | | <0.00010 | <0.00010 |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | | | | <0.00015 DLB | 0.00035 DLB |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | | | | <0.00010 | <0.00010 |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | | | | <0.00010 | <0.00010 |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | | | | <0.00035 | <0.00035 |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | | | | <0.30 | <0.30 |
| | Perfluoroheptanoic acid (PFHpA) (mg/kg) | | | | <0.00010 | <0.00010 |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | | | | 0.00017 | 0.00016 |
| | Perfluorononanoic acid (PFNA) (mg/kg) | | | | <0.00010 | <0.00010 |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | | | | <0.00010 | <0.00010 |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | | | | 0.00017 | 0.00011 |

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2459618-15 | | | | |
| | **Description** | SO | | | | |
| | **Sampled Date** | 10-JUN-20 | | | | |
| | **Sampled Time** | 12:52 | | | | |
| | **Client ID** | 02929-03 | | | | |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Dibenz(a,h)anthracene (mg/kg) | | | | | |
| | Fluoranthene (mg/kg) | | | | | |
| | Fluorene (mg/kg) | | | | | |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | | | | | |
| | 1-Methylnaphthalene (mg/kg) | | | | | |
| | 2-Methylnaphthalene (mg/kg) | | | | | |
| | Naphthalene (mg/kg) | | | | | |
| | Phenanthrene (mg/kg) | | | | | |
| | Pyrene (mg/kg) | | | | | |
| | Quinoline (mg/kg) | | | | | |
| | Surrogate: Chrysene d12 (%) | | | | | |
| | Surrogate: Naphthalene d8 (%) | | | | | |
| | Surrogate: Phenanthrene d10 (%) | | | | | |
| | B(a)P Total Potency Equivalent (mg/kg) | | | | | |
| | IACR (CCME) | | | | | |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (mg/kg) | <0.00010 | | | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (mg/kg) | <0.00010 | | | | |
| | Perfluorobutane sulfonic acid (PFBS) (mg/kg) | <0.00010 | | | | |
| | Perfluorohexane sulfonic acid (PFHxS) (mg/kg) | <0.00010 | | | | |
| | Perfluorooctane sulfonic acid (PFOS) (mg/kg) | <0.00035 | | | | |
| | Perfluorobutanoic acid (PFBA) (mg/kg) | <0.30 | | | | |
| | Perfluoroheptanoic acid (PFHpA) (mg/kg) | <0.00010 | | | | |
| | Perfluorohexanoic acid (PFHxA) (mg/kg) | <0.00010 | | | | |
| | Perfluorononanoic acid (PFNA) (mg/kg) | <0.00010 | | | | |
| | Perfluorooctanoic acid (PFOA) (mg/kg) | <0.00010 | | | | |
| | Perfluoropentanoic acid (PFPeA) (mg/kg) | <0.00010 | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2459618-11 | | | | |
| | **Description** | SO | | | | |
| | **Sampled Date** | 10-JUN-20 | | | | |
| | **Sampled Time** | 12:52 | | | | |
| | **Client ID** | 02925-11 | | | | |
| **Grouping** | **Analyte** | | | | | |
| **WASTE** | | | | | | |
| **Waste Characterizations** | Benzene (mg/L) | 0.0242 | | | | |
| | Toluene (mg/L) | 0.406 | | | | |
| | Ethylbenzene (mg/L) | 0.305 | | | | |
| | meta- & para-Xylene (mg/L) | 1.36 | | | | |
| | ortho-Xylene (mg/L) | 0.742 | | | | |
| | Xylenes (mg/L) | 2.10 | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# Reference Information

**QC Samples with Qualifiers & Comments:**

| QC Type Description | Parameter | Qualifier | Applies to Sample Number(s) |
|---|---|---|---|
| Laboratory Control Sample | 6:2 Fluorotelomer sulfonic acid(6:2 FT | LCS-H | L2459618-13, -14, -15 |
| Laboratory Control Sample | Perfluorobutanoic acid (PFBA) | LCS-H | L2459618-13, -14, -15 |
| Method Blank | 6:2 Fluorotelomer sulfonic acid(6:2 FT | MB-LOR | L2459618-13, -14, -15 |
| Matrix Spike | Perfluorobutanoic acid (PFBA) | MS-B | L2459618-13, -14, -15 |

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| DLB | Detection Limit Raised. Analyte detected at comparable level in Method Blank. |
| DLCI | Detection Limit Raised: Chromatographic Interference due to co-elution. |
| DLQ | Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria. |
| LCS-H | Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified. |
| MB-LOR | Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level. |
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |
| SMI | Surrogate recovery could not be measured due to sample matrix interference. |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **EPH-TUMB-FID-VA** | Soil | EPH in Solids by Tumbler and GCFID | BC MOE EPH GCFID |

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Solids by GC/FID", v2.1, July 1999. Soil samples are extracted with a 1:1 mixture of hexane and acetone using a rotary extraction technique modified from EPA 3570 prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **FUELS-HSMS-VA** | Soil | VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **LEPH/HEPH-CALC-VA** | Soil | LEPHs and HEPHs | BC MOE LEPH/HEPH |

LEPHs and HEPHs are measures of Light and Heavy Extractable Petroleum Hydrocarbons in soil. Results are calculated by subtraction of applicable PAH concentrations from EPH10-19 and EPH19-32, as per the BC Lab Manual LEPH/HEPH calculation procedure.

LEPHs = EPH10-19 minus Naphthalene and Phenanthrene.

HEPHs = EPH19-32 minus Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and Pyrene.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **MET-200.2-CCMS-VA** | Soil | Metals in Soil by CRC ICPMS | EPA 200.2/6020A (mod) |

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **MOISTURE-VA** | Soil | Moisture content | CCME PHC in Soil - Tier 1 (mod) |

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of two hours.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **MOISTURE-WT** | Soil | % Moisture | CCME PHC in Soil - Tier 1 (mod) |
| **PAH-TMB-H/A-MS-VA** | Soil | PAH - Rotary Extraction (Hexane/Acetone) | EPA 3570/8270 |

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3570 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

Benzo(a)pyrene Total Potency Equivalents [B(a)P TPE] represents the sum of estimated cancer potency relative to B(a)P for all potentially carcinogenic unsubstituted PAHs, and is calculated as per the CCME PAH Soil Quality Guidelines reference document (2010).

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **PFAS-LL-EX-LCMS-WT** | Soil | Perfluorinated Compounds by LC/MS-MS | MOECC E3506 |

Soil sample was extracted with alkaline organic solvent. Dilute organic extract with water (10% organic/water) then passed through SPE. Final extract

# Reference Information

of Perfluorinated compounds are analyzed by LC/MS-MS.

**PH-1:2-VA** Soil pH in Soil (1:2 Soil:Water Extraction) BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in "pH, Electrometric in Soil and Sediment - Prescriptive Method", Rev. 2005, Section B Physical, Inorganic and Misc. Constituents, BC Environmental Laboratory Manual. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

**VH-HSFID-VA** Soil VH in soil by Headspace GCFID BC Env. Lab Manual (VH in Solids)

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999).

**VH-SURR-FID-VA** Soil VH Surrogates for Soils BC Env. Lab Manual (VH in Solids)

**VOC-M2-HSMS-VA** Soil Misc VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7-L-HSMS-VA** Soil VOCs in soil by Headspace GCMS EPA 5035A/5021A/8260C

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7-TCLP-VA** Waste BTEX in Waste by TCLP USEPA Method 1311

This analysis is carried out in accordance with the extraction procedure outlined in "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods Volume 1C" SW-846 EPA Method 1311, published by the United States Environmental Protection Agency (EPA). A representative sample of waste is extracted in a Zero Headspace Extractor at a 20:1 liquid to solids ratio for 16 to 20 hours using extraction fluid #1. Following extraction, the liquid extract is separated from the solid phase by filtration and preserved. The extract, with added reagents, is then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

**VOC7/VOC-SURR-MS-VA** Soil VOC7 and/or VOC Surrogates for Soils EPA 5035A/5021A/8260C

**VPH-CALC-VA** Soil VPH is VH minus select aromatics BC MOE VPH

VPHs measures Volatile Petroleum Hydrocarbons in soil. Results are calculated by subtraction of specific Monocyclic Aromatic Hydrocarbons from VH6-10, as per the BC Lab Manual VPH calculation procedure.
VPHs = VH6-10 minus Benzene, Toluene, Ethylbenzene, Xylenes, and Styrene

**XYLENES-CALC-VA** Soil Sum of Xylene Isomer Concentrations EPA 8260B & 524.2

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

**XYLENES-TCLP-CALC-VA** Waste Sum of Xylene Isomer Concentrations CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

---

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |
| VA | ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA |

**Chain of Custody Numbers:**

02925 02929

# Reference Information

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*

*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

ALS Environmental

# Quality Control Report

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4

Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **EPH-TUMB-FID-VA** | **Soil** | | | | | | | |
| **Batch R5117830** | | | | | | | | |
| **WG3341491-3 DUP** | | **L2459618-2** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| **WG3341491-4 IRM** | | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 94.7 | | % | | 70-130 | 15-JUN-20 |
| EPH19-32 | | | 99.3 | | % | | 70-130 | 15-JUN-20 |
| **WG3341491-2 LCS** | | | | | | | | |
| EPH10-19 | | | 94.5 | | % | | 70-130 | 15-JUN-20 |
| EPH19-32 | | | 97.9 | | % | | 70-130 | 15-JUN-20 |
| **WG3341491-1 MB** | | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 15-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 15-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 84.0 | | % | | 60-140 | 15-JUN-20 |
| **FUELS-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3341494-2 LCS** | | | | | | | | |
| 1,2-Dibromoethane | | | 95.3 | | % | | 70-130 | 13-JUN-20 |
| **WG3341494-1 MB** | | | | | | | | |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 13-JUN-20 |
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5117551** | | | | | | | | |
| **WG3341489-4 CRM** | | **SCP SS-2** | | | | | | |
| Cadmium (Cd) | | | 100.0 | | % | | 70-130 | 15-JUN-20 |
| Chromium (Cr) | | | 100.3 | | % | | 70-130 | 15-JUN-20 |
| **WG3341489-2 DUP** | | **L2459618-4** | | | | | | |
| Cadmium (Cd) | | 0.203 | 0.155 | | mg/kg | 27 | 30 | 15-JUN-20 |
| Chromium (Cr) | | 45.6 | 47.4 | | mg/kg | 3.8 | 30 | 15-JUN-20 |
| **WG3341489-3 LCS** | | | | | | | | |
| Cadmium (Cd) | | | 100.3 | | % | | 80-120 | 15-JUN-20 |
| Chromium (Cr) | | | 97.1 | | % | | 80-120 | 15-JUN-20 |
| **WG3341489-1 MB** | | | | | | | | |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 15-JUN-20 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 15-JUN-20 |
| **MOISTURE-VA** | **Soil** | | | | | | | |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **MOISTURE-VA** | **Soil** | | | | | | | |
| **Batch R5117023** | | | | | | | | |
| **WG3341490-3 DUP** | | **L2459618-2** | | | | | | |
| Moisture | | 23.5 | 23.9 | | % | 1.7 | 20 | 12-JUN-20 |
| **WG3341490-2 LCS** | | | | | | | | |
| Moisture | | | 99.7 | | % | | 90-110 | 12-JUN-20 |
| **WG3341490-1 MB** | | | | | | | | |
| Moisture | | | <0.25 | | % | | 0.25 | 12-JUN-20 |
| **MOISTURE-WT** | **Soil** | | | | | | | |
| **Batch R5117747** | | | | | | | | |
| **WG3342049-2 LCS** | | | | | | | | |
| % Moisture | | | 99.6 | | % | | 90-110 | 16-JUN-20 |
| **WG3342049-1 MB** | | | | | | | | |
| % Moisture | | | <0.25 | | % | | 0.25 | 16-JUN-20 |
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5117663** | | | | | | | | |
| **WG3341491-3 DUP** | | **L2459618-2** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Phenanthrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| **WG3341491-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 98.7 | | % | | 60-130 | 15-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5117663** | | | | | | | | |
| **WG3341491-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthylene | | | 115.0 | | % | | 60-130 | 15-JUN-20 |
| Anthracene | | | 112.5 | | % | | 60-130 | 15-JUN-20 |
| Benz(a)anthracene | | | 102.4 | | % | | 60-130 | 15-JUN-20 |
| Benzo(a)pyrene | | | 104.0 | | % | | 60-130 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | 101.1 | | % | | 60-130 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | 102.9 | | % | | 60-130 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | 97.4 | | % | | 60-130 | 15-JUN-20 |
| Chrysene | | | 109.8 | | % | | 60-130 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | 102.7 | | % | | 60-130 | 15-JUN-20 |
| Fluoranthene | | | 100.5 | | % | | 60-130 | 15-JUN-20 |
| Fluorene | | | 98.2 | | % | | 60-130 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 106.5 | | % | | 60-130 | 15-JUN-20 |
| 1-Methylnaphthalene | | | 97.3 | | % | | 60-130 | 15-JUN-20 |
| 2-Methylnaphthalene | | | 96.1 | | % | | 60-130 | 15-JUN-20 |
| Naphthalene | | | 99.8 | | % | | 50-130 | 15-JUN-20 |
| Phenanthrene | | | 98.5 | | % | | 60-130 | 15-JUN-20 |
| Pyrene | | | 103.1 | | % | | 60-130 | 15-JUN-20 |
| **WG3341491-2 LCS** | | | | | | | | |
| Acenaphthene | | | 101.0 | | % | | 60-130 | 15-JUN-20 |
| Acenaphthylene | | | 99.0 | | % | | 60-130 | 15-JUN-20 |
| Anthracene | | | 101.9 | | % | | 60-130 | 15-JUN-20 |
| Benz(a)anthracene | | | 103.1 | | % | | 60-130 | 15-JUN-20 |
| Benzo(a)pyrene | | | 95.6 | | % | | 60-130 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | 101.7 | | % | | 60-130 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | 96.2 | | % | | 60-130 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | 97.9 | | % | | 60-130 | 15-JUN-20 |
| Chrysene | | | 91.4 | | % | | 60-130 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | 99.8 | | % | | 60-130 | 15-JUN-20 |
| Fluoranthene | | | 100.3 | | % | | 60-130 | 15-JUN-20 |
| Fluorene | | | 99.8 | | % | | 60-130 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 103.4 | | % | | 60-130 | 15-JUN-20 |
| 1-Methylnaphthalene | | | 99.4 | | % | | 60-130 | 15-JUN-20 |
| 2-Methylnaphthalene | | | 98.9 | | % | | 60-130 | 15-JUN-20 |
| Naphthalene | | | 100.1 | | % | | 50-130 | 15-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5117663** | | | | | | | | |
| **WG3341491-2 LCS** | | | | | | | | |
| Phenanthrene | | | 99.98 | | % | | 60-130 | 15-JUN-20 |
| Pyrene | | | 104.5 | | % | | 60-130 | 15-JUN-20 |
| Quinoline | | | 101.3 | | % | | 60-130 | 15-JUN-20 |
| **WG3341491-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 15-JUN-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| Surrogate: Naphthalene d8 | | | 96.0 | | % | | 50-130 | 15-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 98.5 | | % | | 60-130 | 15-JUN-20 |
| Surrogate: Chrysene d12 | | | 104.2 | | % | | 60-130 | 15-JUN-20 |
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5118857** | | | | | | | | |
| **WG3342031-3 DUP** | | **L2459618-13** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | <0.35 | <0.50 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | <300 | <20 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | 0.17 | 0.15 | | ug/kg | 12 | 50 | 16-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5118857** | | | | | | | | |
| **WG3342031-3 DUP** | | **L2459618-13** | | | | | | |
| Perfluorohexanoic acid (PFHxA) | | 0.17 | 0.15 | | ug/kg | 15 | 50 | 16-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| Perfluorononanoic acid (PFNA) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | <0.15 | 0.12 | | ug/kg | 9.9 | 50 | 16-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | <0.10 | <0.10 | RPD-NA | ug/kg | N/A | 50 | 16-JUN-20 |
| **WG3342031-2 LCS** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 65.3 | | % | | 50-150 | 16-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 58.0 | | % | | 50-150 | 16-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 62.7 | | % | | 50-150 | 16-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | N/A | LCS-H | % | | 50-150 | 16-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | 71.3 | | % | | 50-150 | 16-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | 68.0 | | % | | 50-150 | 16-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 64.0 | | % | | 50-150 | 16-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | 76.7 | | % | | 50-150 | 16-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | 58.0 | | % | | 50-150 | 16-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | N/A | LCS-H | % | | 50-150 | 16-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 68.7 | | % | | 50-150 | 16-JUN-20 |
| **WG3342031-1 MB** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | <0.50 | | ug/kg | | 0.5 | 16-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | <20 | | ug/kg | | 20 | 16-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 0.23 | MB-LOR | ug/kg | | 0.1 | 16-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | <0.10 | | ug/kg | | 0.1 | 16-JUN-20 |
| **WG3342031-4 MS** | | **L2459618-13** | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 50.7 | | % | | 50-150 | 16-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 51.3 | | % | | 50-150 | 16-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 59.9 | | % | | 50-150 | 16-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | N/A | MS-B | % | | - | 16-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-LL-EX-LCMS-WT** | **Soil** | | | | | | | |
| **Batch R5118857** | | | | | | | | |
| **WG3342031-4 MS** | | **L2459618-13** | | | | | | |
| Perfluoropentanoic acid (PFPeA) | | | 57.8 | | % | | 50-150 | 16-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | 67.1 | | % | | 50-150 | 16-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 54.6 | | % | | 50-150 | 16-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | 63.9 | | % | | 50-150 | 16-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | 52.0 | | % | | 50-150 | 16-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 63.8 | | % | | 50-150 | 16-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 53.3 | | % | | 50-150 | 16-JUN-20 |
| **PH-1:2-VA** | **Soil** | | | | | | | |
| **Batch R5117619** | | | | | | | | |
| **WG3341489-2 DUP** | | **L2459618-4** | | | | | | |
| pH (1:2 soil:water) | | 6.51 | 6.47 | J | pH | 0.04 | 0.2 | 15-JUN-20 |
| **VH-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5117484** | | | | | | | | |
| **WG3341494-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 108.6 | | % | | 70-130 | 13-JUN-20 |
| **WG3341494-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 13-JUN-20 |
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3341494-3 DUP** | | **L2459618-2** | | | | | | |
| n-Nonane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 13-JUN-20 |
| **WG3341494-2 LCS** | | | | | | | | |
| n-Nonane | | | 90.3 | | % | | 70-130 | 13-JUN-20 |
| **WG3341494-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 13-JUN-20 |
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3341494-2 LCS** | | | | | | | | |
| Benzene | | | 91.3 | | % | | 70-130 | 13-JUN-20 |
| Ethylbenzene | | | 91.9 | | % | | 70-130 | 13-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 109.8 | | % | | 70-130 | 13-JUN-20 |
| Styrene | | | 91.0 | | % | | 70-130 | 13-JUN-20 |
| Toluene | | | 92.8 | | % | | 70-130 | 13-JUN-20 |
| meta- & para-Xylene | | | 104.9 | | % | | 70-130 | 13-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3341494-2 LCS** | | | | | | | | |
| ortho-Xylene | | | 90.2 | | % | | 70-130 | 13-JUN-20 |
| **WG3341494-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 13-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 13-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 13-JUN-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 13-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 13-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 13-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 13-JUN-20 |
| **VOC7-TCLP-VA** | **Waste** | | | | | | | |
| **Batch R5088376** | | | | | | | | |
| **WG3344413-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/L | | 0.005 | 18-JUN-20 |
| Ethylbenzene | | | <0.0050 | | mg/L | | 0.005 | 18-JUN-20 |
| Toluene | | | <0.0050 | | mg/L | | 0.005 | 18-JUN-20 |
| meta- & para-Xylene | | | <0.0050 | | mg/L | | 0.005 | 18-JUN-20 |
| ortho-Xylene | | | <0.0050 | | mg/L | | 0.005 | 18-JUN-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| J | Duplicate results and limits are expressed in terms of absolute difference. |
| LCS-H | Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified. |
| MB-LOR | Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level. |
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

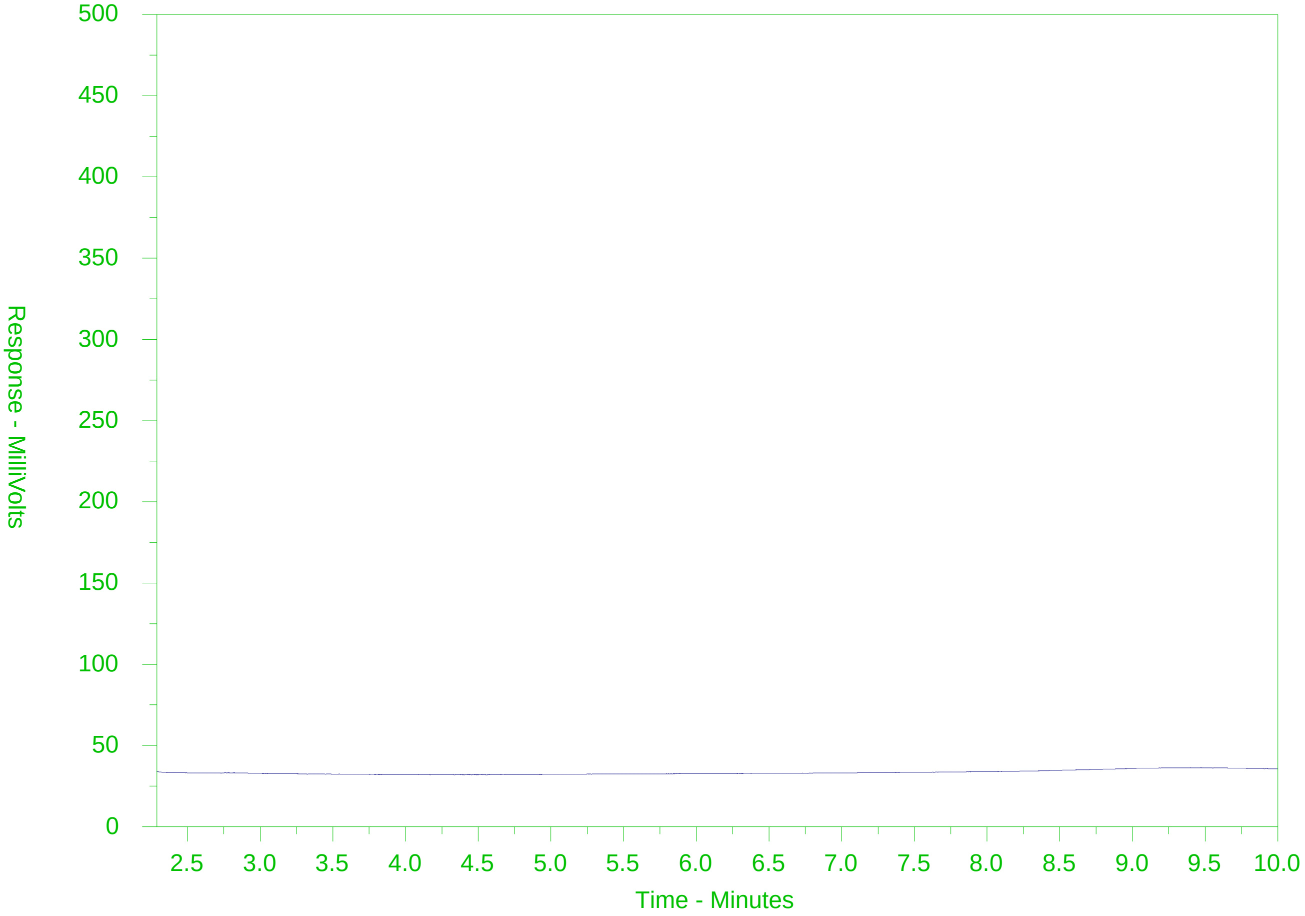
---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-2
Client Sample ID: 02925-02



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

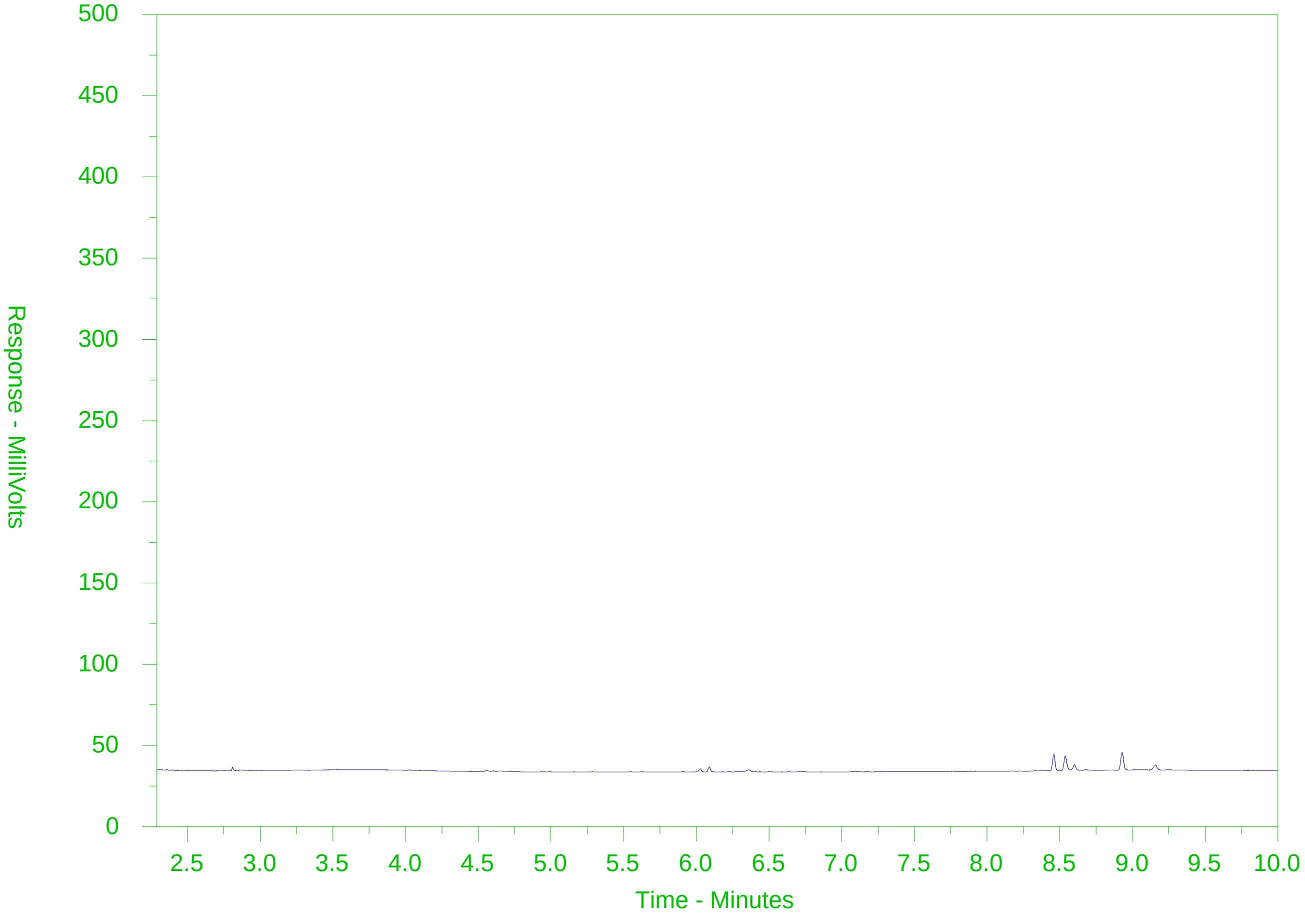
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

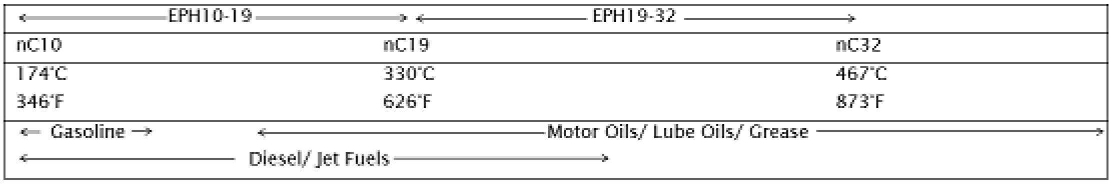
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3341491-3#L2459618-2
Client Sample ID: 02925-02





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

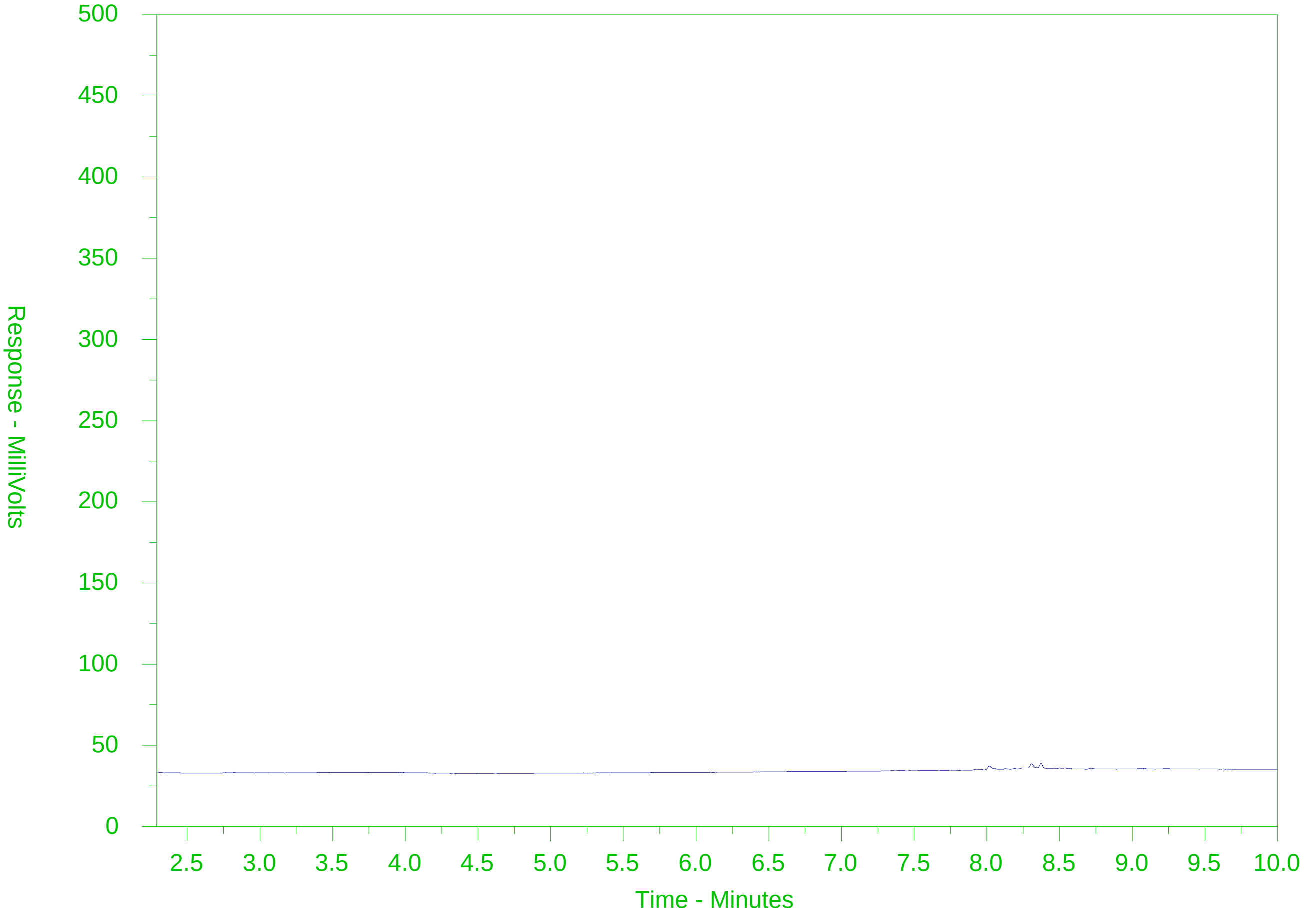
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

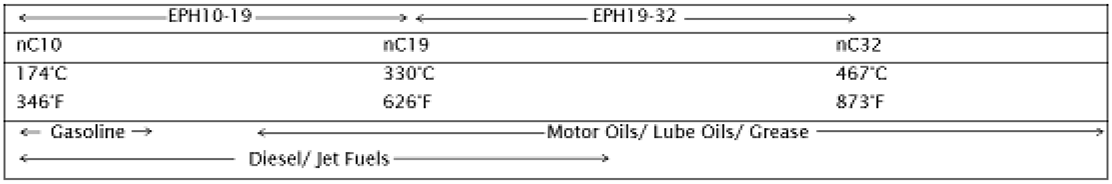
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-4
Client Sample ID: 02925-04





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

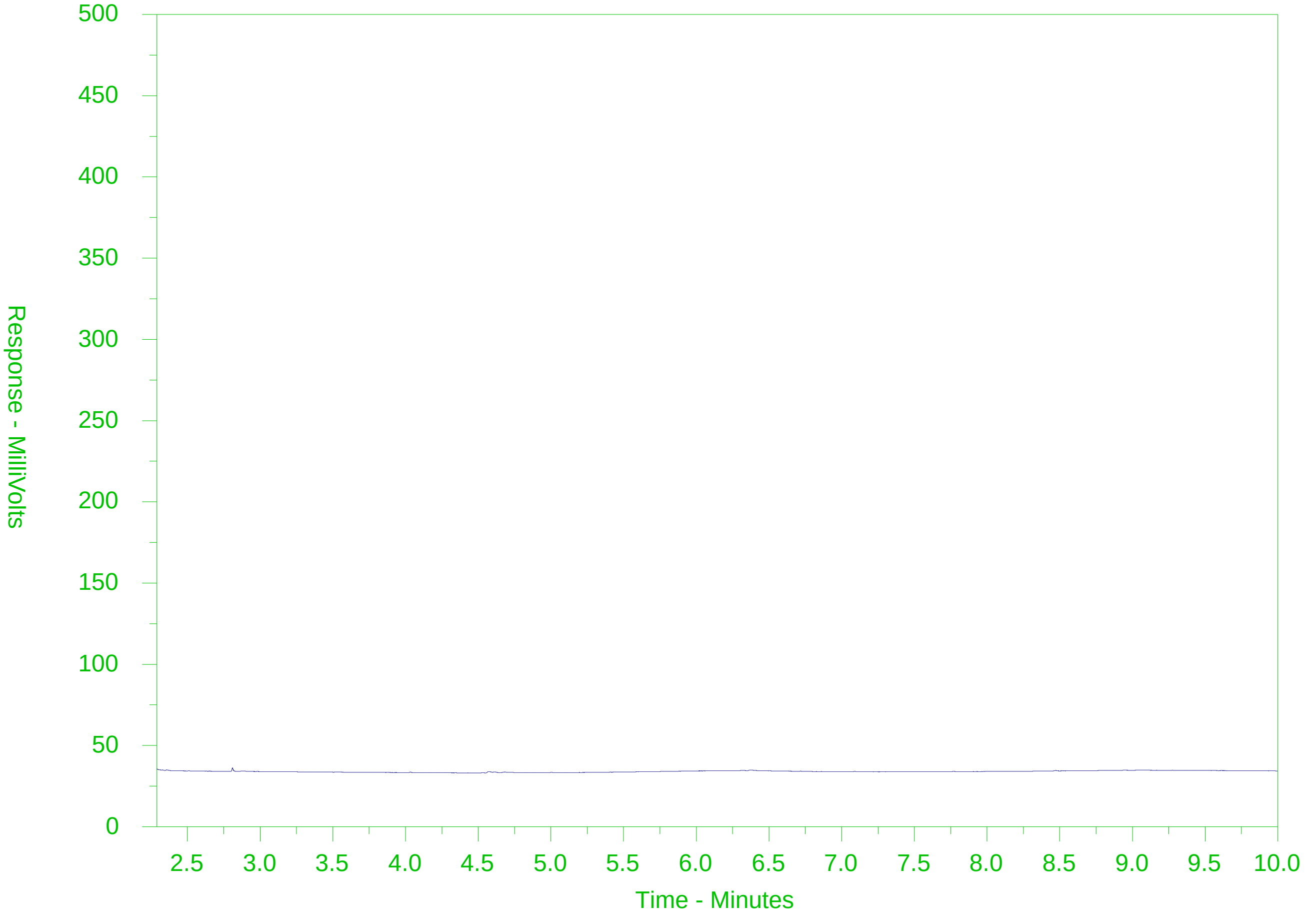
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-5
Client Sample ID: 02925-05



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

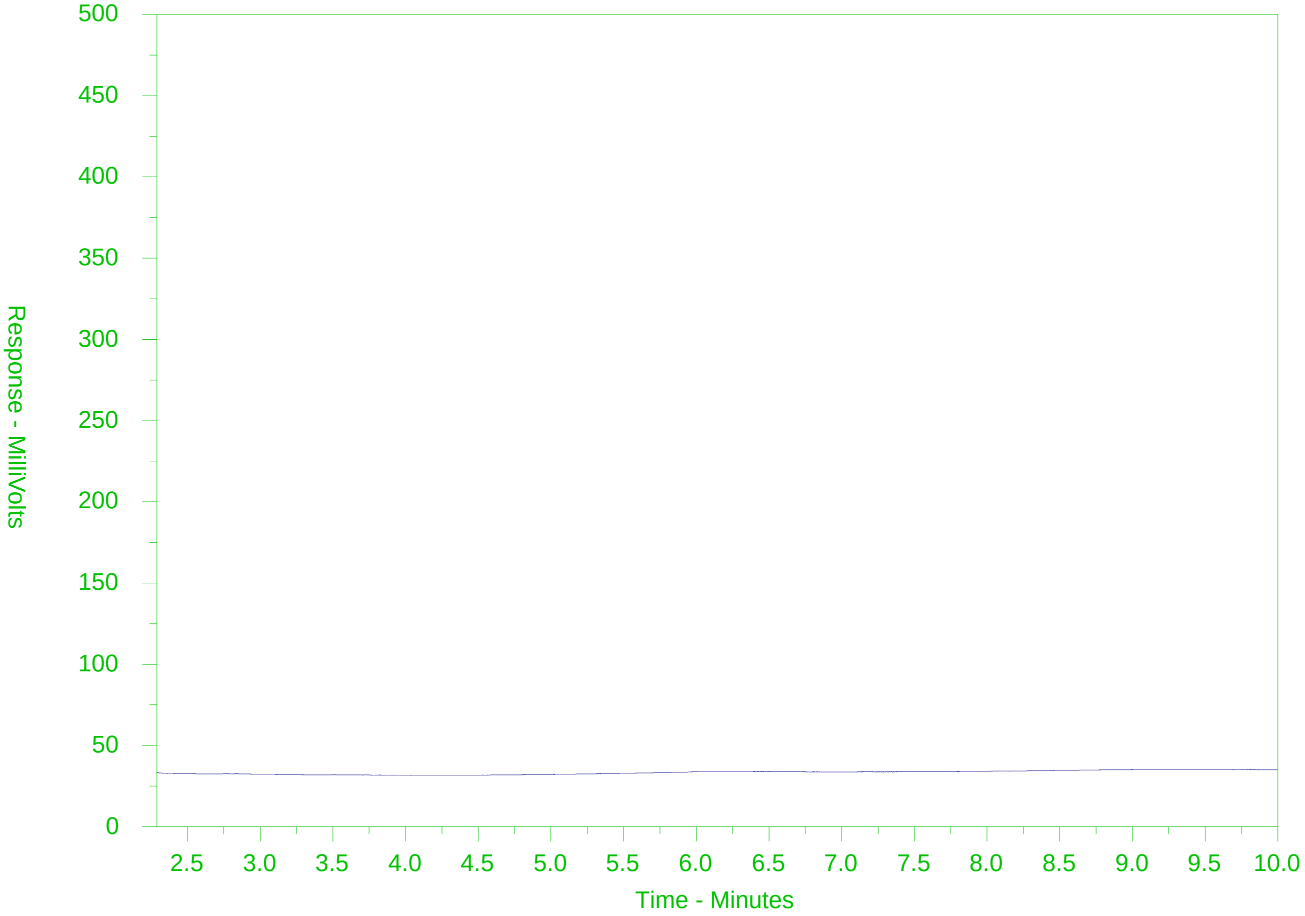
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

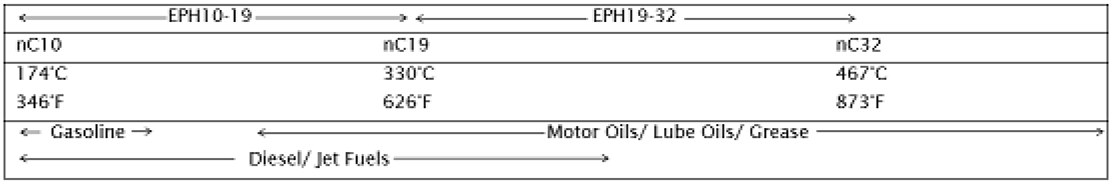
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-8
Client Sample ID: 02925-08





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

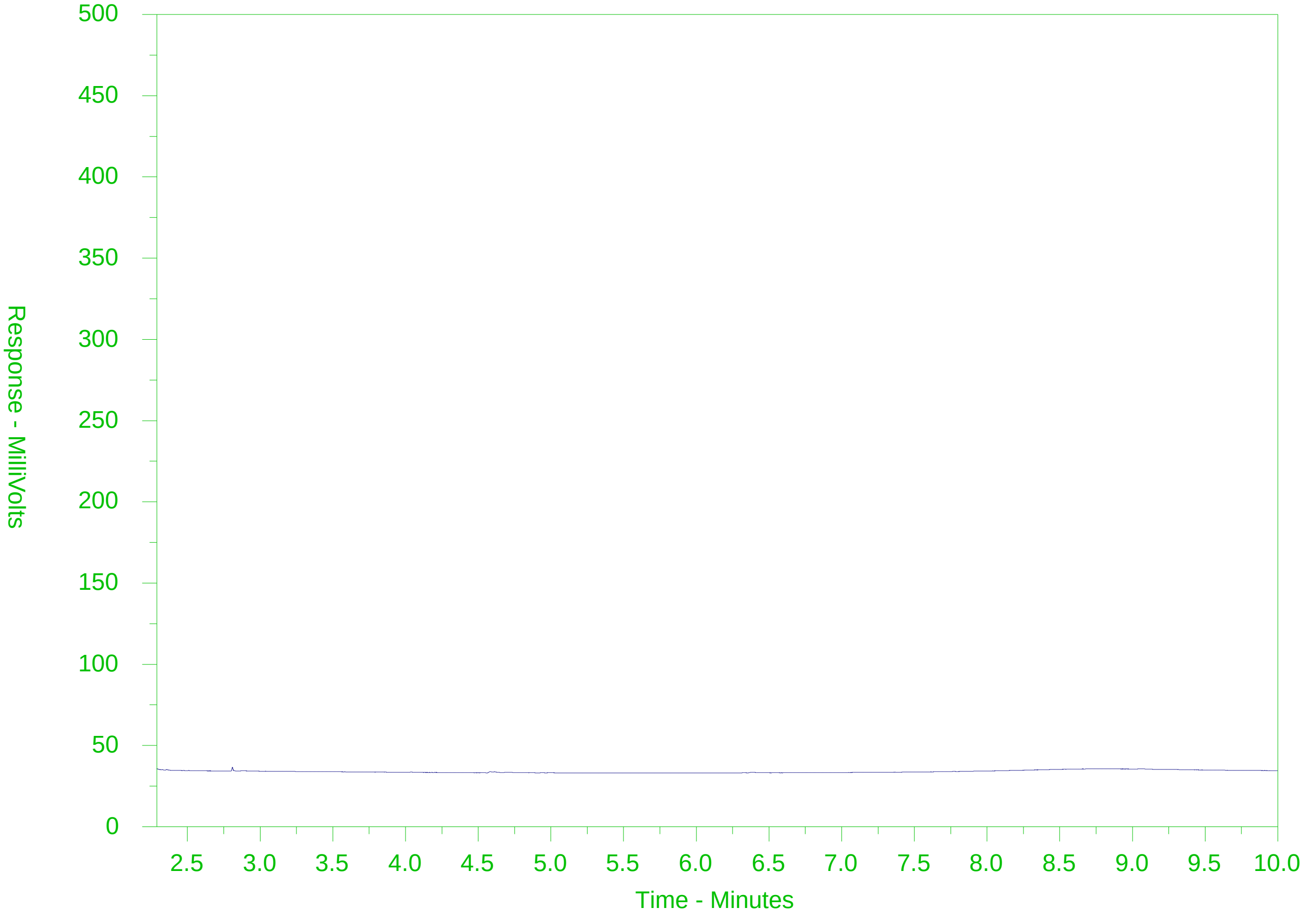
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

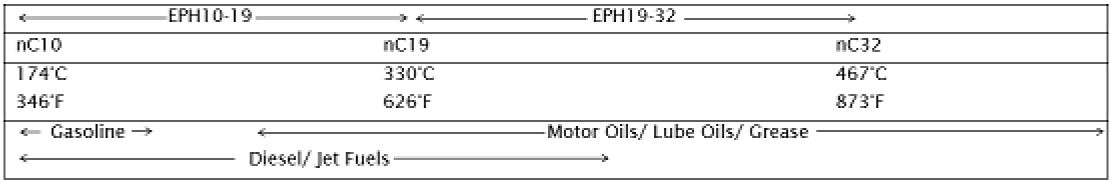
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-9
Client Sample ID: 02925-09





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

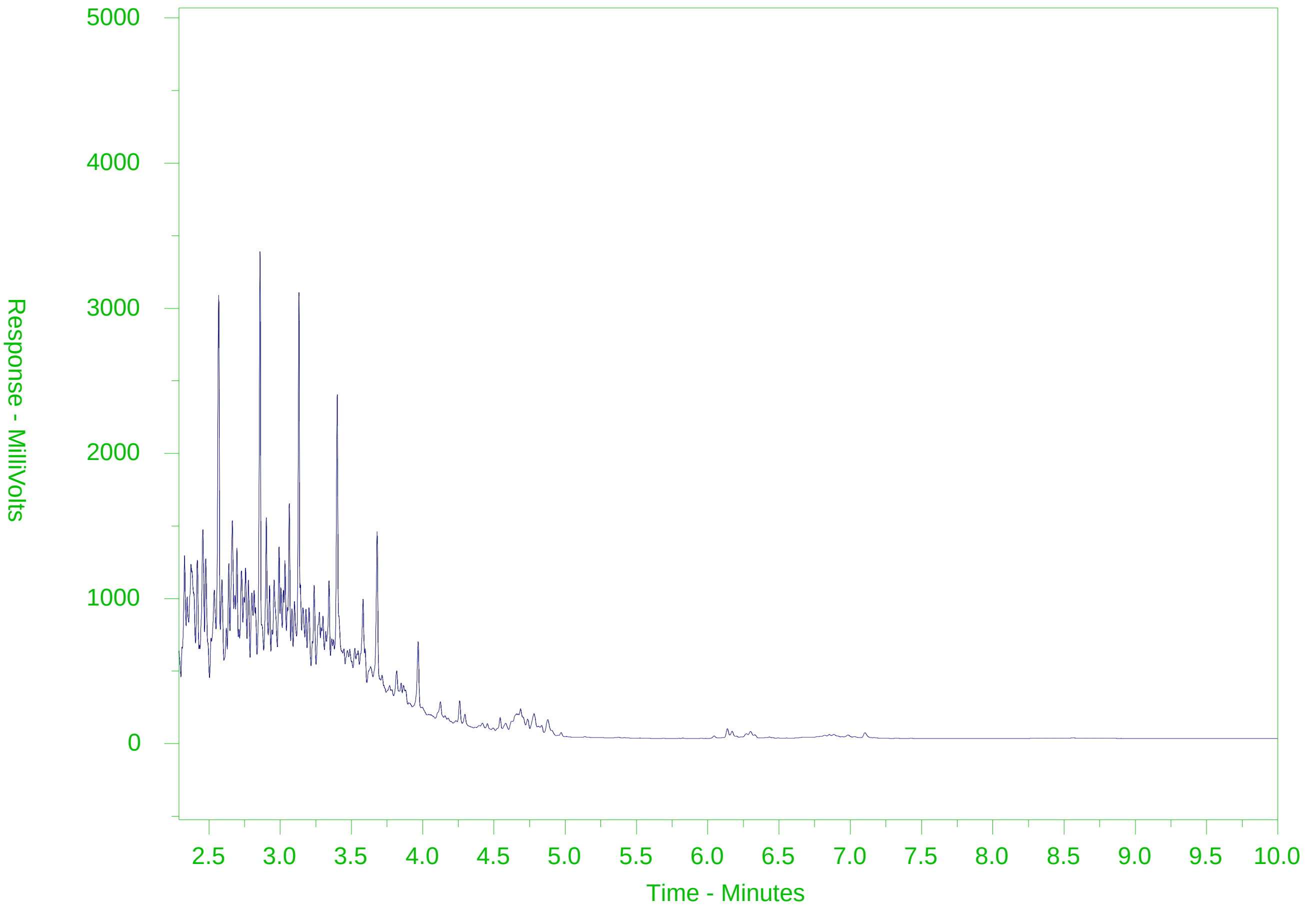
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-10
Client Sample ID: 02925-10



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

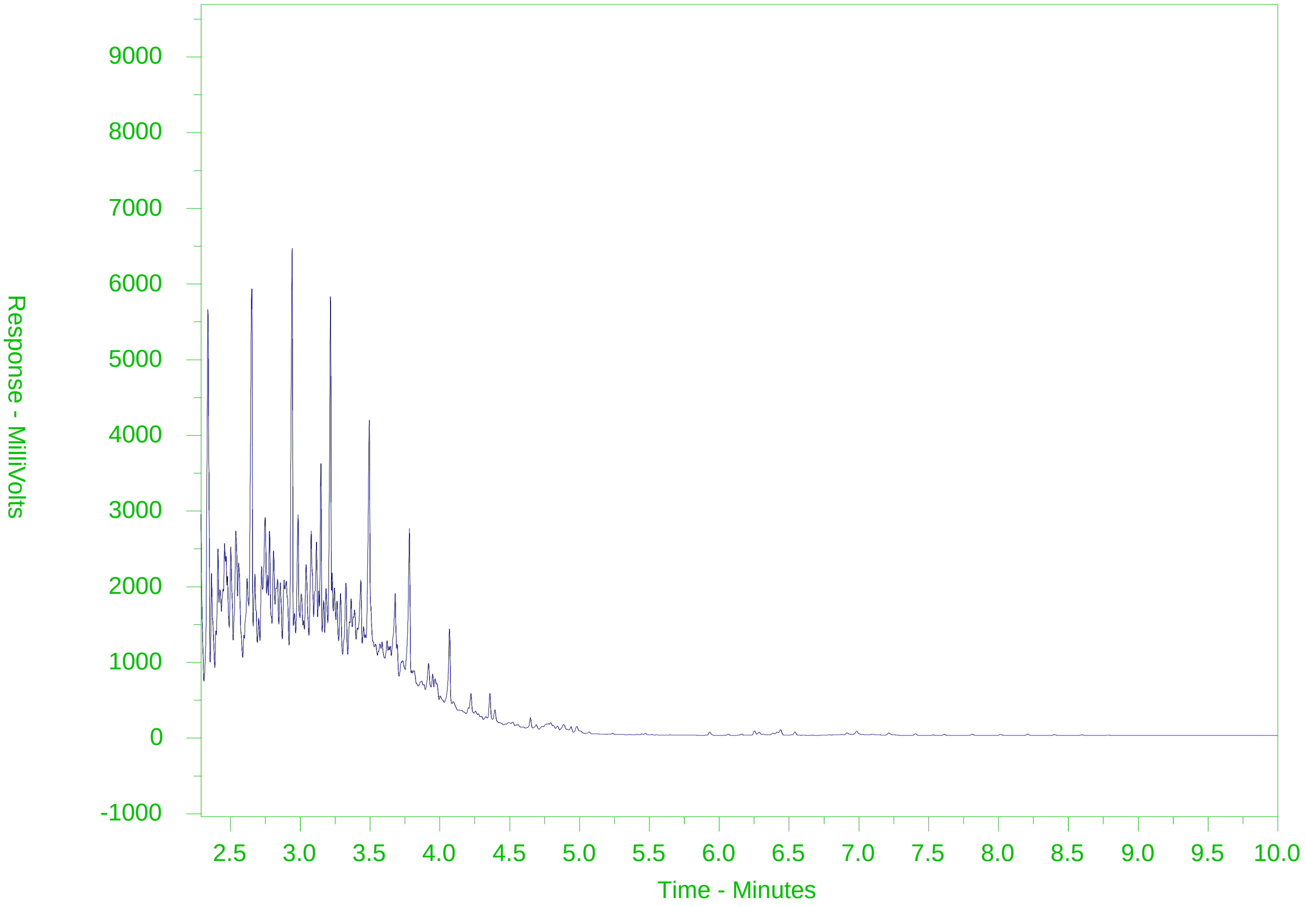
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

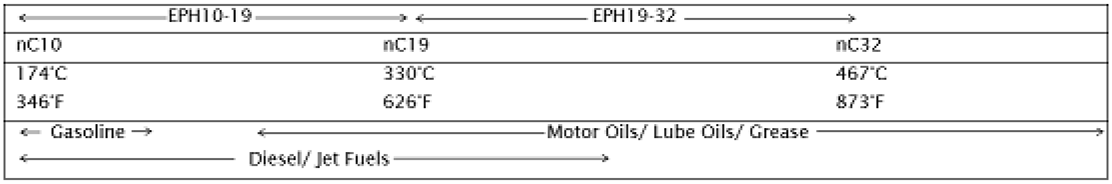
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-11
Client Sample ID: 02925-11





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

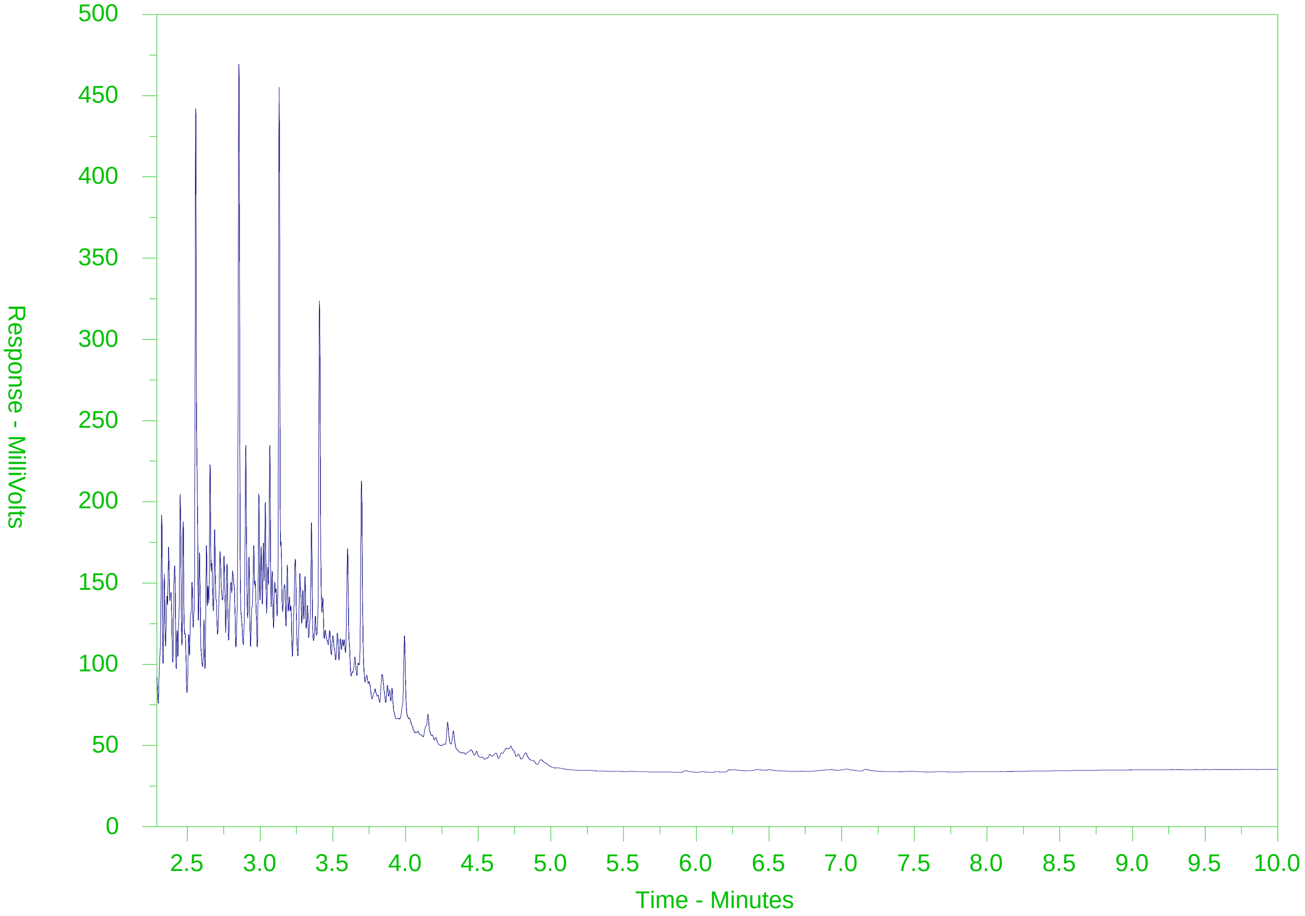
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

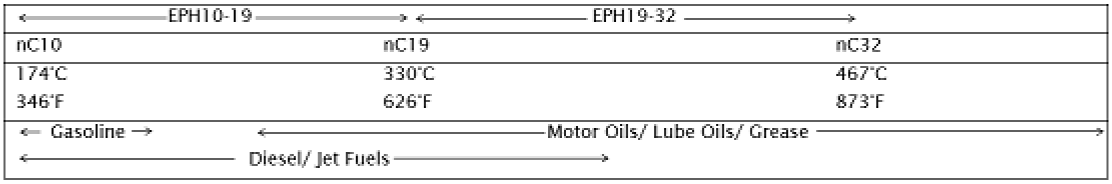
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2459618-12
Client Sample ID: 02925-12





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02925 page 1 of ~~3~~ 2

Project Number: 20145856
Short Title: Snowbird Clean-up
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: Amber Springer

Office Name: Vancouver
EQuIS Facility Code: 217832270
EQuIS upload: ☒

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 15th, 2020

Note: Final Reports to be issued by e-mail
Quote No.: Q80351

| Sample Control Number (SCN) | Sample Location | ~~Sa #~~ | Sample Depth (~~m~~) ft | Sample Matrix (over) | Date Sampled (D / M / Y) | Time Sampled (HH:MM) | Sample Type (over) | QAQC Code (over) | Related SCN (over) | Number of Containers | Moisture | Grain Size - SK | 2-methylnapthalene, naphthalene | LEPH / HEPH / UPH | BTEX | n-nonane | Cadmium, Chromium quinoline | 1,2-dibromoethane | PFAS - Health Canada | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02925 - 01 | BH20-06 | 2"-6" | ↙ | So | 10/6/20 | 12:52 | GRAB |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 02 | ↓ | 3'-3'6" |  | ↓ | ↓ |  | ↓ |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 03 | ↓ | 8'-8'6" |  |  |  | ↓ |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  | - All on |
| - 04 | MW20-03 | 2"-6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  | hold analysis |
| - 05 | ↓ | 3'-3'6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  | selected |
| - 06 | ↓ | 8'-8'6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  | June 11/20 |
| - 07 | MW20-04 | 2"-6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 08 | ↓ | 3'-3'6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 09 | ↓ | 8'-8'6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 10 | BH20-05 | 2"-6" |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 11 | ↓ | 3'-3'6" |  |  |  | ↓ |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |
| - 12 | ↓ | 8'-8'6" |  | ↓ | ↓ | 16:00 | ↓ |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |

L2459618-COFC

Sampler's Signature:
Comments: On Ice
- Dropped at after hours depot ALS Kamloops in lock-up

Relinquished by: Signature
Company: Golder
Date: 10/6/20
Time: 6:58
Received by: Signature
Company
Method of Shipment:
Waybill No.:
Received for Lab by:
Date: JUN 11 2020
Time: 830
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): 8
Cooler opened by:
Date
Time

WHITE: Golder Copy YELLOW: Lab Copy

ESED

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02929 page 2 of 2

Project Number: 20145856
Short Title: Snowbird Clean-up
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: IOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Longheed Hwy
Telephone/Fax: 604-258-4188
Contact: Amber Springer

Office Name: Vancouver
EQuIS Facility Code: 217832270
EQuIS upload: ☒

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 15th, 2020

Note: Final Reports to be issued by e-mail
Quote No.: Q80351

Analyses Required

| Sample Control Number (SCN) | Sample Location | Sa. # | Sample Depth (m) (ft) | Sample Matrix (over) | Date Sampled (D / M / Y) | Time Sampled (HH:MM) | Sample Type (over) | QAQC Code (over) | Related SCN (over) | Number of Containers | PFAS - Heath Canada | | | | | | | | Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02929 - 01 | BH20-07 | | 6"-1' | SO | 10/6/20 | 11:50 | GRAB | FDA | 02929-02 | 1 | | | | | | | | | X | | |
| ↓ - 02 | ↓ | | 6'-1' | ↓ | ↓ | 12:15 | ↓ | FD | 02929-01 | 1 | | | | | | | | | X | | -All on hold |
| - 03 | ↓ | | 1'-1'6" | ↓ | ↓ | " | ↓ | | | 1 | | | | | | | | | X | | analysis |
| - 04 | | | | | | | | | | | | | | | | | | | | | selected |
| - 05 | | | | | | | | | | | | | | | | | | | | | June 11/20 |
| - 06 | | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2459618-COFC

6:58

| | | | | | | |
|---|---|---|---|---|---|---|
| Sampler's Signature: | Relinquished by: Signature | Company Golder | Date 10/6/20 | Time 6:58 | Received by: Signature | Company |
| Comments: On Ice -Dropped at after hours depot at ALS Kamloops in lock-up | Method of Shipment: | Waybill No.: | Received for Lab by: OL | | Date JUN 11 2020 | Time 830 |
| | Shipped by: | Shipment Condition:<br>Seal Intact: | Temp (°C) 8 | Cooler opened by: | Date | Time |

**WHITE: Golder Copy YELLOW: Lab Copy**

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

Date Received: 11-JUN-20
Report Date: 15-JUN-20 13:36 (MT)
Version: FINAL

Client Phone: 604-297-2036

# Certificate of Analysis

**Lab Work Order #: L2459640**
Project P.O. #: NOT SUBMITTED
Job Reference: 20145856
C of C Numbers: 02930
Legal Site Desc:

**Comments:** ADDITIONAL 12-JUN-20 14:11

Amber Springer

Amber Springer, B.Sc
Account Manager

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID | L2459640-1 | | | | |
|---|---|---|---|---|---|---|
| | Description | H2O | | | | |
| | Sampled Date | 10-JUN-20 | | | | |
| | Sampled Time | 12:00 | | | | |
| | Client ID | 02930-01 | | | | |
| **Grouping** | **Analyte** | | | | | |
| **WATER** | | | | | | |
| **Perfluorinated Compounds** | 8:2 Fluorotelomer sulfonic acid(8:2 FTS) (ug/L) | <0.010 | | | | |
| | 6:2 Fluorotelomer sulfonic acid(6:2 FTS) (ug/L) | <0.010 | | | | |
| | Perfluorobutane sulfonic acid (PFBS) (ug/L) | <0.020 | | | | |
| | Perfluorohexane sulfonic acid (PFHxS) (ug/L) | <0.020 | | | | |
| | Perfluorooctane sulfonic acid (PFOS) (ug/L) | <0.010 | | | | |
| | Perfluorobutanoic acid (PFBA) (ug/L) | <0.80 | | | | |
| | Perfluoroheptanoic acid (PFHpA) (ug/L) | <0.020 | | | | |
| | Perfluorohexanoic acid (PFHxA) (ug/L) | <0.020 | | | | |
| | Perfluorononanoic acid (PFNA) (ug/L) | <0.020 | | | | |
| | Perfluorooctanoic acid (PFOA) (ug/L) | <0.010 | | | | |
| | Perfluoropentanoic acid (PFPeA) (ug/L) | <0.020 | | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# Reference Information

**QC Samples with Qualifiers & Comments:**

| QC Type Description | Parameter | Qualifier | Applies to Sample Number(s) |
|---|---|---|---|
| Matrix Spike | Perfluorohexanoic acid (PFHxA) | MS-B | L2459640-1 |
| Matrix Spike | Perfluoropentanoic acid (PFPeA) | MS-B | L2459640-1 |

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| MS-B | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **PFAS-DI-EX-LCMS-WT** | Water | PFC's by Direct Injection LC/MS-MS | MOECC E3533 and E3457 |

An aliquot of water is analyzed for PFCs by direct injection LC/MS/MS

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |

**Chain of Custody Numbers:**

02930

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2459640 Report Date: 15-JUN-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4

Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PFAS-DI-EX-LCMS-WT** | **Water** | | | | | | | |
| **Batch R5117660** | | | | | | | | |
| **WG3341075-2 LCS** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | 78.7 | | % | | 50-150 | 12-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | 86.0 | | % | | 50-150 | 12-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | 82.0 | | % | | 50-150 | 12-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | 118.0 | | % | | 50-150 | 12-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | 102.0 | | % | | 50-150 | 12-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | 104.7 | | % | | 50-150 | 12-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | 97.3 | | % | | 50-150 | 12-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | 93.3 | | % | | 50-150 | 12-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | 98.7 | | % | | 50-150 | 12-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | 76.0 | | % | | 50-150 | 12-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | 83.3 | | % | | 50-150 | 12-JUN-20 |
| **WG3341075-1 MB** | | | | | | | | |
| Perfluorobutane sulfonic acid (PFBS) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluorohexane sulfonic acid (PFHxS) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluorooctane sulfonic acid (PFOS) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluorobutanoic acid (PFBA) | | | <0.10 | | ug/L | | 0.1 | 12-JUN-20 |
| Perfluoropentanoic acid (PFPeA) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluorohexanoic acid (PFHxA) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluoroheptanoic acid (PFHpA) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluorooctanoic acid (PFOA) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| Perfluorononanoic acid (PFNA) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| 6:2 Fluorotelomer sulfonic acid(6:2 FTS) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |
| 8:2 Fluorotelomer sulfonic acid(8:2 FTS) | | | <0.010 | | ug/L | | 0.01 | 12-JUN-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02930 page ~~3 of 3~~ 1 of 1

Project Number: 20145856
Short Title: Snowbird Clean-up
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy, BBY
Telephone/Fax:
Contact:

Office Name: Vancouver
EQuIS Facility Code: 217832270
EQuIS upload: ☒
Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 15th, 2020
Note: Final Reports to be issued by e-mail
Quote No.: Q80351

| 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: PFAS - Health Canada | | | | | | | | Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02930 - 01 | Equipment Blank | | – | $H_2O$ | 10/6/20 | 12:00 | WO | | | 1 | | | | | | | | | X | | |
| - 02 | | | | | | | | | | | | | | | | | | | | | |
| - 03 | | | | | | | | | | | | | | | | | | | | | - On hold analysis selected June 11/20 |
| - 04 | | | | | | | | | | | | | | | | | | | | | |
| - 05 | | | | | | | | | | | | | | | | | | | | | |
| - 06 | | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2459640-COFC

Sampler's Signature:
Comments: On Ice
- Dropped at after hours depot at ALS Kamloops in lock-up

Relinquished by: Signature
Company: Golder
Date: 10/6/20
Time: 6:58
Received by: Signature
Company:
Method of Shipment:
Waybill No.:
Received for Lab by:
Date: JUN 11 2020
Time: 830
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): 13
Cooler opened by:
Date:
Time:

**WHITE: Golder Copy YELLOW: Lab Copy**

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

| | |
|---|---|
| Date Received: | 12-JUN-20 |
| Report Date: | 30-JUN-20 19:00 (MT) |
| Version: | FINAL REV. 3 |

Client Phone: 604-297-2036

# Certificate of Analysis

| | |
|---|---|
| **Lab Work Order #:** | **L2460211** |
| Project P.O. #: | NOT SUBMITTED |
| Job Reference: | 20145856 |
| C of C Numbers: | 02926, 02927, 02931 |
| Legal Site Desc: | |

**Comments:**

| | |
|---|---|
| 15-JUN-2020 | PAH data is included for L2460211-5. |
| 16-JUN-2020 | Additional rush data is included. |
| 23-JUN-2020 | Rush data is included for L2460211-2. |
| 30-JUN-2020 | Addition data included for samples L2460211-7, -15 to -21 |

Amber Springer

Amber Springer, B.Sc
Account Manager

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2460211-2 | L2460211-4 | L2460211-5 | L2460211-6 | L2460211-7 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 |
| | **Sampled Time** | 08:00 | 08:00 | 08:00 | 08:00 | 08:00 |
| | **Client ID** | 02926-02 | 02926-04 | 02926-05 | 02926-06 | 02926-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | pH (1:2 soil:water) (pH) | | 8.05 | 8.14 | 8.06 | 8.16 |
| **Metals** | Cadmium (Cd) (mg/kg) | | 0.139 | 0.166 | 0.118 | 0.080 |
| | Chromium (Cr) (mg/kg) | | 45.9 | 43.2 | 39.8 | 41.2 |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | | | | Field MeOH |
| | Benzene (mg/kg) | 0.399 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | 1,2-Dibromoethane (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | Ethylbenzene (mg/kg) | 15.2 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | | <0.050 | <0.050 | <0.050 | <0.050 |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Toluene (mg/kg) | 7.03 | <0.050 | <0.050 | <0.050 | <0.050 |
| | ortho-Xylene (mg/kg) | 29.9 | <0.050 | <0.050 | <0.050 | <0.050 |
| | meta- & para-Xylene (mg/kg) | 61.3 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Xylenes (mg/kg) | 91.1 | <0.075 | <0.075 | <0.075 | <0.075 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 96.0 | 103.8 | 111.2 | 98.9 | 104.7 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 92.0 | 120.0 | 116.1 | 111.2 | 109.1 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | 8920 | <200 | <200 | <200 | <200 |
| | EPH19-32 (mg/kg) | 240 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | 8920 | <200 | <200 | <200 | <200 |
| | HEPH (mg/kg) | 240 | <200 | <200 | <200 | <200 |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | 980 | <100 | <100 | <100 | <100 |
| | VPH (C6-C10) (mg/kg) | 860 | <100 | <100 | <100 | <100 |
| | Surrogate: 2-Bromobenzotrifluoride (%) | Not Reportable $^{SMI}$ | 87.6 | 88.6 | 88.5 | 83.2 |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | Not Reportable $^{SMI}$ | 89.6 | 107.2 | 101.2 | 116.6 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.70 $^{DLCI}$ | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Acenaphthylene (mg/kg) | <0.16 $^{DLCI}$ | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Anthracene (mg/kg) | <0.040 $^{DLCI}$ | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2460211-8 | L2460211-9 | L2460211-10 | L2460211-11 | L2460211-12 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 |
| | **Sampled Time** | 08:00 | 08:00 | 08:00 | 08:00 | 14:30 |
| | **Client ID** | 02926-08 | 02926-09 | 02926-10 | 02926-11 | 02926-12 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | pH (1:2 soil:water) (pH) | | | | | |
| **Metals** | Cadmium (Cd) (mg/kg) | | | | | |
| | Chromium (Cr) (mg/kg) | | | | | |
| **Volatile Organic Compounds** | VOC Sample Container | | | | | Field MeOH |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | | <0.0050 |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | <0.050 | | |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | <0.015 | | <0.015 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | | <0.20 |
| | n-Nonane (mg/kg) | <0.060 DLQ | <0.050 | <0.050 | | <0.050 |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | | <0.050 |
| | Toluene (mg/kg) | <0.050 | <0.050 | <0.050 | | <0.050 |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | | <0.050 |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | | <0.050 |
| | Xylenes (mg/kg) | <0.075 | <0.075 | <0.075 | | <0.075 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 99.0 | 105.7 | 98.8 | | 81.0 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 105.2 | 108.3 | 103.6 | | 89.4 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | <100 | | <100 |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | <100 | | <100 |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 86.1 | 90.5 | 89.6 | 77.9 | 75.8 |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 120.8 | 119.4 | 114.9 | | 89.3 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2460211-15 | L2460211-16 | L2460211-17 | L2460211-18 | L2460211-19 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 |
| | **Sampled Time** | 14:30 | 14:30 | 14:30 | 14:30 | 14:30 |
| | **Client ID** | 02927-03 | 02927-04 | 02927-05 | 02927-06 | 02927-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | pH (1:2 soil:water) (pH) | 7.72 | 7.38 | 7.70 | 7.56 | 6.93 |
| **Metals** | Cadmium (Cd) (mg/kg) | 0.035 | 0.063 | 0.046 | 0.034 | 0.142 |
| | Chromium (Cr) (mg/kg) | 20.0 | 15.8 | 17.7 | 18.9 | 26.0 |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | Field MeOH | Field MeOH | Field MeOH | Field MeOH |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Toluene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Xylenes (mg/kg) | <0.075 | <0.075 | <0.075 | <0.075 | <0.075 |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 107.4 | 109.5 | 105.8 | 117.5 | 92.1 |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 108.2 | 115.0 | 114.4 | 127.1 | 97.3 |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | LEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | <200 |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | <100 | <100 | <100 |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 84.7 | 86.8 | 85.0 | 89.9 | 88.9 |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 107.3 | 123.7 | 81.3 | 115.6 | 116.5 |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Sample ID** | L2460211-20 | L2460211-21 | | | |
| | **Description** | SO | SO | | | |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | | | |
| | **Sampled Time** | 13:00 | 13:00 | | | |
| | **Client ID** | 02931-01 | 02931-02 | | | |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | pH (1:2 soil:water) (pH) | 6.79 | 7.39 | | | |
| **Metals** | Cadmium (Cd) (mg/kg) | 0.065 | 0.090 | | | |
| | Chromium (Cr) (mg/kg) | 27.7 | 16.9 | | | |
| **Volatile Organic Compounds** | VOC Sample Container | Soil Jar | Soil Jar | | | |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | | | |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | | | |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | | | |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | | | |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | | | |
| | Styrene (mg/kg) | <0.050 | <0.050 | | | |
| | Toluene (mg/kg) | <0.050 | <0.050 | | | |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | | | |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | | | |
| | Xylenes (mg/kg) | <0.075 | <0.075 | | | |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 96.0 | 95.8 | | | |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 89.5 | 92.3 | | | |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | | | |
| | EPH19-32 (mg/kg) | <200 | <200 | | | |
| | LEPH (mg/kg) | <200 | <200 | | | |
| | HEPH (mg/kg) | <200 | <200 | | | |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | | | |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | | | |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 87.7 | 84.4 | | | |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 107.1 | SURR-ND<br>62.6 | | | |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | | | |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | | | |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | | | |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | | | |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | | | |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | | | |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | | | |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | | | |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | | | |
| | Chrysene (mg/kg) | <0.010 | <0.010 | | | |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2460211-2 | L2460211-4 | L2460211-5 | L2460211-6 | L2460211-7 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 |
| | **Sampled Time** | 08:00 | 08:00 | 08:00 | 08:00 | 08:00 |
| | **Client ID** | 02926-02 | 02926-04 | 02926-05 | 02926-06 | 02926-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Fluorene (mg/kg) | 0.812 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | 8.21 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | 11.7 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <6.5 DLQ | <0.010 | <0.010 | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.40 DLQ | <0.010 | <0.010 | <0.010 | <0.010 |
| | Pyrene (mg/kg) | 0.054 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Quinoline (mg/kg) | <1.5 DLCI | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 94.2 | 104.1 | 92.0 | 106.2 | 96.3 |
| | Surrogate: Naphthalene d8 (%) | 109.3 | 95.7 | 86.2 | 99.9 | 91.9 |
| | Surrogate: Phenanthrene d10 (%) | 104.0 | 99.2 | 92.1 | 101.4 | 96.7 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2460211-8 | L2460211-9 | L2460211-10 | L2460211-11 | L2460211-12 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 |
| | **Sampled Time** | 08:00 | 08:00 | 08:00 | 08:00 | 14:30 |
| | **Client ID** | 02926-08 | 02926-09 | 02926-10 | 02926-11 | 02926-12 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 109.4 | 102.9 | 101.0 | 85.4 | 86.9 |
| | Surrogate: Naphthalene d8 (%) | 104.5 | 99.3 | 98.3 | 82.0 | 85.2 |
| | Surrogate: Phenanthrene d10 (%) | 105.6 | 100.2 | 99.7 | 86.7 | 88.5 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2460211-15 | L2460211-16 | L2460211-17 | L2460211-18 | L2460211-19 |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | SO |
| | **Sampled Date** | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 | 11-JUN-20 |
| | **Sampled Time** | 14:30 | 14:30 | 14:30 | 14:30 | 14:30 |
| | **Client ID** | 02927-03 | 02927-04 | 02927-05 | 02927-06 | 02927-07 |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 98.7 | 94.2 | 92.8 | 94.7 | 101.0 |
| | Surrogate: Naphthalene d8 (%) | 96.0 | 96.5 | 95.2 | 98.4 | 102.9 |
| | Surrogate: Phenanthrene d10 (%) | 94.8 | 93.6 | 92.3 | 92.5 | 101.3 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | <0.15 | <0.15 | <0.15 | <0.15 | <0.15 |

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID<br>Description<br>Sampled Date<br>Sampled Time<br>Client ID | L2460211-20<br>SO<br>11-JUN-20<br>13:00<br>02931-01 | L2460211-21<br>SO<br>11-JUN-20<br>13:00<br>02931-02 | | | |
|---|---|---|---|---|---|---|
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Fluoranthene (mg/kg) | <0.010 | <0.010 | | | |
| | Fluorene (mg/kg) | <0.010 | <0.010 | | | |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | | | |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | | | |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | | | |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | | | |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | | | |
| | Pyrene (mg/kg) | <0.010 | <0.010 | | | |
| | Quinoline (mg/kg) | <0.050 | <0.050 | | | |
| | Surrogate: Chrysene d12 (%) | 95.3 | 103.2 | | | |
| | Surrogate: Naphthalene d8 (%) | 93.1 | 92.3 | | | |
| | Surrogate: Phenanthrene d10 (%) | 92.7 | 99.6 | | | |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | | | |
| | IACR (CCME) | <0.15 | <0.15 | | | |

# Reference Information

**Qualifiers for Sample Submission Listed:**

| Qualifier | Description |
|---|---|
| VOCC | Soil jar was submitted as VOC sample container. VOC results may be biased low, and do not meet federal (CCME) or provincial requirements (for BC, AB-Tier1, MB, ON, SK). - Sample#20 and 21 |

**Qualifiers for Individual Samples Listed:**

| Sample Number | Client Sample ID | Qualifier | Description |
|---|---|---|---|
| L2460211-20 | 02931-01 | VOCC | Soil jar was submitted as VOC sample container. VOC results may be biased low, and do not meet federal (CCME) or provincial requirements (for BC, AB-Tier1, MB, ON, SK). |
| L2460211-21 | 02931-02 | VOCC | Soil jar was submitted as VOC sample container. VOC results may be biased low, and do not meet federal (CCME) or provincial requirements (for BC, AB-Tier1, MB, ON, SK). |

**QC Samples with Qualifiers & Comments:**

| QC Type Description | Parameter | Qualifier | Applies to Sample Number(s) |
|---|---|---|---|
| Duplicate | EPH10-19 | DUP-H | L2460211-2 |
| Duplicate | Chromium (Cr) | DUP-H | L2460211-15, -16, -17, -18, -19, -20, -21, -7 |
| Duplicate | 1-Methylnaphthalene | DUP-H | L2460211-2 |
| Duplicate | Fluorene | DUP-H | L2460211-2 |
| Laboratory Control Sample | n-Nonane | LCS-ND | L2460211-10, -4, -5, -6, -8, -9 |
| Laboratory Control Sample | n-Nonane | LCS-ND | L2460211-20, -21 |

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| DLCI | Detection Limit Raised: Chromatographic Interference due to co-elution. |
| DLQ | Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria. |
| DUP-H | Duplicate results outside ALS DQO, due to sample heterogeneity. |
| LCS-ND | Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected. |
| SMI | Surrogate recovery could not be measured due to sample matrix interference. |
| SURR-ND | Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected. |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **EPH-TUMB-FID-VA** | Soil | EPH in Solids by Tumbler and GCFID | BC MOE EPH GCFID |

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Solids by GC/FID", v2.1, July 1999. Soil samples are extracted with a 1:1 mixture of hexane and acetone using a rotary extraction technique modified from EPA 3570 prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **FUELS-HSMS-VA** | Soil | VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **GRAIN SIZE-SK** | Soil | Grain Size Analysis | SSIR-51 METHOD 3.2.1 |

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **LEPH/HEPH-CALC-VA** | Soil | LEPHs and HEPHs | BC MOE LEPH/HEPH |

LEPHs and HEPHs are measures of Light and Heavy Extractable Petroleum Hydrocarbons in soil. Results are calculated by subtraction of applicable PAH concentrations from EPH10-19 and EPH19-32, as per the BC Lab Manual LEPH/HEPH calculation procedure.

LEPHs = EPH10-19 minus Naphthalene and Phenanthrene.

HEPHs = EPH19-32 minus Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and Pyrene.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **MET-200.2-CCMS-VA** | Soil | Metals in Soil by CRC ICPMS | EPA 200.2/6020A (mod) |

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only

# Reference Information

partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

| | | | |
|---|---|---|---|
| **MOISTURE-VA** | Soil | Moisture content | CCME PHC in Soil - Tier 1 (mod) |

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of two hours.

| | | | |
|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | Soil | PAH - Rotary Extraction (Hexane/Acetone) | EPA 3570/8270 |

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3570 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

Benzo(a)pyrene Total Potency Equivalents [B(a)P TPE] represents the sum of estimated cancer potency relative to B(a)P for all potentially carcinogenic unsubstituted PAHs, and is calculated as per the CCME PAH Soil Quality Guidelines reference document (2010).

| | | | |
|---|---|---|---|
| **PH-1:2-VA** | Soil | pH in Soil (1:2 Soil:Water Extraction) | BC WLAP METHOD: PH, ELECTROMETRIC, SOIL |

This analysis is carried out in accordance with procedures described in "pH, Electrometric in Soil and Sediment - Prescriptive Method", Rev. 2005, Section B Physical, Inorganic and Misc. Constituents, BC Environmental Laboratory Manual. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

| | | | |
|---|---|---|---|
| **VH-HSFID-VA** | Soil | VH in soil by Headspace GCFID | BC Env. Lab Manual (VH in Solids) |

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999).

| | | | |
|---|---|---|---|
| **VH-SURR-FID-VA** | Soil | VH Surrogates for Soils | BC Env. Lab Manual (VH in Solids) |
| **VOC-HSMS-VA** | Soil | VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| | | | |
|---|---|---|---|
| **VOC-M2-HSMS-VA** | Soil | Misc VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| | | | |
|---|---|---|---|
| **VOC7-L-HSMS-VA** | Soil | VOCs in soil by Headspace GCMS | EPA 5035A/5021A/8260C |

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

| | | | |
|---|---|---|---|
| **VOC7/VOC-SURR-MS-VA** | Soil | VOC7 and/or VOC Surrogates for Soils | EPA 5035A/5021A/8260C |
| **VPH-CALC-VA** | Soil | VPH is VH minus select aromatics | BC MOE VPH |

VPHs measures Volatile Petroleum Hydrocarbons in soil. Results are calculated by subtraction of specific Monocyclic Aromatic Hydrocarbons from VH6-10, as per the BC Lab Manual VPH calculation procedure.
VPHs = VH6-10 minus Benzene, Toluene, Ethylbenzene, Xylenes, and Styrene

| | | | |
|---|---|---|---|
| **XYLENES-CALC-VA** | Soil | Sum of Xylene Isomer Concentrations | EPA 8260B & 524.2 |

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| SK | ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA |
| VA | ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA |

**Chain of Custody Numbers:**

02926 02927 02931

# Reference Information

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2460211 Report Date: 30-JUN-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4
Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **EPH-TUMB-FID-VA** | **Soil** | | | | | | | |
| **Batch R5117830** | | | | | | | | |
| **WG3341710-3 DUP** | | **L2460211-5** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| **WG3341710-4 IRM** | | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 92.8 | | % | | 70-130 | 15-JUN-20 |
| EPH19-32 | | | 96.0 | | % | | 70-130 | 15-JUN-20 |
| **WG3341710-2 LCS** | | | | | | | | |
| EPH10-19 | | | 96.5 | | % | | 70-130 | 15-JUN-20 |
| EPH19-32 | | | 95.9 | | % | | 70-130 | 15-JUN-20 |
| **WG3341710-1 MB** | | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 15-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 15-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 89.6 | | % | | 60-140 | 15-JUN-20 |
| **Batch R5119096** | | | | | | | | |
| **WG3342711-3 DUP** | | **L2460211-7** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 16-JUN-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 16-JUN-20 |
| **WG3342711-4 IRM** | | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 91.9 | | % | | 70-130 | 16-JUN-20 |
| EPH19-32 | | | 94.6 | | % | | 70-130 | 16-JUN-20 |
| **WG3342711-2 LCS** | | | | | | | | |
| EPH10-19 | | | 93.6 | | % | | 70-130 | 16-JUN-20 |
| EPH19-32 | | | 96.7 | | % | | 70-130 | 16-JUN-20 |
| **WG3342711-1 MB** | | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 16-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 16-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 80.4 | | % | | 60-140 | 16-JUN-20 |
| **Batch R5130219** | | | | | | | | |
| **WG3347576-3 DUP** | | **L2460211-2** | | | | | | |
| EPH10-19 | | 8920 | 5520 | DUP-H | mg/kg | 47 | 40 | 23-JUN-20 |
| EPH19-32 | | 240 | <200 | RPD-NA | mg/kg | N/A | 40 | 23-JUN-20 |
| **WG3347576-4 IRM** | | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 94.5 | | % | | 70-130 | 23-JUN-20 |
| EPH19-32 | | | 93.6 | | % | | 70-130 | 23-JUN-20 |
| **WG3347576-2 LCS** | | | | | | | | |
| EPH10-19 | | | 93.3 | | % | | 70-130 | 23-JUN-20 |
| EPH19-32 | | | 92.1 | | % | | 70-130 | 23-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **EPH-TUMB-FID-VA** | **Soil** | | | | | | | |
| **Batch R5130219** | | | | | | | | |
| **WG3347576-1** | **MB** | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 23-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 23-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 88.0 | | % | | 60-140 | 23-JUN-20 |
| **Batch R5132236** | | | | | | | | |
| **WG3348924-3** | **DUP** | **L2460211-21** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 25-JUN-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 25-JUN-20 |
| **WG3348924-4** | **IRM** | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 92.1 | | % | | 70-130 | 25-JUN-20 |
| EPH19-32 | | | 94.4 | | % | | 70-130 | 25-JUN-20 |
| **WG3348924-2** | **LCS** | | | | | | | |
| EPH10-19 | | | 88.6 | | % | | 70-130 | 25-JUN-20 |
| EPH19-32 | | | 82.8 | | % | | 70-130 | 25-JUN-20 |
| **WG3348924-1** | **MB** | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 25-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 25-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 83.3 | | % | | 60-140 | 25-JUN-20 |
| **Batch R5136000** | | | | | | | | |
| **WG3352606-3** | **DUP** | **L2460211-15** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 30-JUN-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 30-JUN-20 |
| **WG3352606-4** | **IRM** | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 93.8 | | % | | 70-130 | 30-JUN-20 |
| EPH19-32 | | | 95.0 | | % | | 70-130 | 30-JUN-20 |
| **WG3352606-2** | **LCS** | | | | | | | |
| EPH10-19 | | | 93.8 | | % | | 70-130 | 30-JUN-20 |
| EPH19-32 | | | 94.9 | | % | | 70-130 | 30-JUN-20 |
| **WG3352606-1** | **MB** | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 30-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 30-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 87.5 | | % | | 60-140 | 30-JUN-20 |
| **FUELS-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5112127** | | | | | | | | |
| **WG3341835-3** | **DUP** | **L2460211-8** | | | | | | |
| 1,2-Dibromoethane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| **WG3349012-3** | **DUP** | **L2460211-19** | | | | | | |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **FUELS-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5112127** | | | | | | | | |
| **WG3349012-3 DUP** | | **L2460211-19** | | | | | | |
| 1,2-Dibromoethane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 24-JUN-20 |
| **WG3341835-2 LCS** | | | | | | | | |
| 1,2-Dibromoethane | | | 107.9 | | % | | 70-130 | 15-JUN-20 |
| **WG3349012-2 LCS** | | | | | | | | |
| 1,2-Dibromoethane | | | 105.8 | | % | | 70-130 | 24-JUN-20 |
| **WG3341835-1 MB** | | | | | | | | |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| **WG3349012-1 MB** | | | | | | | | |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 24-JUN-20 |
| **Batch R5117129** | | | | | | | | |
| **WG3349866-3 DUP** | | **L2460211-21** | | | | | | |
| 1,2-Dibromoethane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| **WG3349866-2 LCS** | | | | | | | | |
| 1,2-Dibromoethane | | | 102.8 | | % | | 70-130 | 25-JUN-20 |
| **WG3349866-1 MB** | | | | | | | | |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 25-JUN-20 |
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5117551** | | | | | | | | |
| **WG3341709-4 CRM** | | **SCP SS-2** | | | | | | |
| Cadmium (Cd) | | | 109.3 | | % | | 70-130 | 15-JUN-20 |
| Chromium (Cr) | | | 97.6 | | % | | 70-130 | 15-JUN-20 |
| **WG3341709-2 DUP** | | **L2460211-4** | | | | | | |
| Cadmium (Cd) | | 0.139 | 0.127 | | mg/kg | 8.9 | 30 | 15-JUN-20 |
| Chromium (Cr) | | 45.9 | 41.7 | | mg/kg | 9.6 | 30 | 15-JUN-20 |
| **WG3341709-3 LCS** | | | | | | | | |
| Cadmium (Cd) | | | 99.5 | | % | | 80-120 | 15-JUN-20 |
| Chromium (Cr) | | | 98.5 | | % | | 80-120 | 15-JUN-20 |
| **WG3341709-1 MB** | | | | | | | | |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 15-JUN-20 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 15-JUN-20 |
| **Batch R5132027** | | | | | | | | |
| **WG3348942-4 CRM** | | **SCP SS-2** | | | | | | |
| Cadmium (Cd) | | | 104.7 | | % | | 70-130 | 25-JUN-20 |
| Chromium (Cr) | | | 102.4 | | % | | 70-130 | 25-JUN-20 |
| **WG3348942-2 DUP** | | **L2460211-15** | | | | | | |
| Cadmium (Cd) | | 0.035 | 0.041 | | mg/kg | 16 | 30 | 25-JUN-20 |
| Chromium (Cr) | | 20.0 | 32.7 | DUP-H | mg/kg | 48 | 30 | 25-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5132027** | | | | | | | | |
| **WG3348942-3 LCS** | | | | | | | | |
| Cadmium (Cd) | | | 97.4 | | % | | 80-120 | 25-JUN-20 |
| Chromium (Cr) | | | 93.3 | | % | | 80-120 | 25-JUN-20 |
| **WG3348942-1 MB** | | | | | | | | |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 25-JUN-20 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 25-JUN-20 |
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5116579** | | | | | | | | |
| **WG3342529-3 DUP** | | **L2460211-5** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Phenanthrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| **WG3342529-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 90.6 | | % | | 60-130 | 15-JUN-20 |
| Acenaphthylene | | | 105.4 | | % | | 60-130 | 15-JUN-20 |
| Anthracene | | | 102.9 | | % | | 60-130 | 15-JUN-20 |
| Benz(a)anthracene | | | 92.3 | | % | | 60-130 | 15-JUN-20 |
| Benzo(a)pyrene | | | 93.2 | | % | | 60-130 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | 90.7 | | % | | 60-130 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | 92.4 | | % | | 60-130 | 15-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5116579** | | | | | | | | |
| **WG3342529-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Benzo(k)fluoranthene | | | 81.5 | | % | | 60-130 | 15-JUN-20 |
| Chrysene | | | 97.4 | | % | | 60-130 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | 94.6 | | % | | 60-130 | 15-JUN-20 |
| Fluoranthene | | | 91.7 | | % | | 60-130 | 15-JUN-20 |
| Fluorene | | | 91.7 | | % | | 60-130 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 90.7 | | % | | 60-130 | 15-JUN-20 |
| 1-Methylnaphthalene | | | 90.0 | | % | | 60-130 | 15-JUN-20 |
| 2-Methylnaphthalene | | | 86.7 | | % | | 60-130 | 15-JUN-20 |
| Naphthalene | | | 91.0 | | % | | 50-130 | 15-JUN-20 |
| Phenanthrene | | | 91.1 | | % | | 60-130 | 15-JUN-20 |
| Pyrene | | | 92.7 | | % | | 60-130 | 15-JUN-20 |
| **WG3342529-2 LCS** | | | | | | | | |
| Acenaphthene | | | 94.4 | | % | | 60-130 | 15-JUN-20 |
| Acenaphthylene | | | 92.9 | | % | | 60-130 | 15-JUN-20 |
| Anthracene | | | 95.0 | | % | | 60-130 | 15-JUN-20 |
| Benz(a)anthracene | | | 93.1 | | % | | 60-130 | 15-JUN-20 |
| Benzo(a)pyrene | | | 97.1 | | % | | 60-130 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | 94.6 | | % | | 60-130 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | 89.6 | | % | | 60-130 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | 95.2 | | % | | 60-130 | 15-JUN-20 |
| Chrysene | | | 94.0 | | % | | 60-130 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | 93.5 | | % | | 60-130 | 15-JUN-20 |
| Fluoranthene | | | 95.5 | | % | | 60-130 | 15-JUN-20 |
| Fluorene | | | 94.7 | | % | | 60-130 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 89.9 | | % | | 60-130 | 15-JUN-20 |
| 1-Methylnaphthalene | | | 91.7 | | % | | 60-130 | 15-JUN-20 |
| 2-Methylnaphthalene | | | 91.1 | | % | | 60-130 | 15-JUN-20 |
| Naphthalene | | | 89.6 | | % | | 50-130 | 15-JUN-20 |
| Phenanthrene | | | 94.4 | | % | | 60-130 | 15-JUN-20 |
| Pyrene | | | 97.8 | | % | | 60-130 | 15-JUN-20 |
| Quinoline | | | 87.4 | | % | | 60-130 | 15-JUN-20 |
| **WG3342529-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 15-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5116579** | | | | | | | | |
| **WG3342529-1 MB** | | | | | | | | |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| Surrogate: Naphthalene d8 | | | 88.6 | | % | | 50-130 | 15-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 93.2 | | % | | 60-130 | 15-JUN-20 |
| Surrogate: Chrysene d12 | | | 90.9 | | % | | 60-130 | 15-JUN-20 |
| **Batch R5117663** | | | | | | | | |
| **WG3341710-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 95.4 | | % | | 60-130 | 15-JUN-20 |
| Acenaphthylene | | | 105.4 | | % | | 60-130 | 15-JUN-20 |
| Anthracene | | | 104.6 | | % | | 60-130 | 15-JUN-20 |
| Benz(a)anthracene | | | 97.7 | | % | | 60-130 | 15-JUN-20 |
| Benzo(a)pyrene | | | 97.5 | | % | | 60-130 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | 93.4 | | % | | 60-130 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | 96.9 | | % | | 60-130 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | 90.6 | | % | | 60-130 | 15-JUN-20 |
| Chrysene | | | 86.0 | | % | | 60-130 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | 99.5 | | % | | 60-130 | 15-JUN-20 |
| Fluoranthene | | | 95.3 | | % | | 60-130 | 15-JUN-20 |
| Fluorene | | | 95.5 | | % | | 60-130 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 98.5 | | % | | 60-130 | 15-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5117663** | | | | | | | | |
| **WG3341710-5 IRM** | | **ALS PAH RM2** | | | | | | |
| 1-Methylnaphthalene | | | 93.7 | | % | | 60-130 | 15-JUN-20 |
| 2-Methylnaphthalene | | | 91.5 | | % | | 60-130 | 15-JUN-20 |
| Naphthalene | | | 95.5 | | % | | 50-130 | 15-JUN-20 |
| Phenanthrene | | | 94.9 | | % | | 60-130 | 15-JUN-20 |
| Pyrene | | | 97.4 | | % | | 60-130 | 15-JUN-20 |
| **WG3341710-2 LCS** | | | | | | | | |
| Acenaphthene | | | 99.98 | | % | | 60-130 | 15-JUN-20 |
| Acenaphthylene | | | 98.1 | | % | | 60-130 | 15-JUN-20 |
| Anthracene | | | 98.9 | | % | | 60-130 | 15-JUN-20 |
| Benz(a)anthracene | | | 108.3 | | % | | 60-130 | 15-JUN-20 |
| Benzo(a)pyrene | | | 92.9 | | % | | 60-130 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | 99.5 | | % | | 60-130 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | 107.8 | | % | | 60-130 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | 102.5 | | % | | 60-130 | 15-JUN-20 |
| Chrysene | | | 100.4 | | % | | 60-130 | 15-JUN-20 |
| Dibenz(a,h)anthracene | | | 102.8 | | % | | 60-130 | 15-JUN-20 |
| Fluoranthene | | | 100.2 | | % | | 60-130 | 15-JUN-20 |
| Fluorene | | | 98.7 | | % | | 60-130 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 110.6 | | % | | 60-130 | 15-JUN-20 |
| 1-Methylnaphthalene | | | 99.5 | | % | | 60-130 | 15-JUN-20 |
| 2-Methylnaphthalene | | | 98.0 | | % | | 60-130 | 15-JUN-20 |
| Naphthalene | | | 100.1 | | % | | 50-130 | 15-JUN-20 |
| Phenanthrene | | | 98.3 | | % | | 60-130 | 15-JUN-20 |
| Pyrene | | | 104.2 | | % | | 60-130 | 15-JUN-20 |
| Quinoline | | | 97.1 | | % | | 60-130 | 15-JUN-20 |
| **WG3341710-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 15-JUN-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5117663** | | | | | | | | |
| **WG3341710-1 MB** | | | | | | | | |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 15-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| Surrogate: Naphthalene d8 | | | 116.1 | | % | | 50-130 | 15-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 122.6 | | % | | 60-130 | 15-JUN-20 |
| Surrogate: Chrysene d12 | | | 125.7 | | % | | 60-130 | 15-JUN-20 |
| **Batch R5118802** | | | | | | | | |
| **WG3342711-3 DUP** | | **L2460211-7** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Phenanthrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 16-JUN-20 |
| **WG3342711-5** | | **ALS PAH RM2** | | | | | | |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5118802** | | | | | | | | |
| **WG3342711-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 91.3 | | % | | 60-130 | 16-JUN-20 |
| Acenaphthylene | | | 101.3 | | % | | 60-130 | 16-JUN-20 |
| Anthracene | | | 98.4 | | % | | 60-130 | 16-JUN-20 |
| Benz(a)anthracene | | | 89.9 | | % | | 60-130 | 16-JUN-20 |
| Benzo(a)pyrene | | | 90.6 | | % | | 60-130 | 16-JUN-20 |
| Benzo(b&j)fluoranthene | | | 87.3 | | % | | 60-130 | 16-JUN-20 |
| Benzo(g,h,i)perylene | | | 90.4 | | % | | 60-130 | 16-JUN-20 |
| Benzo(k)fluoranthene | | | 82.6 | | % | | 60-130 | 16-JUN-20 |
| Chrysene | | | 94.3 | | % | | 60-130 | 16-JUN-20 |
| Dibenz(a,h)anthracene | | | 92.6 | | % | | 60-130 | 16-JUN-20 |
| Fluoranthene | | | 90.4 | | % | | 60-130 | 16-JUN-20 |
| Fluorene | | | 91.2 | | % | | 60-130 | 16-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 88.0 | | % | | 60-130 | 16-JUN-20 |
| 1-Methylnaphthalene | | | 90.1 | | % | | 60-130 | 16-JUN-20 |
| 2-Methylnaphthalene | | | 87.6 | | % | | 60-130 | 16-JUN-20 |
| Naphthalene | | | 91.9 | | % | | 50-130 | 16-JUN-20 |
| Phenanthrene | | | 90.2 | | % | | 60-130 | 16-JUN-20 |
| Pyrene | | | 91.6 | | % | | 60-130 | 16-JUN-20 |
| **WG3342711-2 LCS** | | | | | | | | |
| Acenaphthene | | | 101.3 | | % | | 60-130 | 16-JUN-20 |
| Acenaphthylene | | | 99.0 | | % | | 60-130 | 16-JUN-20 |
| Anthracene | | | 98.9 | | % | | 60-130 | 16-JUN-20 |
| Benz(a)anthracene | | | 97.9 | | % | | 60-130 | 16-JUN-20 |
| Benzo(a)pyrene | | | 99.6 | | % | | 60-130 | 16-JUN-20 |
| Benzo(b&j)fluoranthene | | | 99.0 | | % | | 60-130 | 16-JUN-20 |
| Benzo(g,h,i)perylene | | | 96.2 | | % | | 60-130 | 16-JUN-20 |
| Benzo(k)fluoranthene | | | 102.9 | | % | | 60-130 | 16-JUN-20 |
| Chrysene | | | 99.5 | | % | | 60-130 | 16-JUN-20 |
| Dibenz(a,h)anthracene | | | 101.1 | | % | | 60-130 | 16-JUN-20 |
| Fluoranthene | | | 101.4 | | % | | 60-130 | 16-JUN-20 |
| Fluorene | | | 99.8 | | % | | 60-130 | 16-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 95.8 | | % | | 60-130 | 16-JUN-20 |
| 1-Methylnaphthalene | | | 99.3 | | % | | 60-130 | 16-JUN-20 |
| 2-Methylnaphthalene | | | 98.2 | | % | | 60-130 | 16-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5118802** | | | | | | | | |
| **WG3342711-2 LCS** | | | | | | | | |
| Naphthalene | | | 98.1 | | % | | 50-130 | 16-JUN-20 |
| Phenanthrene | | | 99.3 | | % | | 60-130 | 16-JUN-20 |
| Pyrene | | | 103.8 | | % | | 60-130 | 16-JUN-20 |
| Quinoline | | | 93.8 | | % | | 60-130 | 16-JUN-20 |
| **WG3342711-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 16-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 16-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 16-JUN-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 16-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 16-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 16-JUN-20 |
| Surrogate: Naphthalene d8 | | | 92.8 | | % | | 50-130 | 16-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 94.6 | | % | | 60-130 | 16-JUN-20 |
| Surrogate: Chrysene d12 | | | 91.4 | | % | | 60-130 | 16-JUN-20 |
| **Batch R5130179** | | | | | | | | |
| **WG3347576-3 DUP** | | **L2460211-2** | | | | | | |
| Acenaphthene | | <0.70 | <0.50 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Acenaphthylene | | <0.16 | <0.15 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Anthracene | | <0.040 | <0.040 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5130179** | | | | | | | | |
| **WG3347576-3 DUP** | | **L2460211-2** | | | | | | |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Fluorene | | 0.812 | 0.486 | DUP-H | mg/kg | 50 | 50 | 23-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| 1-Methylnaphthalene | | 8.21 | 4.88 | DUP-H | mg/kg | 51 | 50 | 23-JUN-20 |
| 2-Methylnaphthalene | | 11.7 | 7.01 | | mg/kg | 50 | 50 | 23-JUN-20 |
| Naphthalene | | <6.5 | <4.0 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Phenanthrene | | <0.40 | <0.30 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| Pyrene | | 0.054 | 0.034 | | mg/kg | 47 | 50 | 23-JUN-20 |
| Quinoline | | <1.5 | <1.5 | RPD-NA | mg/kg | N/A | 50 | 23-JUN-20 |
| **WG3347576-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 97.6 | | % | | 60-130 | 23-JUN-20 |
| Acenaphthylene | | | 103.4 | | % | | 60-130 | 23-JUN-20 |
| Anthracene | | | 104.9 | | % | | 60-130 | 23-JUN-20 |
| Benz(a)anthracene | | | 88.3 | | % | | 60-130 | 23-JUN-20 |
| Benzo(a)pyrene | | | 89.8 | | % | | 60-130 | 23-JUN-20 |
| Benzo(b&j)fluoranthene | | | 87.6 | | % | | 60-130 | 23-JUN-20 |
| Benzo(g,h,i)perylene | | | 92.9 | | % | | 60-130 | 23-JUN-20 |
| Benzo(k)fluoranthene | | | 90.1 | | % | | 60-130 | 23-JUN-20 |
| Chrysene | | | 96.2 | | % | | 60-130 | 23-JUN-20 |
| Dibenz(a,h)anthracene | | | 93.8 | | % | | 60-130 | 23-JUN-20 |
| Fluoranthene | | | 93.7 | | % | | 60-130 | 23-JUN-20 |
| Fluorene | | | 96.8 | | % | | 60-130 | 23-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 88.2 | | % | | 60-130 | 23-JUN-20 |
| 1-Methylnaphthalene | | | 95.8 | | % | | 60-130 | 23-JUN-20 |
| 2-Methylnaphthalene | | | 94.4 | | % | | 60-130 | 23-JUN-20 |
| Naphthalene | | | 98.6 | | % | | 50-130 | 23-JUN-20 |
| Phenanthrene | | | 94.3 | | % | | 60-130 | 23-JUN-20 |
| Pyrene | | | 95.4 | | % | | 60-130 | 23-JUN-20 |
| **WG3347576-2 LCS** | | | | | | | | |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5130179** | | | | | | | | |
| **WG3347576-2 LCS** | | | | | | | | |
| Acenaphthene | | | 95.2 | | % | | 60-130 | 23-JUN-20 |
| Acenaphthylene | | | 93.2 | | % | | 60-130 | 23-JUN-20 |
| Anthracene | | | 94.7 | | % | | 60-130 | 23-JUN-20 |
| Benz(a)anthracene | | | 92.1 | | % | | 60-130 | 23-JUN-20 |
| Benzo(a)pyrene | | | 95.2 | | % | | 60-130 | 23-JUN-20 |
| Benzo(b&j)fluoranthene | | | 91.4 | | % | | 60-130 | 23-JUN-20 |
| Benzo(g,h,i)perylene | | | 91.8 | | % | | 60-130 | 23-JUN-20 |
| Benzo(k)fluoranthene | | | 97.5 | | % | | 60-130 | 23-JUN-20 |
| Chrysene | | | 94.2 | | % | | 60-130 | 23-JUN-20 |
| Dibenz(a,h)anthracene | | | 95.3 | | % | | 60-130 | 23-JUN-20 |
| Fluoranthene | | | 95.4 | | % | | 60-130 | 23-JUN-20 |
| Fluorene | | | 94.6 | | % | | 60-130 | 23-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 89.8 | | % | | 60-130 | 23-JUN-20 |
| 1-Methylnaphthalene | | | 92.8 | | % | | 60-130 | 23-JUN-20 |
| 2-Methylnaphthalene | | | 92.1 | | % | | 60-130 | 23-JUN-20 |
| Naphthalene | | | 91.7 | | % | | 50-130 | 23-JUN-20 |
| Phenanthrene | | | 93.5 | | % | | 60-130 | 23-JUN-20 |
| Pyrene | | | 98.1 | | % | | 60-130 | 23-JUN-20 |
| Quinoline | | | 88.7 | | % | | 60-130 | 23-JUN-20 |
| **WG3347576-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 23-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 23-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 23-JUN-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 23-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5130179** | | | | | | | | |
| **WG3347576-1 MB** | | | | | | | | |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 23-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 23-JUN-20 |
| Surrogate: Naphthalene d8 | | | 101.2 | | % | | 50-130 | 23-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 103.2 | | % | | 60-130 | 23-JUN-20 |
| Surrogate: Chrysene d12 | | | 100.2 | | % | | 60-130 | 23-JUN-20 |
| **Batch R5132043** | | | | | | | | |
| **WG3348924-3 DUP** | | **L2460211-21** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Phenanthrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 25-JUN-20 |
| **WG3348924-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 87.6 | | % | | 60-130 | 25-JUN-20 |
| Acenaphthylene | | | 86.4 | | % | | 60-130 | 25-JUN-20 |
| Anthracene | | | 85.0 | | % | | 60-130 | 25-JUN-20 |
| Benz(a)anthracene | | | 83.1 | | % | | 60-130 | 25-JUN-20 |
| Benzo(a)pyrene | | | 82.4 | | % | | 60-130 | 25-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5132043** | | | | | | | | |
| **WG3348924-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Benzo(b&j)fluoranthene | | | 86.4 | | % | | 60-130 | 25-JUN-20 |
| Benzo(g,h,i)perylene | | | 84.1 | | % | | 60-130 | 25-JUN-20 |
| Benzo(k)fluoranthene | | | 77.8 | | % | | 60-130 | 25-JUN-20 |
| Chrysene | | | 86.4 | | % | | 60-130 | 25-JUN-20 |
| Dibenz(a,h)anthracene | | | 86.2 | | % | | 60-130 | 25-JUN-20 |
| Fluoranthene | | | 87.3 | | % | | 60-130 | 25-JUN-20 |
| Fluorene | | | 88.3 | | % | | 60-130 | 25-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 84.8 | | % | | 60-130 | 25-JUN-20 |
| 1-Methylnaphthalene | | | 82.8 | | % | | 60-130 | 25-JUN-20 |
| 2-Methylnaphthalene | | | 80.5 | | % | | 60-130 | 25-JUN-20 |
| Naphthalene | | | 84.0 | | % | | 50-130 | 25-JUN-20 |
| Phenanthrene | | | 86.9 | | % | | 60-130 | 25-JUN-20 |
| Pyrene | | | 88.8 | | % | | 60-130 | 25-JUN-20 |
| **WG3348924-2 LCS** | | | | | | | | |
| Acenaphthene | | | 88.3 | | % | | 60-130 | 25-JUN-20 |
| Acenaphthylene | | | 87.8 | | % | | 60-130 | 25-JUN-20 |
| Anthracene | | | 96.9 | | % | | 60-130 | 25-JUN-20 |
| Benz(a)anthracene | | | 98.6 | | % | | 60-130 | 25-JUN-20 |
| Benzo(a)pyrene | | | 98.1 | | % | | 60-130 | 25-JUN-20 |
| Benzo(b&j)fluoranthene | | | 99.8 | | % | | 60-130 | 25-JUN-20 |
| Benzo(g,h,i)perylene | | | 93.0 | | % | | 60-130 | 25-JUN-20 |
| Benzo(k)fluoranthene | | | 95.6 | | % | | 60-130 | 25-JUN-20 |
| Chrysene | | | 92.0 | | % | | 60-130 | 25-JUN-20 |
| Dibenz(a,h)anthracene | | | 95.3 | | % | | 60-130 | 25-JUN-20 |
| Fluoranthene | | | 97.1 | | % | | 60-130 | 25-JUN-20 |
| Fluorene | | | 92.6 | | % | | 60-130 | 25-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 96.9 | | % | | 60-130 | 25-JUN-20 |
| 1-Methylnaphthalene | | | 75.8 | | % | | 60-130 | 25-JUN-20 |
| 2-Methylnaphthalene | | | 75.1 | | % | | 60-130 | 25-JUN-20 |
| Naphthalene | | | 66.1 | | % | | 50-130 | 25-JUN-20 |
| Phenanthrene | | | 96.6 | | % | | 60-130 | 25-JUN-20 |
| Pyrene | | | 101.9 | | % | | 60-130 | 25-JUN-20 |
| Quinoline | | | 79.8 | | % | | 60-130 | 25-JUN-20 |
| **WG3348924-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 25-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5132043** | | | | | | | | |
| **WG3348924-1 MB** | | | | | | | | |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 25-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 25-JUN-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 25-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 25-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 25-JUN-20 |
| Surrogate: Naphthalene d8 | | | 95.9 | | % | | 50-130 | 25-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 101.0 | | % | | 60-130 | 25-JUN-20 |
| Surrogate: Chrysene d12 | | | 108.3 | | % | | 60-130 | 25-JUN-20 |
| **Batch R5138217** | | | | | | | | |
| **WG3352606-3 DUP** | | **L2460211-15** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |

# Quality Control Report

Workorder: L2460211 Report Date: 30-JUN-20

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5138217** | | | | | | | | |
| **WG3352606-3 DUP** | | **L2460211-15** | | | | | | |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Phenanthrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| **WG3352606-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 88.3 | | % | | 60-130 | 30-JUN-20 |
| Acenaphthylene | | | 94.5 | | % | | 60-130 | 30-JUN-20 |
| Anthracene | | | 83.1 | | % | | 60-130 | 30-JUN-20 |
| Benz(a)anthracene | | | 83.2 | | % | | 60-130 | 30-JUN-20 |
| Benzo(a)pyrene | | | 80.8 | | % | | 60-130 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | | 81.5 | | % | | 60-130 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | | 81.1 | | % | | 60-130 | 30-JUN-20 |
| Benzo(k)fluoranthene | | | 79.7 | | % | | 60-130 | 30-JUN-20 |
| Chrysene | | | 91.8 | | % | | 60-130 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | | 87.7 | | % | | 60-130 | 30-JUN-20 |
| Fluoranthene | | | 85.3 | | % | | 60-130 | 30-JUN-20 |
| Fluorene | | | 86.7 | | % | | 60-130 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 76.1 | | % | | 60-130 | 30-JUN-20 |
| 1-Methylnaphthalene | | | 87.9 | | % | | 60-130 | 30-JUN-20 |
| 2-Methylnaphthalene | | | 85.2 | | % | | 60-130 | 30-JUN-20 |
| Naphthalene | | | 87.5 | | % | | 50-130 | 30-JUN-20 |
| Phenanthrene | | | 83.8 | | % | | 60-130 | 30-JUN-20 |
| Pyrene | | | 87.1 | | % | | 60-130 | 30-JUN-20 |
| **WG3352606-2 LCS** | | | | | | | | |
| Acenaphthene | | | 101.9 | | % | | 60-130 | 30-JUN-20 |
| Acenaphthylene | | | 97.7 | | % | | 60-130 | 30-JUN-20 |
| Anthracene | | | 86.9 | | % | | 60-130 | 30-JUN-20 |
| Benz(a)anthracene | | | 87.8 | | % | | 60-130 | 30-JUN-20 |
| Benzo(a)pyrene | | | 88.4 | | % | | 60-130 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | | 87.8 | | % | | 60-130 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | | 88.6 | | % | | 60-130 | 30-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5138217** | | | | | | | | |
| **WG3352606-2 LCS** | | | | | | | | |
| Benzo(k)fluoranthene | | | 96.5 | | % | | 60-130 | 30-JUN-20 |
| Chrysene | | | 92.4 | | % | | 60-130 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | | 88.2 | | % | | 60-130 | 30-JUN-20 |
| Fluoranthene | | | 95.1 | | % | | 60-130 | 30-JUN-20 |
| Fluorene | | | 96.8 | | % | | 60-130 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 82.1 | | % | | 60-130 | 30-JUN-20 |
| 1-Methylnaphthalene | | | 101.0 | | % | | 60-130 | 30-JUN-20 |
| 2-Methylnaphthalene | | | 98.7 | | % | | 60-130 | 30-JUN-20 |
| Naphthalene | | | 98.4 | | % | | 50-130 | 30-JUN-20 |
| Phenanthrene | | | 92.6 | | % | | 60-130 | 30-JUN-20 |
| Pyrene | | | 99.6 | | % | | 60-130 | 30-JUN-20 |
| Quinoline | | | 81.8 | | % | | 60-130 | 30-JUN-20 |
| **WG3352606-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 30-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 30-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 30-JUN-20 |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 30-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 30-JUN-20 |
| Surrogate: Naphthalene d8 | | | 92.9 | | % | | 50-130 | 30-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 90.7 | | % | | 60-130 | 30-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5138217** | | | | | | | | |
| **WG3352606-1 MB** | | | | | | | | |
| Surrogate: Chrysene d12 | | | 88.8 | | % | | 60-130 | 30-JUN-20 |
| **PH-1:2-VA** | **Soil** | | | | | | | |
| **Batch R5117620** | | | | | | | | |
| **WG3341709-2 DUP** | | **L2460211-4** | | | | | | |
| pH (1:2 soil:water) | | 8.05 | 8.04 | J | pH | 0.01 | 0.2 | 15-JUN-20 |
| **Batch R5135168** | | | | | | | | |
| **WG3348942-2 DUP** | | **L2460211-15** | | | | | | |
| pH (1:2 soil:water) | | 7.72 | 7.73 | J | pH | 0.01 | 0.2 | 27-JUN-20 |
| **VH-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5088862** | | | | | | | | |
| **WG3347680-3 DUP** | | **L2460211-2** | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | 980 | 1250 | | mg/kg | 25 | 40 | 23-JUN-20 |
| **WG3347680-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 70.2 | | % | | 70-130 | 23-JUN-20 |
| **WG3347680-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 23-JUN-20 |
| **Batch R5115828** | | | | | | | | |
| **WG3341835-3 DUP** | | **L2460211-8** | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | <100 | <100 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| **WG3349012-3 DUP** | | **L2460211-19** | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | <100 | <100 | RPD-NA | mg/kg | N/A | 40 | 25-JUN-20 |
| **WG3341835-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 111.6 | | % | | 70-130 | 15-JUN-20 |
| **WG3349012-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 72.2 | | % | | 70-130 | 25-JUN-20 |
| **WG3341835-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 15-JUN-20 |
| **WG3349012-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 25-JUN-20 |
| **Batch R5117484** | | | | | | | | |
| **WG3349866-3 DUP** | | **L2460211-21** | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | <100 | <100 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| **WG3342742-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 99.5 | | % | | 70-130 | 16-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VH-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5117484** | | | | | | | | |
| **WG3349866-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 108.4 | | % | | 70-130 | 26-JUN-20 |
| **WG3342742-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 16-JUN-20 |
| **WG3349866-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 26-JUN-20 |
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5112127** | | | | | | | | |
| **WG3341835-3 DUP** | | **L2460211-8** | | | | | | |
| n-Nonane | | <0.060 | <0.070 | RPD-NA | mg/kg | N/A | 50 | 15-JUN-20 |
| **WG3349012-3 DUP** | | **L2460211-19** | | | | | | |
| n-Nonane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 24-JUN-20 |
| **WG3341835-2 LCS** | | | | | | | | |
| n-Nonane | | | 132.8 | LCS-ND | % | | 70-130 | 15-JUN-20 |
| **WG3349012-2 LCS** | | | | | | | | |
| n-Nonane | | | 97.7 | | % | | 70-130 | 24-JUN-20 |
| **WG3341835-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| **WG3349012-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 24-JUN-20 |
| **Batch R5117129** | | | | | | | | |
| **WG3349866-3 DUP** | | **L2460211-21** | | | | | | |
| n-Nonane | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 26-JUN-20 |
| **WG3342742-2 LCS** | | | | | | | | |
| n-Nonane | | | 85.5 | | % | | 70-130 | 16-JUN-20 |
| **WG3349866-2 LCS** | | | | | | | | |
| n-Nonane | | | 54.9 | LCS-ND | % | | 70-130 | 26-JUN-20 |
| **WG3342742-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 16-JUN-20 |
| **WG3349866-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 26-JUN-20 |
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5088376** | | | | | | | | |
| **WG3347680-3 DUP** | | **L2460211-2** | | | | | | |
| Benzene | | 0.399 | 0.353 | | mg/kg | 12 | 40 | 23-JUN-20 |
| Ethylbenzene | | 15.2 | 14.9 | | mg/kg | 1.9 | 40 | 23-JUN-20 |
| Methyl t-butyl ether (MTBE) | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 40 | 23-JUN-20 |
| Styrene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 23-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5088376** | | | | | | | | |
| **WG3347680-3 DUP** | | **L2460211-2** | | | | | | |
| Toluene | | 7.03 | 7.48 | | mg/kg | 6.1 | 40 | 23-JUN-20 |
| meta- & para-Xylene | | 61.3 | 60.7 | | mg/kg | 0.9 | 40 | 23-JUN-20 |
| ortho-Xylene | | 29.9 | 29.3 | | mg/kg | 1.7 | 40 | 23-JUN-20 |
| **WG3347680-2 LCS** | | | | | | | | |
| Benzene | | | 87.2 | | % | | 70-130 | 23-JUN-20 |
| Ethylbenzene | | | 94.6 | | % | | 70-130 | 23-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 99.1 | | % | | 70-130 | 23-JUN-20 |
| Styrene | | | 87.9 | | % | | 70-130 | 23-JUN-20 |
| Toluene | | | 92.6 | | % | | 70-130 | 23-JUN-20 |
| meta- & para-Xylene | | | 92.7 | | % | | 70-130 | 23-JUN-20 |
| ortho-Xylene | | | 91.5 | | % | | 70-130 | 23-JUN-20 |
| **WG3347680-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 23-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 23-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 23-JUN-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 23-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 23-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 23-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 23-JUN-20 |
| **Batch R5112127** | | | | | | | | |
| **WG3341835-3 DUP** | | **L2460211-8** | | | | | | |
| Benzene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| Ethylbenzene | | <0.015 | <0.015 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| Methyl t-butyl ether (MTBE) | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| Styrene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| Toluene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| meta- & para-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| ortho-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 15-JUN-20 |
| **WG3349012-3 DUP** | | **L2460211-19** | | | | | | |
| Benzene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |
| Ethylbenzene | | <0.015 | <0.015 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |
| Methyl t-butyl ether (MTBE) | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |
| Styrene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |
| Toluene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |
| meta- & para-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5112127** | | | | | | | | |
| **WG3349012-3 DUP** | | **L2460211-19** | | | | | | |
| ortho-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 24-JUN-20 |
| **WG3341835-2 LCS** | | | | | | | | |
| Benzene | | | 101.8 | | % | | 70-130 | 15-JUN-20 |
| Ethylbenzene | | | 110.4 | | % | | 70-130 | 15-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 104.5 | | % | | 70-130 | 15-JUN-20 |
| Styrene | | | 93.0 | | % | | 70-130 | 15-JUN-20 |
| Toluene | | | 105.5 | | % | | 70-130 | 15-JUN-20 |
| meta- & para-Xylene | | | 110.1 | | % | | 70-130 | 15-JUN-20 |
| ortho-Xylene | | | 109.3 | | % | | 70-130 | 15-JUN-20 |
| **WG3349012-2 LCS** | | | | | | | | |
| Benzene | | | 103.3 | | % | | 70-130 | 24-JUN-20 |
| Ethylbenzene | | | 111.8 | | % | | 70-130 | 24-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 107.3 | | % | | 70-130 | 24-JUN-20 |
| Styrene | | | 90.6 | | % | | 70-130 | 24-JUN-20 |
| Toluene | | | 108.9 | | % | | 70-130 | 24-JUN-20 |
| meta- & para-Xylene | | | 113.2 | | % | | 70-130 | 24-JUN-20 |
| ortho-Xylene | | | 109.1 | | % | | 70-130 | 24-JUN-20 |
| **WG3341835-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 15-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 15-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 15-JUN-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 15-JUN-20 |
| **WG3349012-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 24-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 24-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 24-JUN-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 24-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 24-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 24-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 24-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3349866-3 DUP** | | **L2460211-21** | | | | | | |
| Benzene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| Ethylbenzene | | <0.015 | <0.015 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| Methyl t-butyl ether (MTBE) | | <0.20 | <0.20 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| Styrene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| Toluene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| meta- & para-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| ortho-Xylene | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 40 | 26-JUN-20 |
| **WG3342742-2 LCS** | | | | | | | | |
| Benzene | | | 92.7 | | % | | 70-130 | 16-JUN-20 |
| Ethylbenzene | | | 94.1 | | % | | 70-130 | 16-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 111.7 | | % | | 70-130 | 16-JUN-20 |
| Styrene | | | 88.7 | | % | | 70-130 | 16-JUN-20 |
| Toluene | | | 95.8 | | % | | 70-130 | 16-JUN-20 |
| meta- & para-Xylene | | | 106.2 | | % | | 70-130 | 16-JUN-20 |
| ortho-Xylene | | | 90.6 | | % | | 70-130 | 16-JUN-20 |
| **WG3349866-2 LCS** | | | | | | | | |
| Benzene | | | 99.98 | | % | | 70-130 | 26-JUN-20 |
| Ethylbenzene | | | 95.7 | | % | | 70-130 | 26-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 120.2 | | % | | 70-130 | 26-JUN-20 |
| Styrene | | | 93.8 | | % | | 70-130 | 26-JUN-20 |
| Toluene | | | 99.4 | | % | | 70-130 | 26-JUN-20 |
| meta- & para-Xylene | | | 109.0 | | % | | 70-130 | 26-JUN-20 |
| ortho-Xylene | | | 93.7 | | % | | 70-130 | 26-JUN-20 |
| **WG3342742-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 16-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 16-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 16-JUN-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 16-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 16-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 16-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 16-JUN-20 |
| **WG3349866-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 26-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 26-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 26-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3349866-1 MB** | | | | | | | | |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 26-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 26-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 26-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 26-JUN-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| DUP-H | Duplicate results outside ALS DQO, due to sample heterogeneity. |
| J | Duplicate results and limits are expressed in terms of absolute difference. |
| LCS-ND | Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

# Quality Control Report

**Hold Time Exceedances:**

| ALS Product Description | Sample ID | Sampling Date | Date Processed | Rec. HT | Actual HT | Units | Qualifier |
|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | | | | |
| VOC in Soil Methanol Extraction | | | | | | | |
| | 20 | 11-JUN-20 13:00 | 25-JUN-20 07:54 | 48 | 331 | hours | EHT |
| | 21 | 11-JUN-20 13:00 | 25-JUN-20 07:54 | 48 | 331 | hours | EHT |
| **Hydrocarbons** | | | | | | | |
| EPH in Solids by Tumbler and GCFID | | | | | | | |
| | 15 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 16 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 17 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 18 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 19 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 20 | 11-JUN-20 13:00 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | |
| PAH - Rotary Extraction (Hexane/Acetone) | | | | | | | |
| | 15 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 16 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 17 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 18 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 19 | 11-JUN-20 14:30 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |
| | 20 | 11-JUN-20 13:00 | 29-JUN-20 20:53 | 14 | 18 | days | EHT |

**Legend & Qualifier Definitions:**

| | |
|---|---|
| EHTR-FM: | Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended. |
| EHTR: | Exceeded ALS recommended hold time prior to sample receipt. |
| EHTL: | Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry. |
| EHT: | Exceeded ALS recommended hold time prior to analysis. |
| Rec. HT: | ALS recommended hold time (see units). |

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2460211 were received on 12-JUN-20 08:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

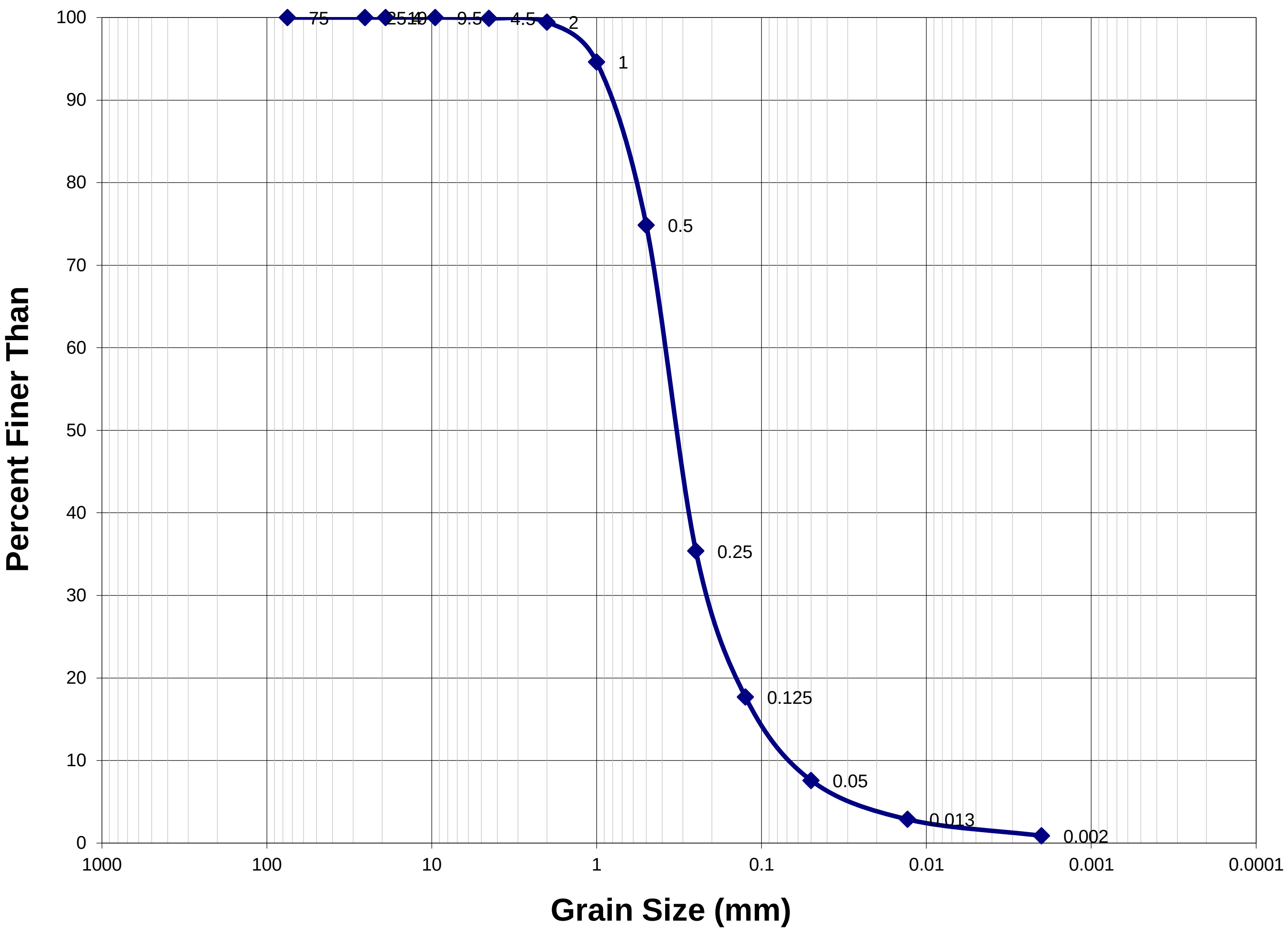
---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

**Client Name:** GOLDER ASSOCIATES LTD. ~VAN
**Project:**
**Sample ID:** 02927-03
**Lab ID:** L2460211-15

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 0 |
| Coarse Sand | 2.0mm - 4.75mm | 0 |
| Medium Sand | 0.425mm - 2.0mm | 25 |
| Fine Sand | 0.075mm - 0.425mm | 64 |
| Fines | < 0.075mm | 11 |

**Canadian Soil Survey Committee (CSSC)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 1 |
| Sand | 0.05mm - 2mm | 92 |
| Silt | 0.002mm - 0.05mm | 7 |
| Clay | < 0.002mm | 1 |

Texture   Sample contains material greater than 4.75mm.  T

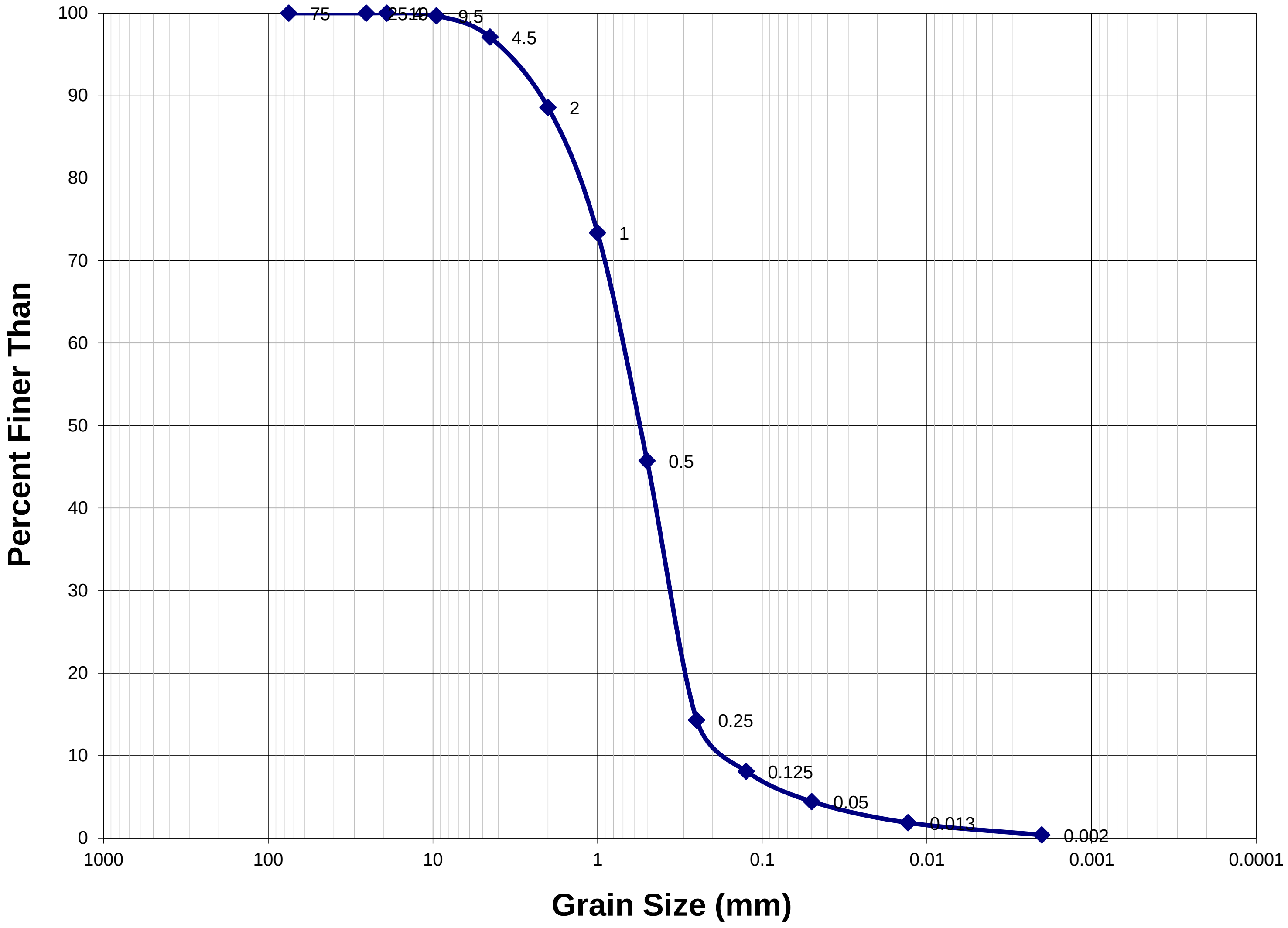
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

**819-58th Street, Saskatoon, SK  S7K 6X5**

**Client Name:** GOLDER ASSOCIATES LTD. ~VAN
**Project:**
**Sample ID:** 02927-04
**Lab ID:** L2460211-16

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 3 |
| Coarse Sand | 2.0mm - 4.75mm | 9 |
| Medium Sand | 0.425mm - 2.0mm | 43 |
| Fine Sand | 0.075mm - 0.425mm | 40 |
| Fines | < 0.075mm | 6 |

**Canadian Soil Survey Committee (CSSC)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 11 |
| Sand | 0.05mm - 2mm | 84 |
| Silt | 0.002mm - 0.05mm | 4 |
| Clay | < 0.002mm | 0 |

Texture Sample contains material greater than 4.75mm. T

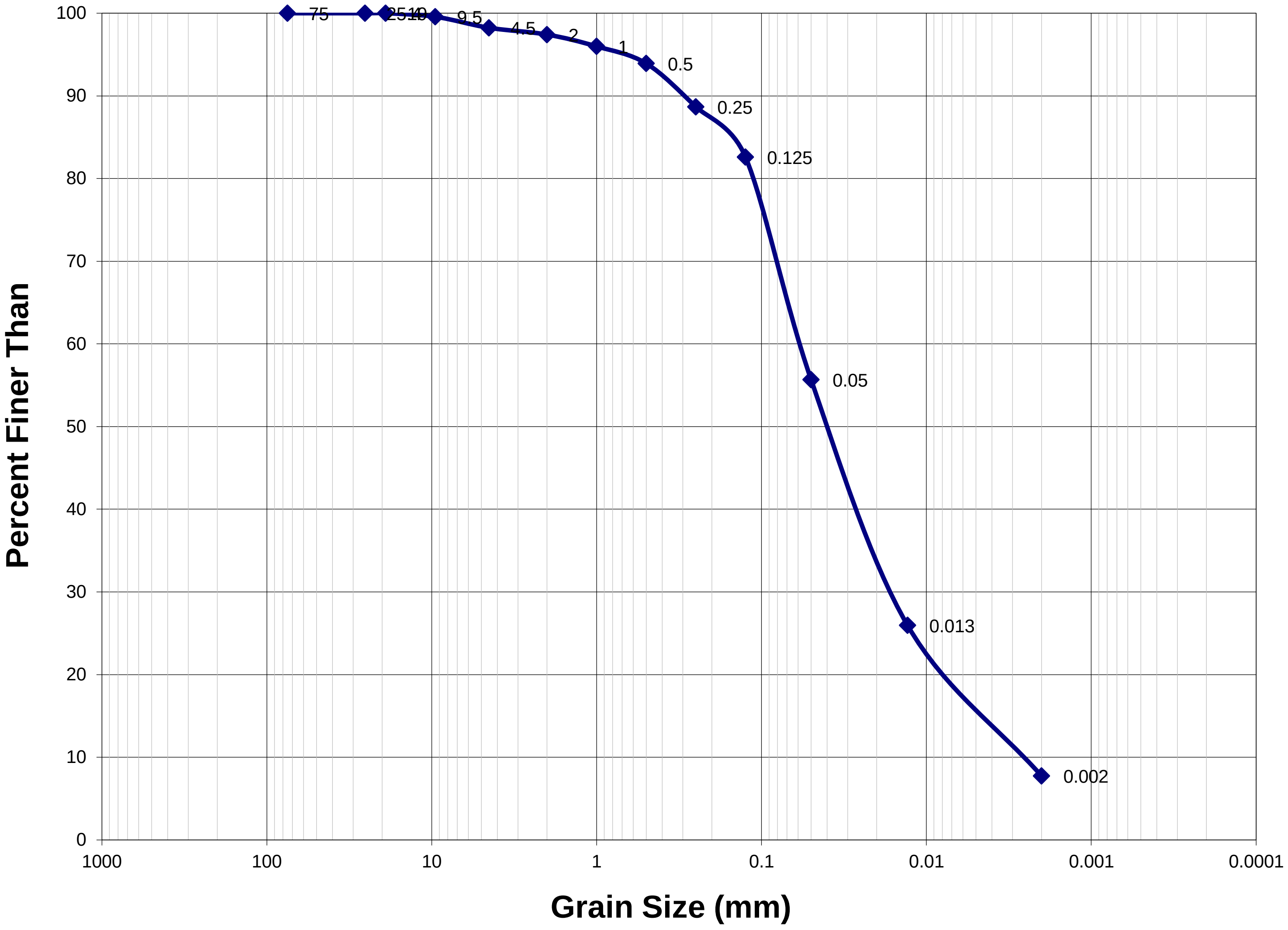
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

**819-58th Street, Saskatoon, SK  S7K 6X5**

**Client Name:** **GOLDER ASSOCIATES LTD. ~VAN**
**Project:**
**Sample ID:** **02926-06**
**Lab ID:** **L2460211-6**

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| **Size Class** | **Size Range** | **Wt. (%)** |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 2 |
| Coarse Sand | 2.0mm - 4.75mm | 1 |
| Medium Sand | 0.425mm - 2.0mm | 3 |
| Fine Sand | 0.075mm - 0.425mm | 29 |
| Fines | < 0.075mm | 65 |

**Canadian Soil Survey Committee (CSSC)**

| **Size Class** | **Size Range** | **Wt. (%)** |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 3 |
| Sand | 0.05mm - 2mm | 42 |
| Silt | 0.002mm - 0.05mm | 48 |
| Clay | < 0.002mm | 8 |

Texture Sample contains material greater than 4.75mm.  T

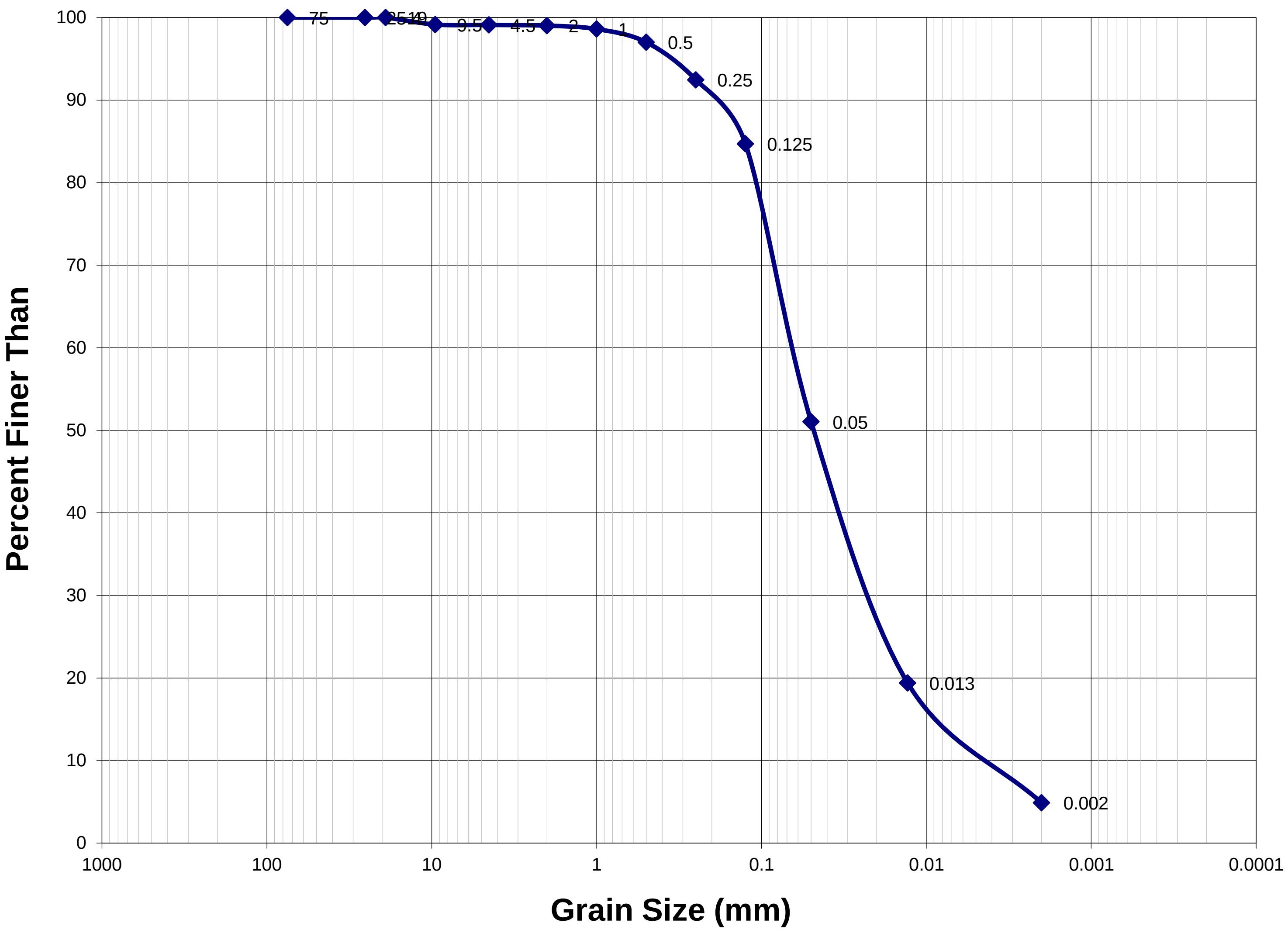
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

**819-58th Street, Saskatoon, SK  S7K 6X5**

**Client Name:** GOLDER ASSOCIATES LTD. ~VAN
**Project:**
**Sample ID:** 02926-07
**Lab ID:** L2460211-7

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 1 |
| Coarse Sand | 2.0mm - 4.75mm | 0 |
| Medium Sand | 0.425mm - 2.0mm | 2 |
| Fine Sand | 0.075mm - 0.425mm | 35 |
| Fines | < 0.075mm | 62 |

**Canadian Soil Survey Committee (CSSC)**

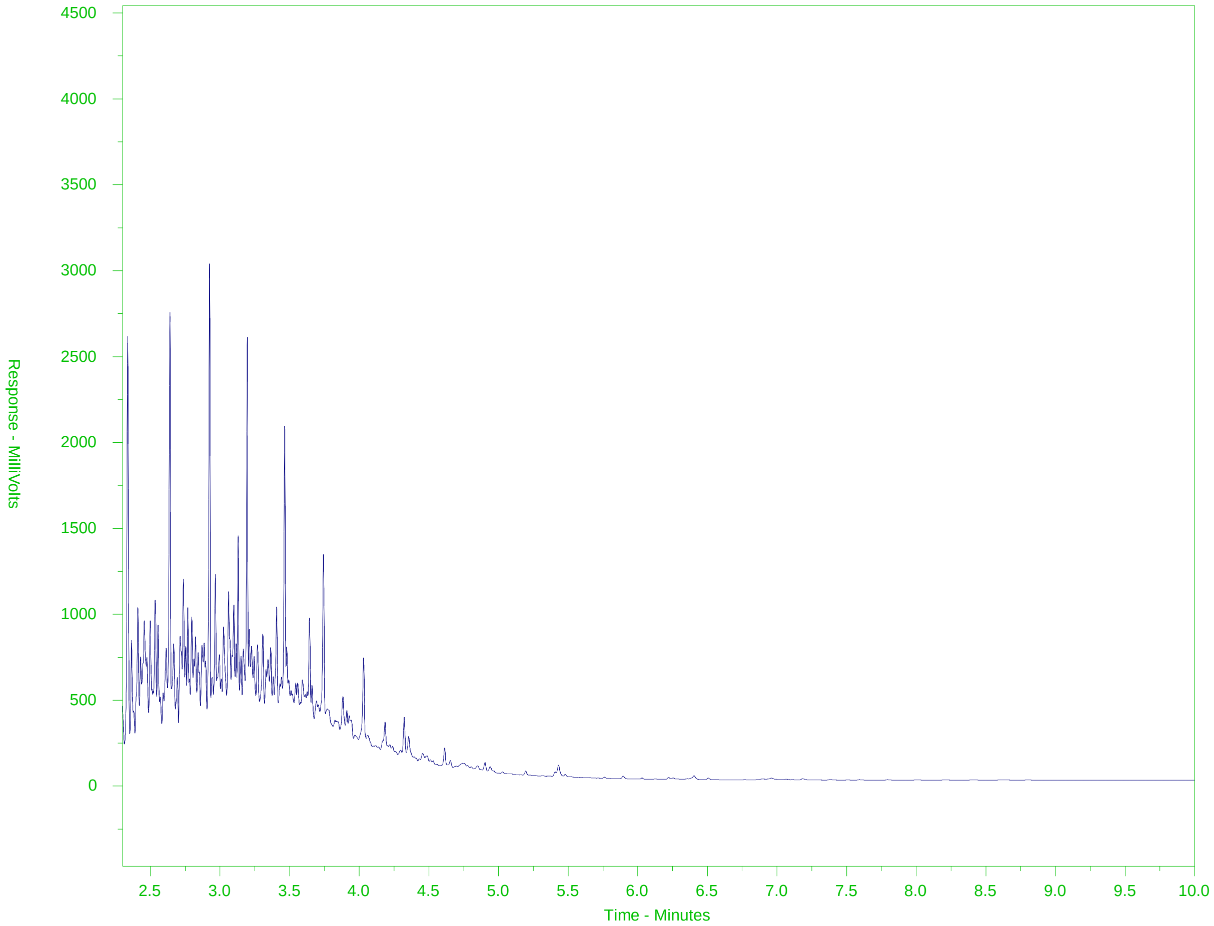
| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 1 |
| Sand | 0.05mm - 2mm | 48 |
| Silt | 0.002mm - 0.05mm | 46 |
| Clay | < 0.002mm | 5 |

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-2
Client Sample ID: 02926-02



| | | |
|---|---|---|
| ←EPH10-19→ | ←EPH19-32→ | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ←Motor Oils/ Lube Oils/ Grease→ | |
| ←Diesel/ Jet Fuels→ | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

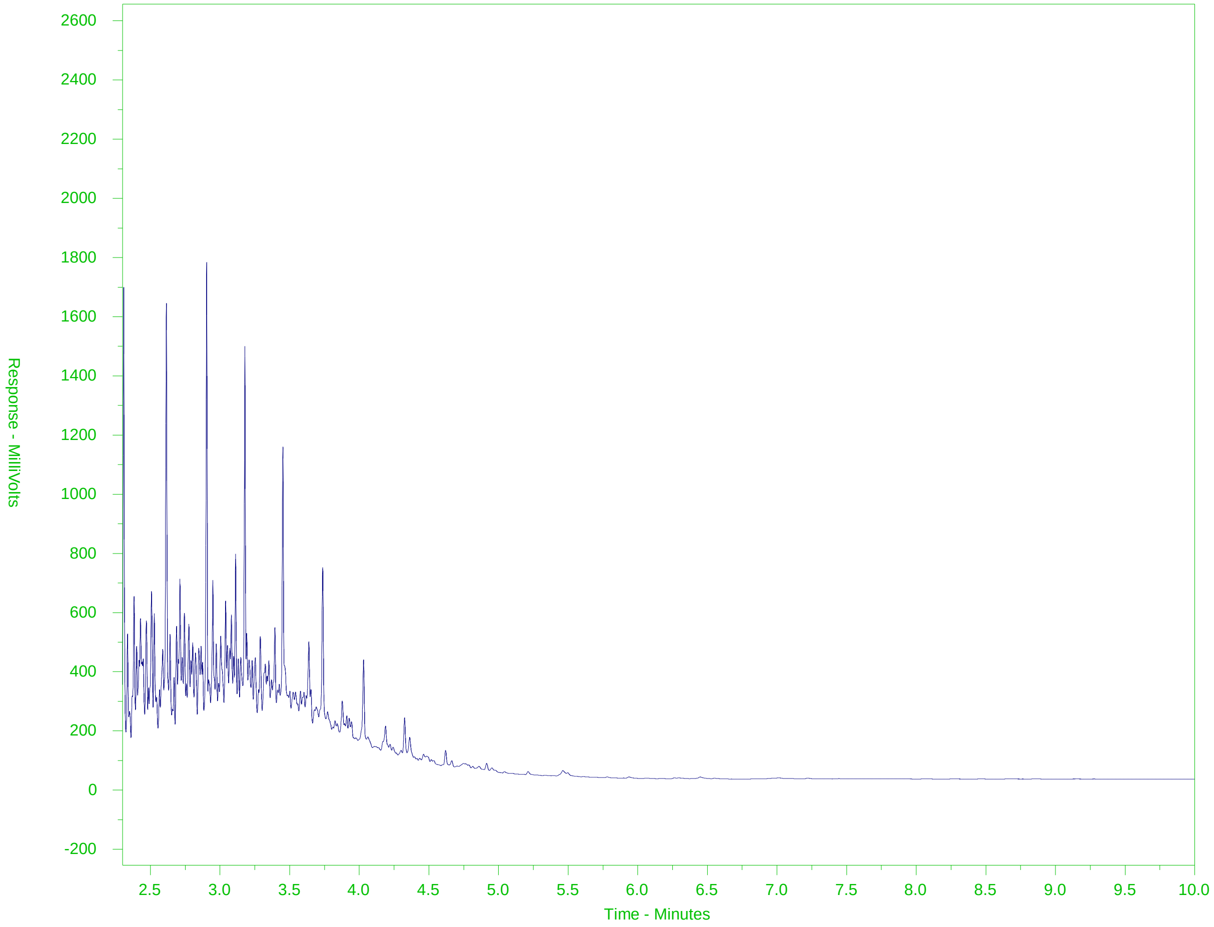
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3347576-3#L2460211-2
Client Sample ID: 02926-02



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

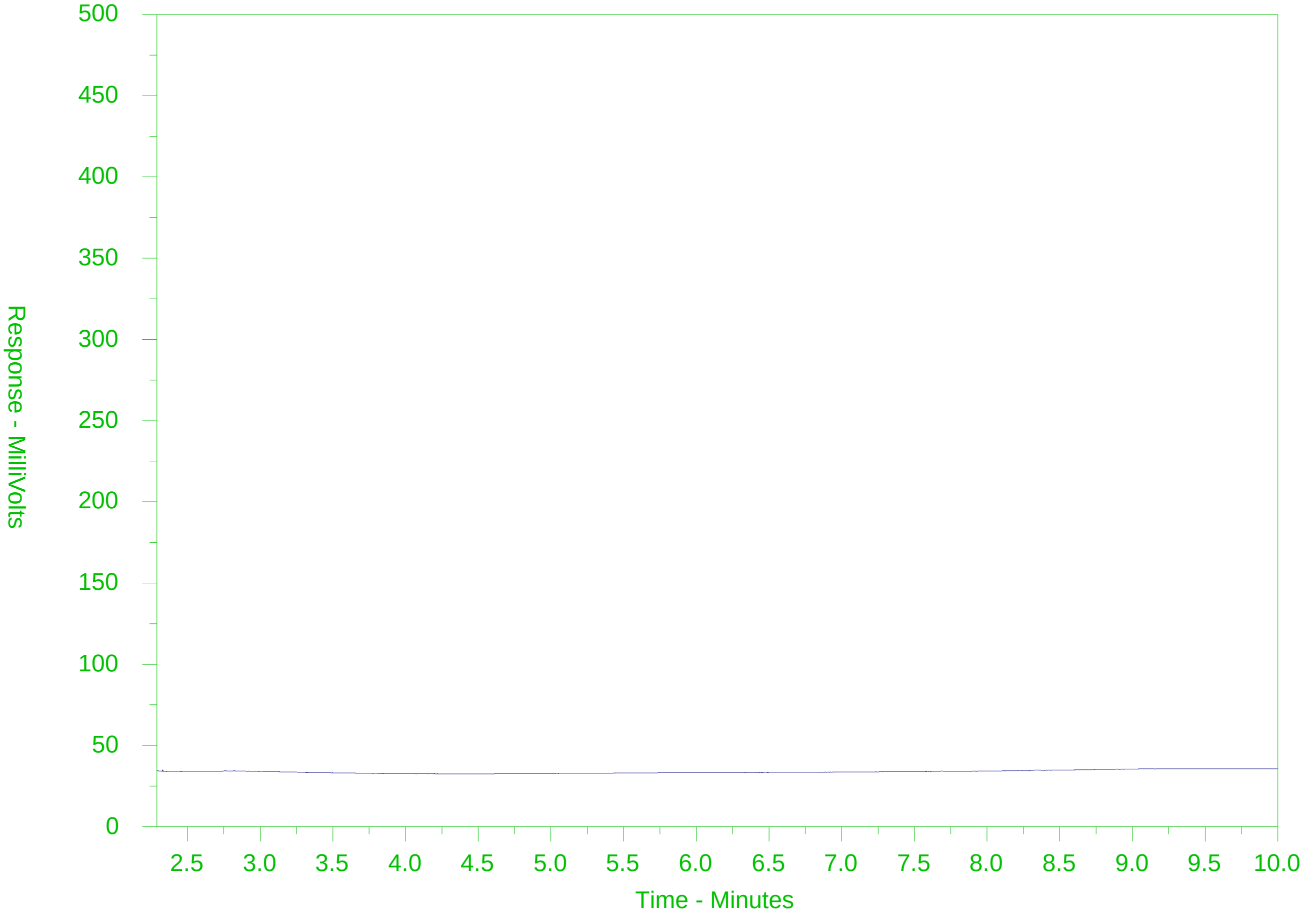
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

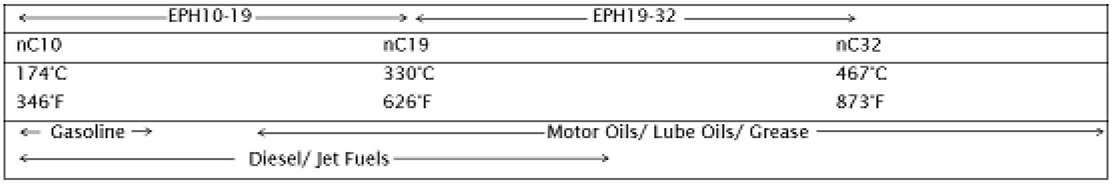
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-4
Client Sample ID: 02926-04





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

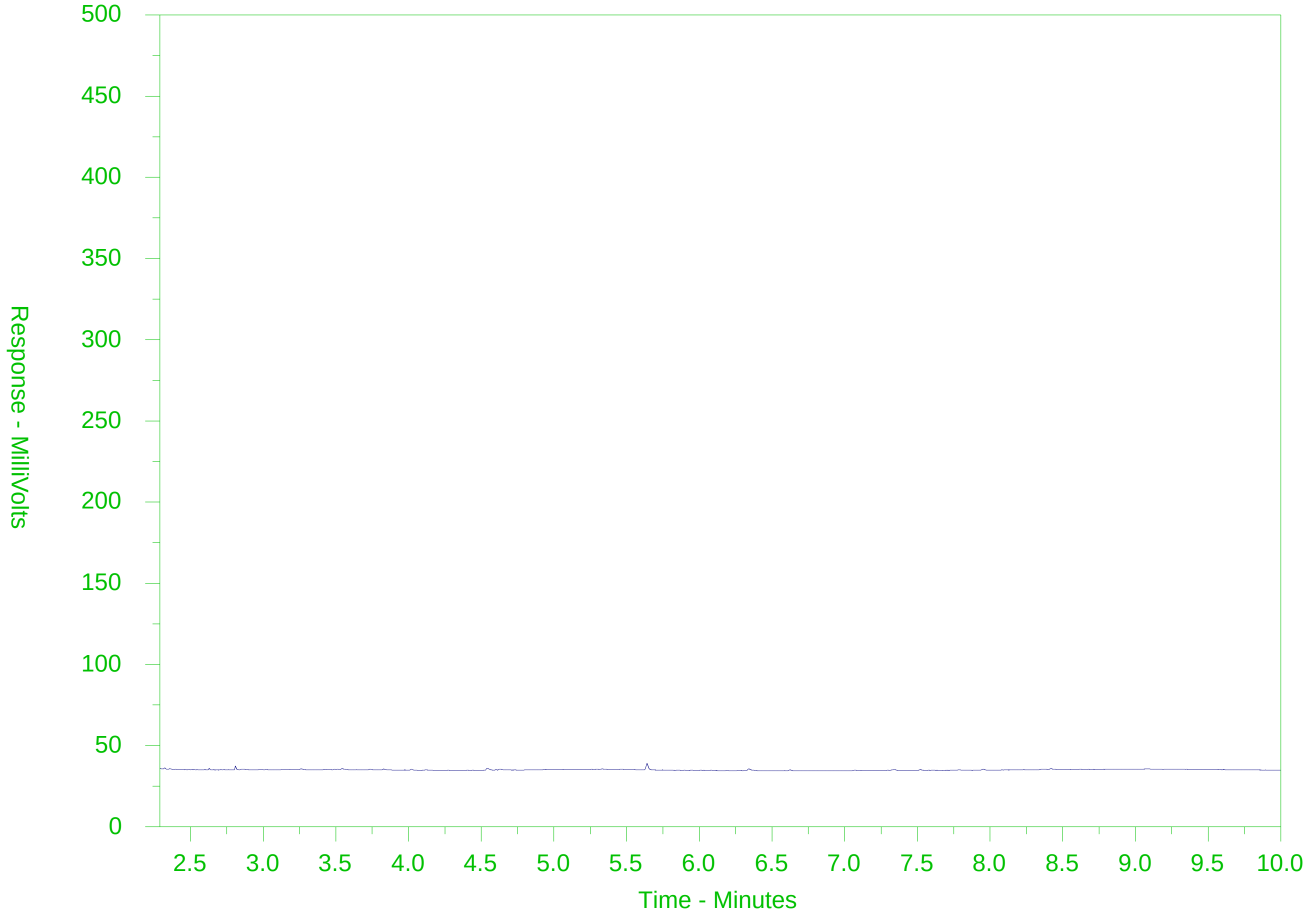
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-5
Client Sample ID: 02926-05



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

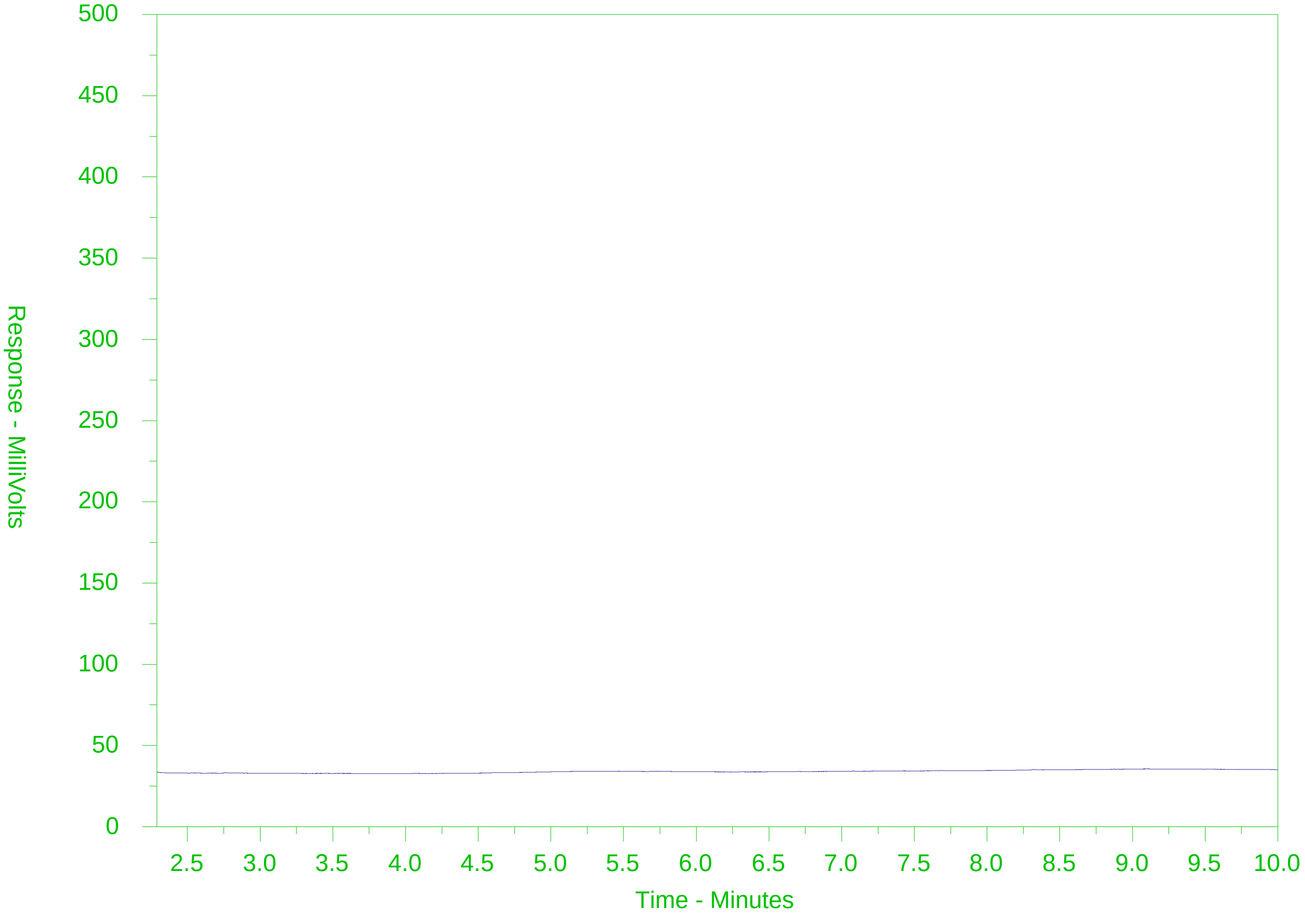
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

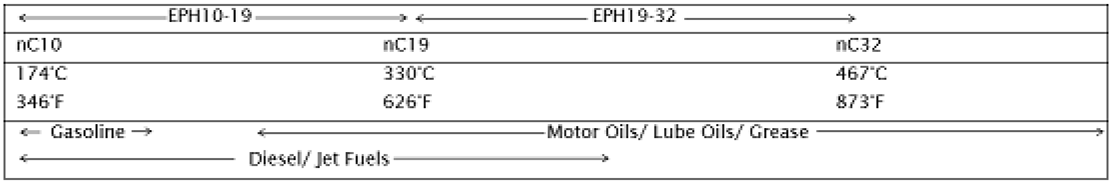
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3341710-3#L2460211-5
Client Sample ID: 02926-05





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

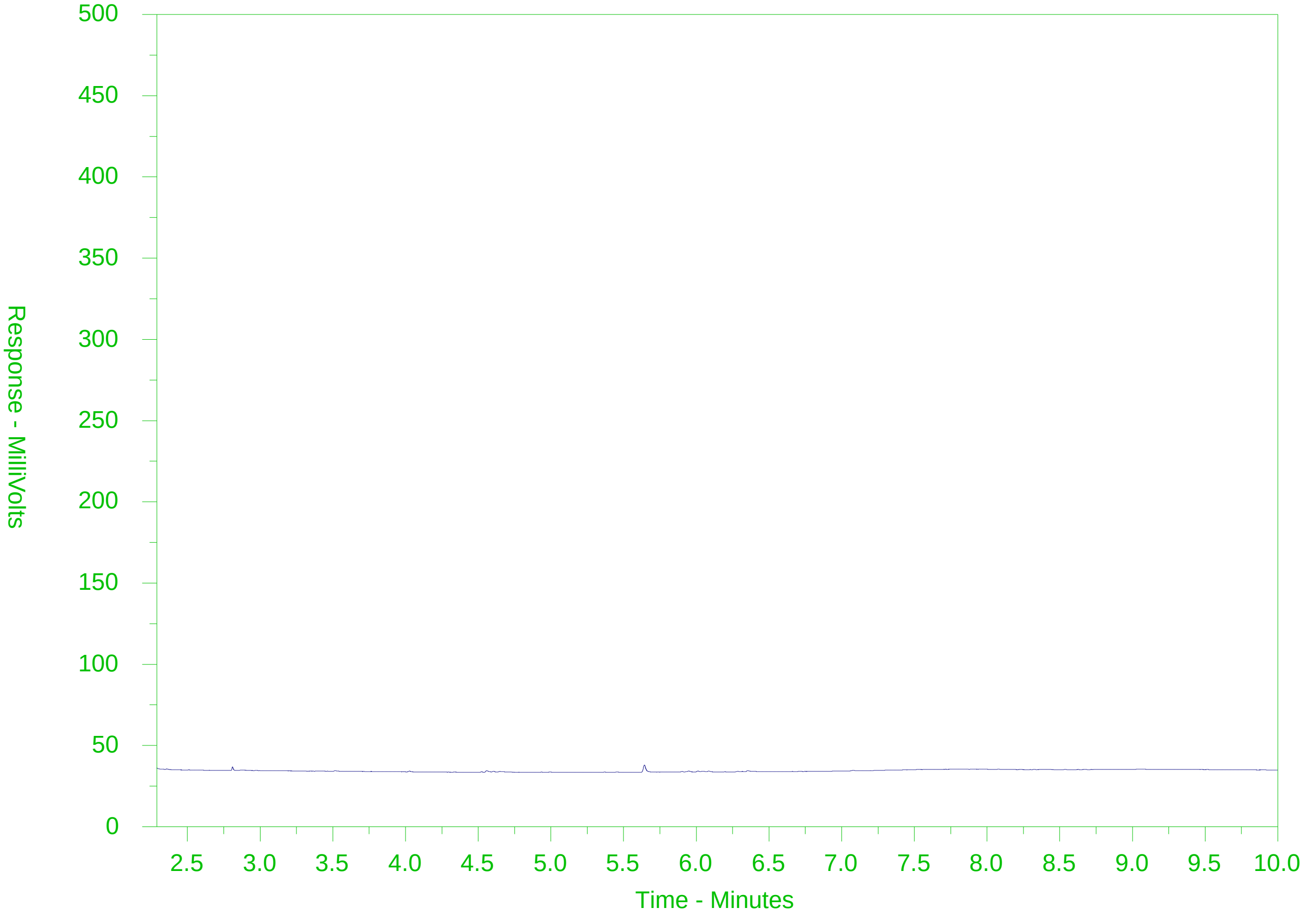
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-6
Client Sample ID: 02926-06



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

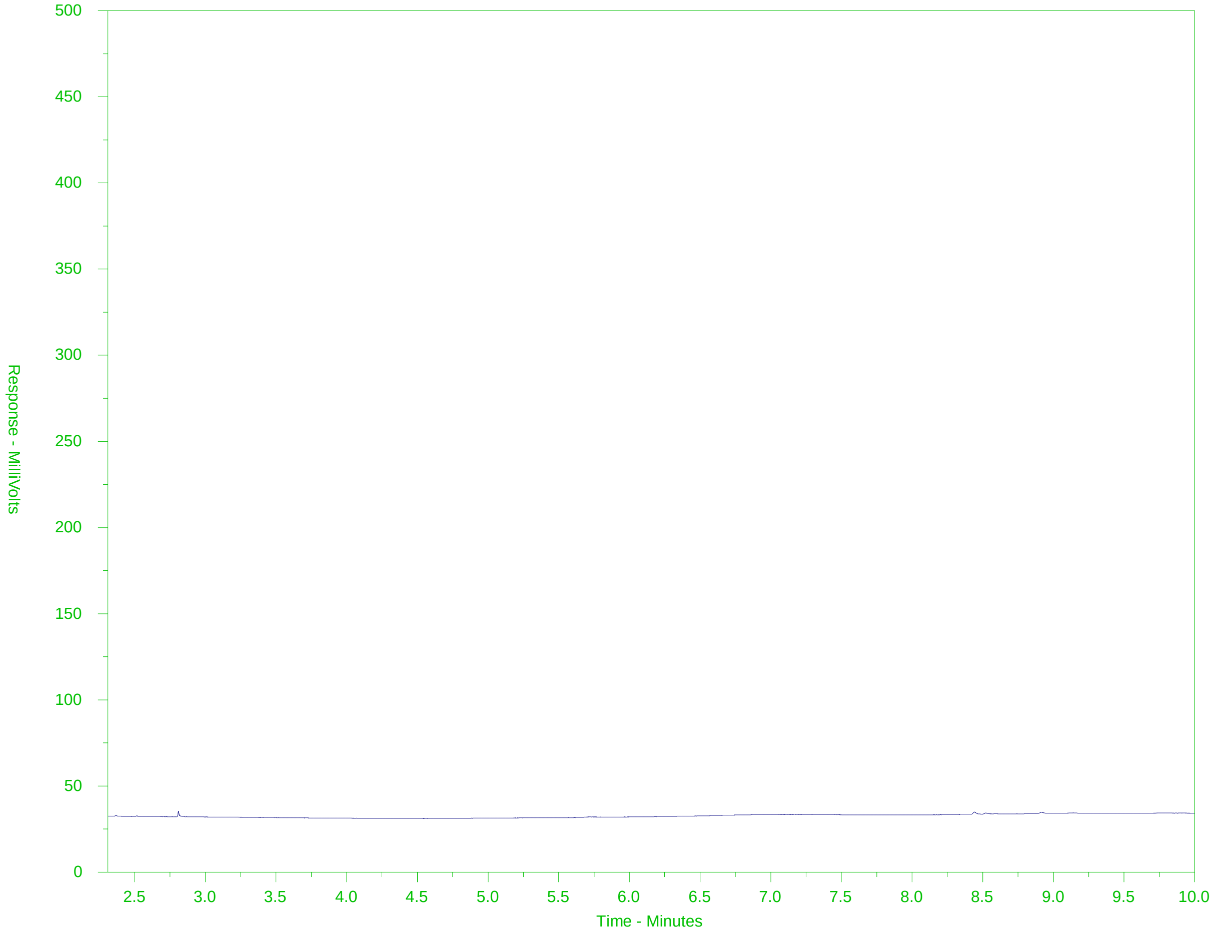
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-7
Client Sample ID: 02926-07



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

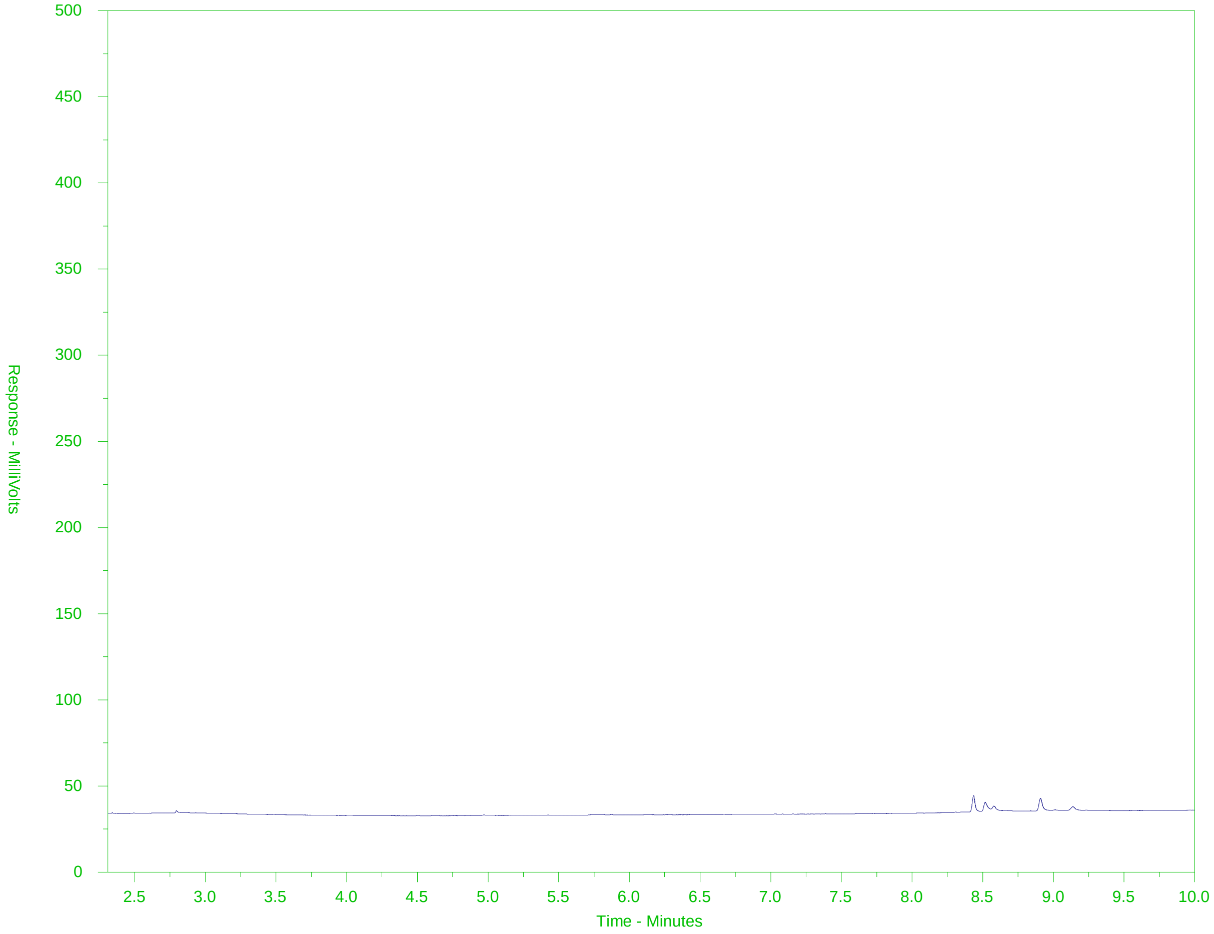
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3342711-3#L2460211-7
Client Sample ID: 02926-07



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

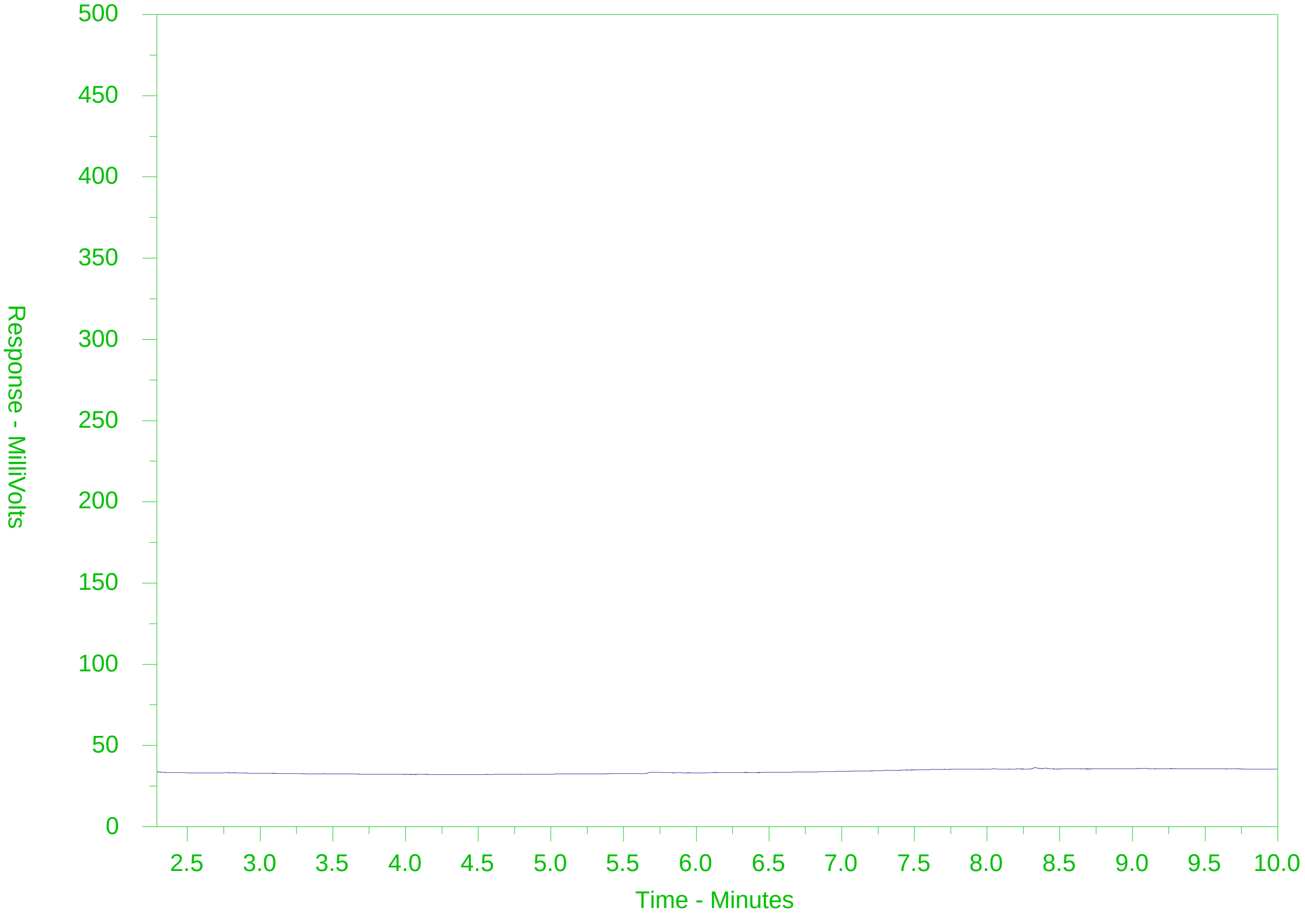
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

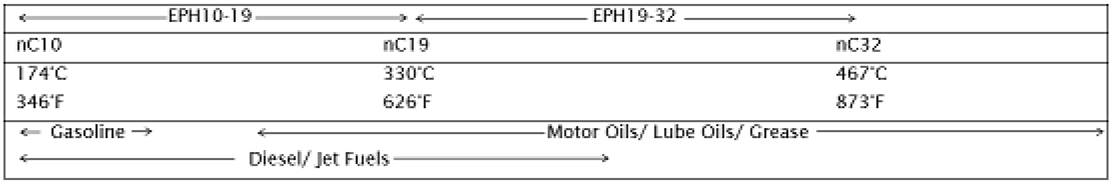
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-8
Client Sample ID: 02926-08





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

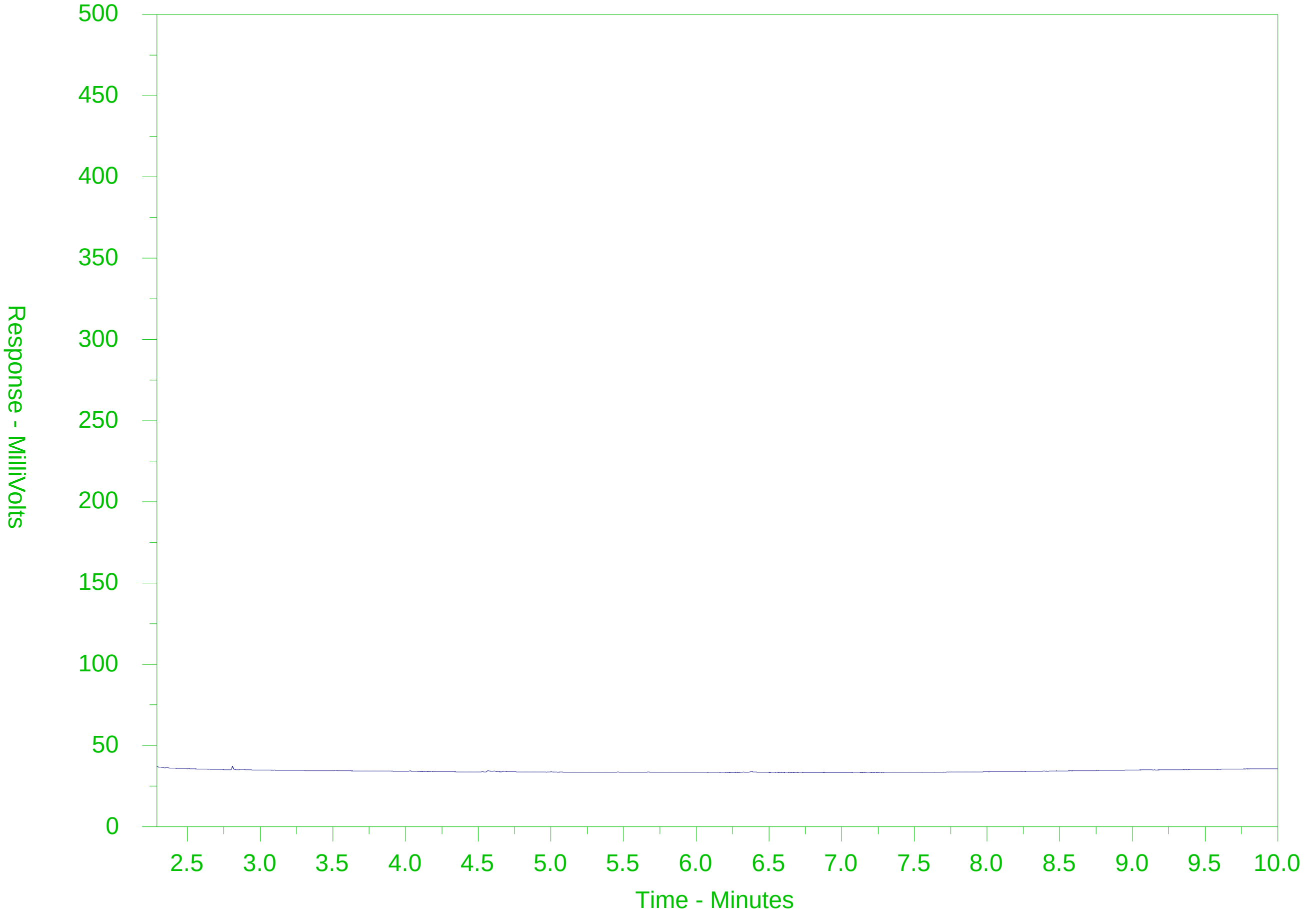
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

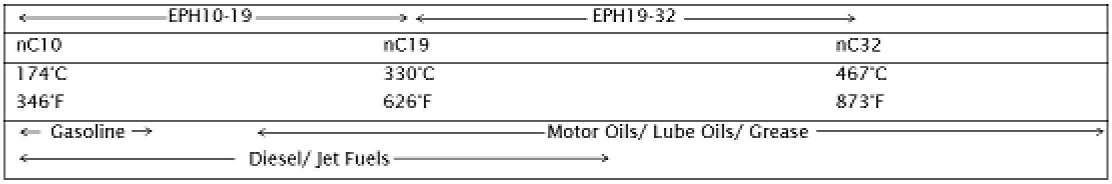
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-9
Client Sample ID: 02926-09





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

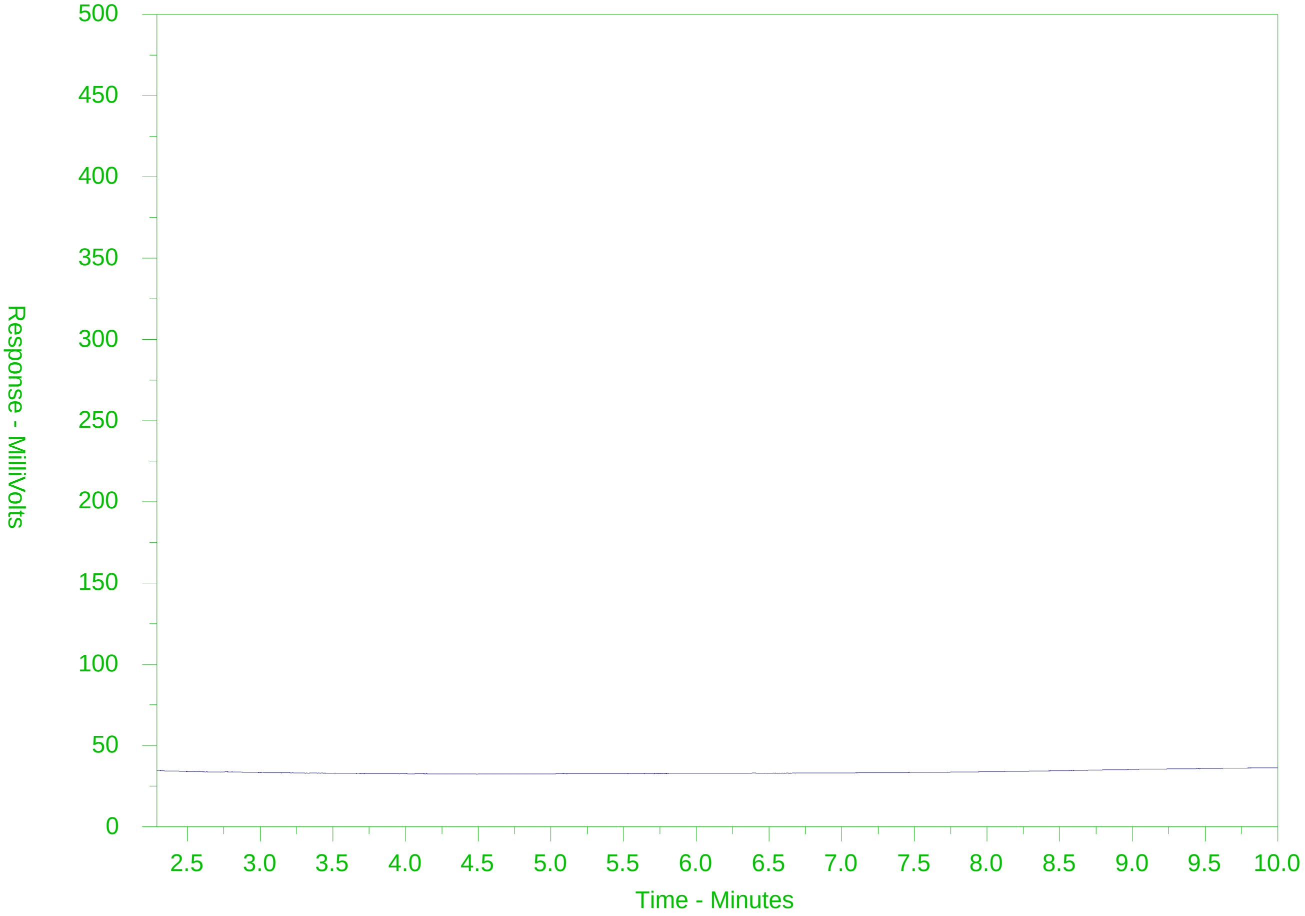
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

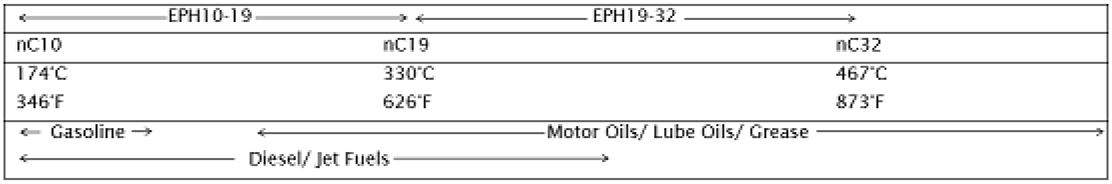
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-10
Client Sample ID: 02926-10





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

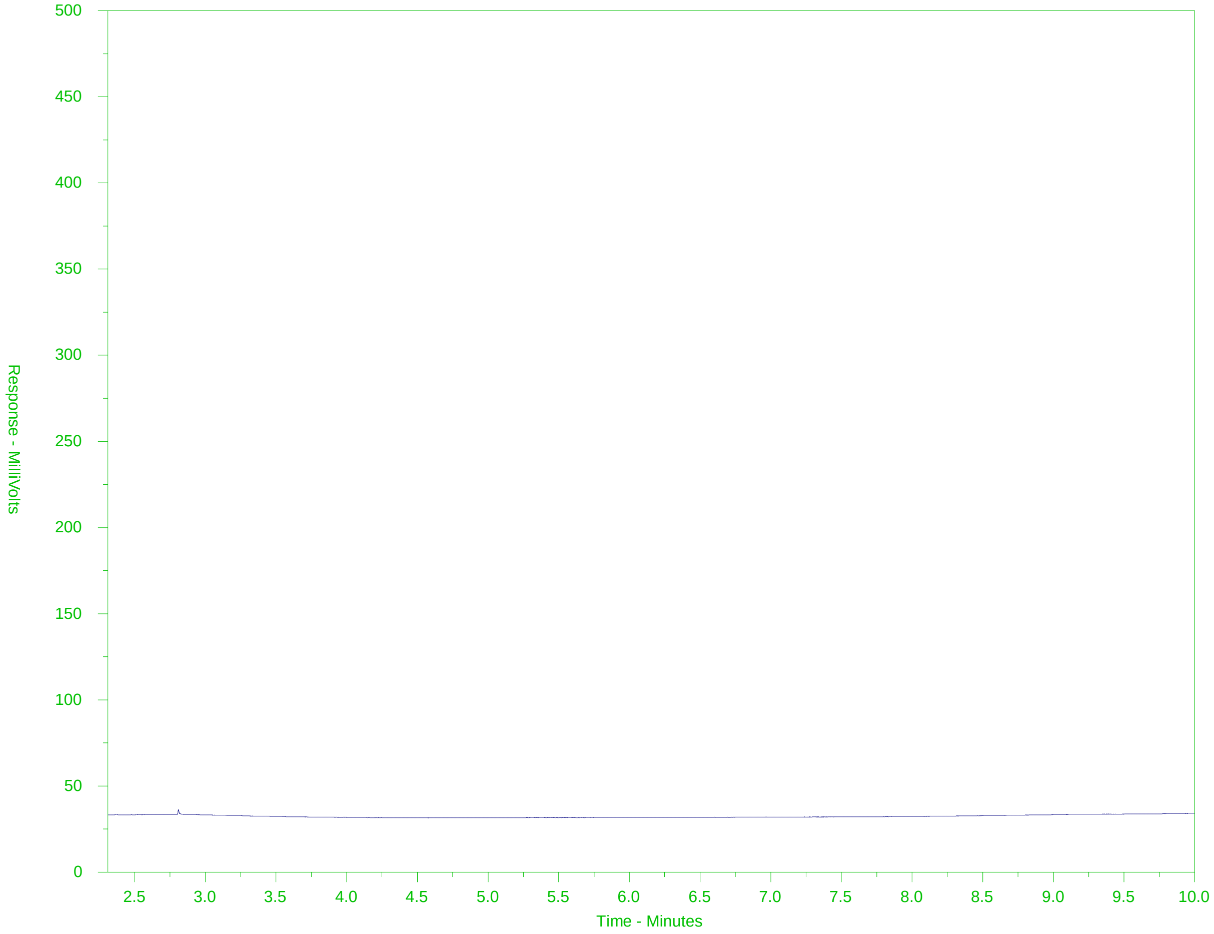
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-11
Client Sample ID: 02926-11



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

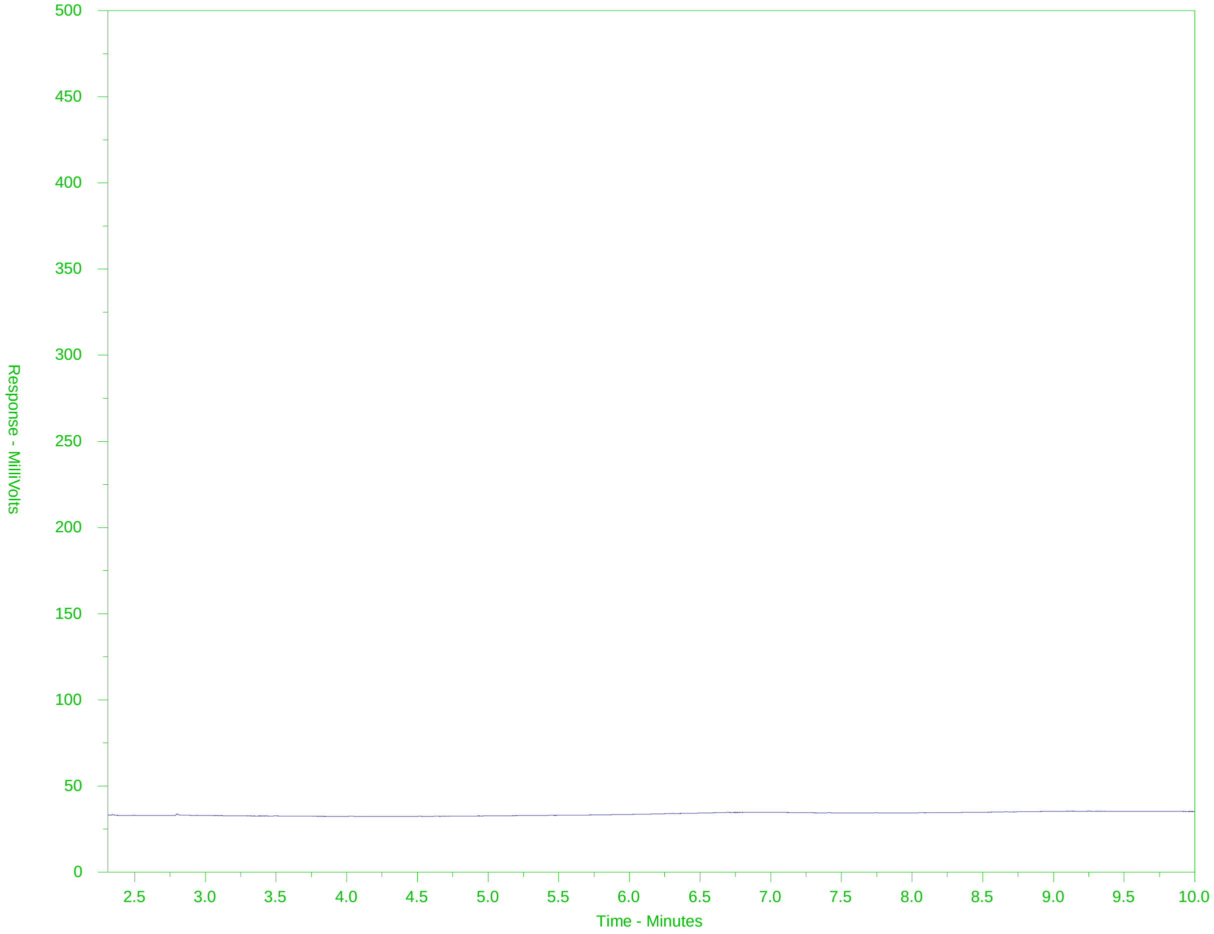
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-12
Client Sample ID: 02926-12



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

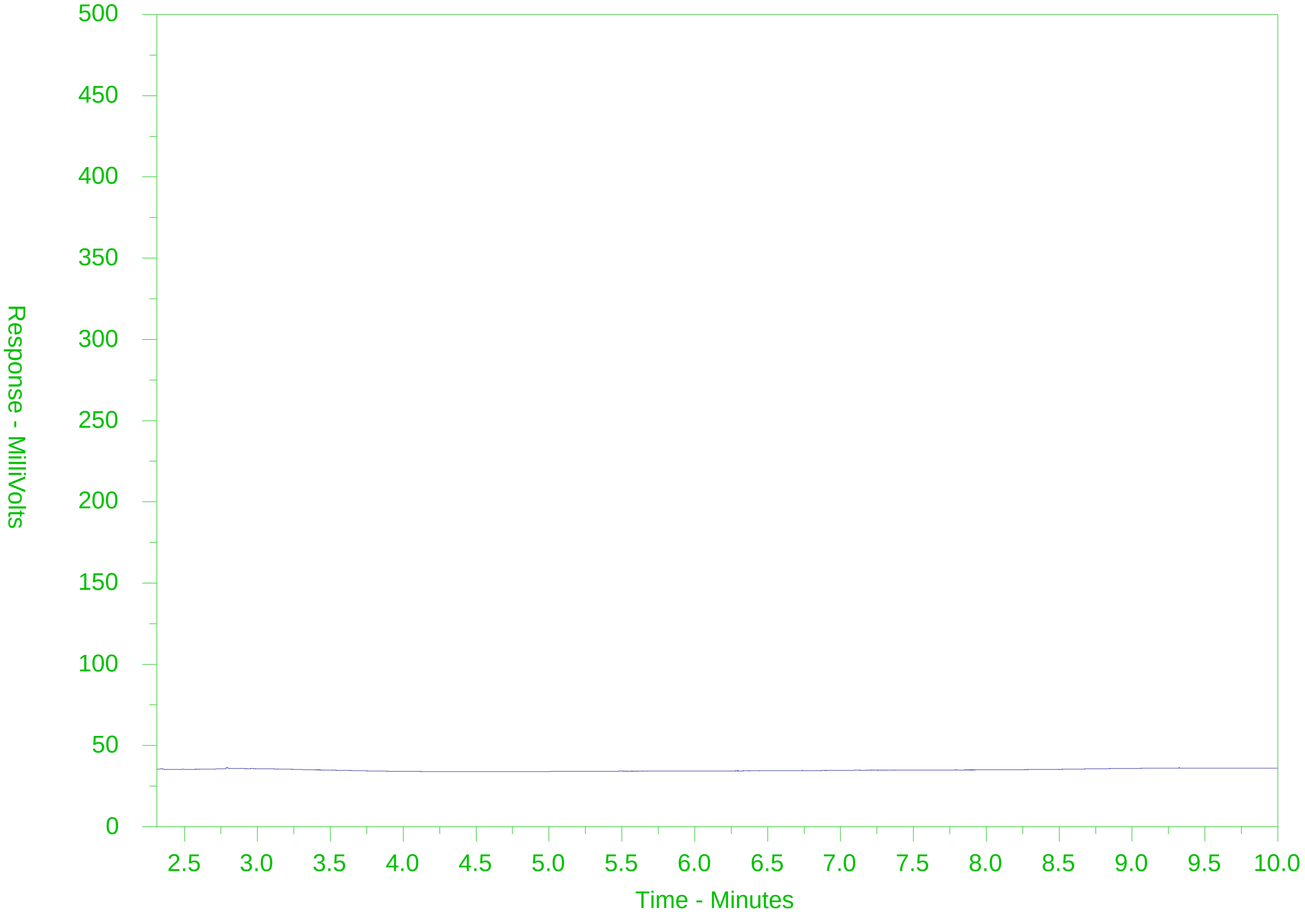
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

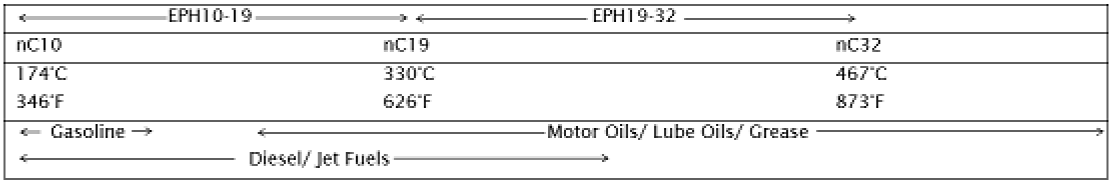
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-15
Client Sample ID: 02927-03





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

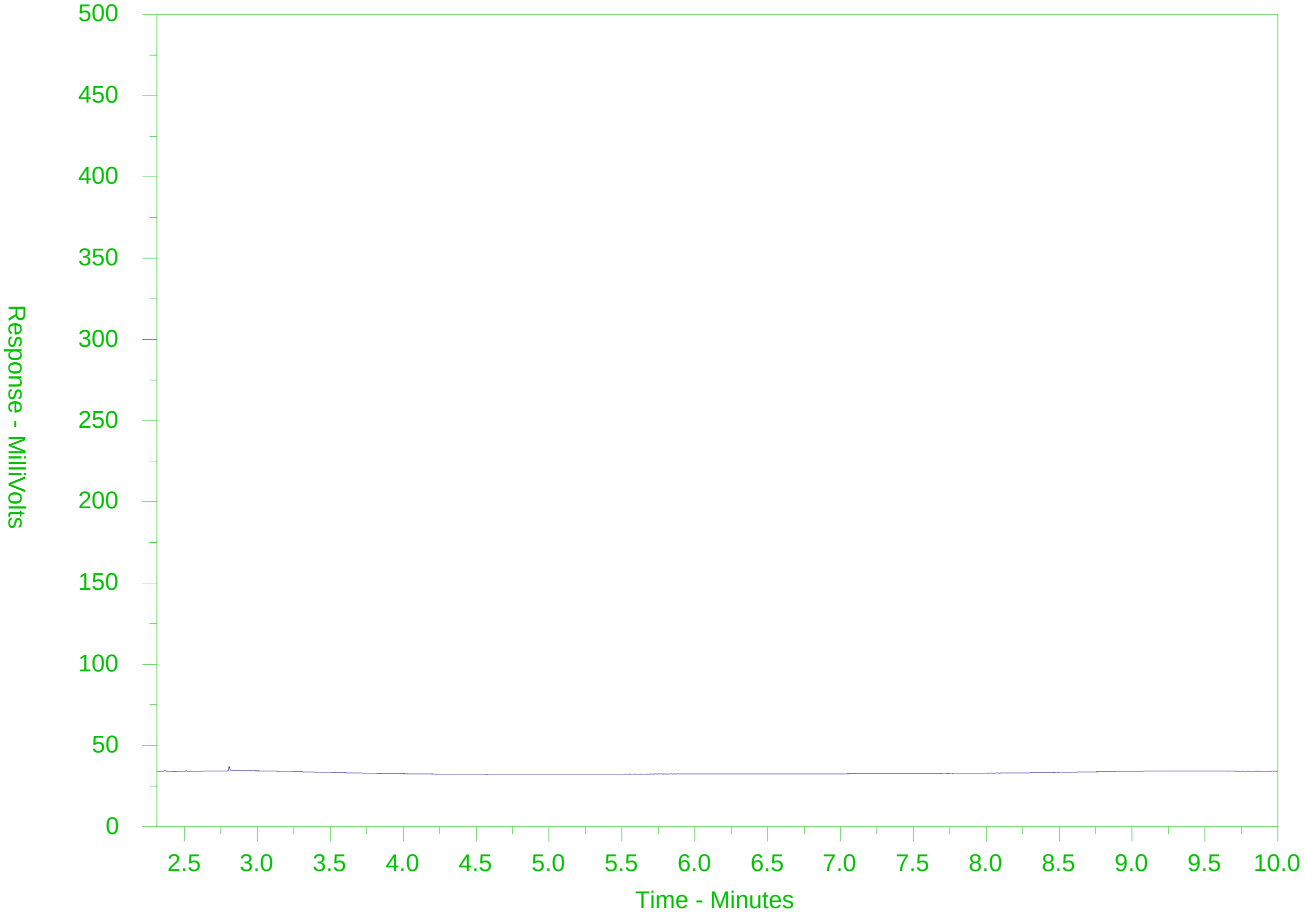
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3352606-3#L2460211-15
Client Sample ID: 02927-03



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

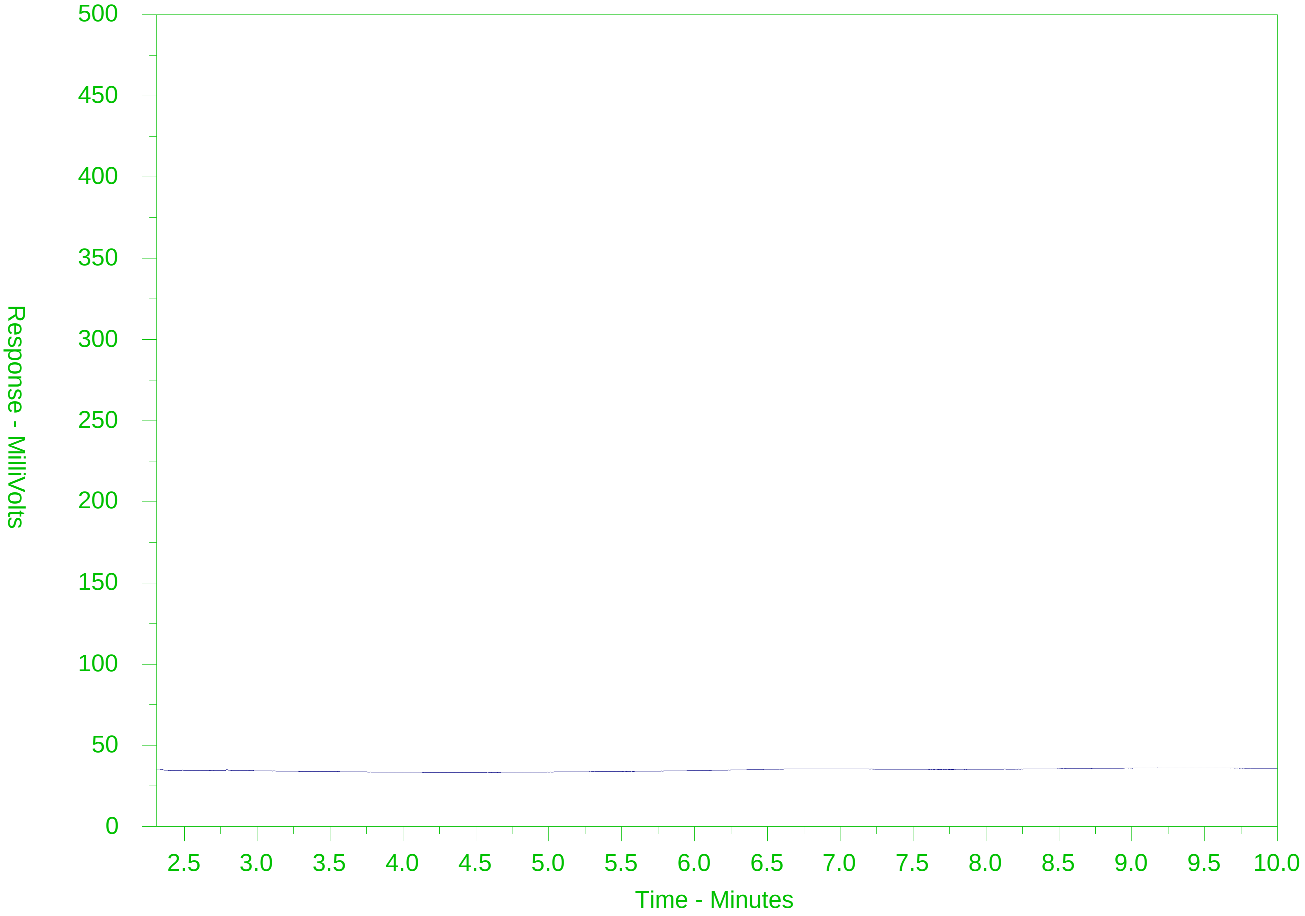
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

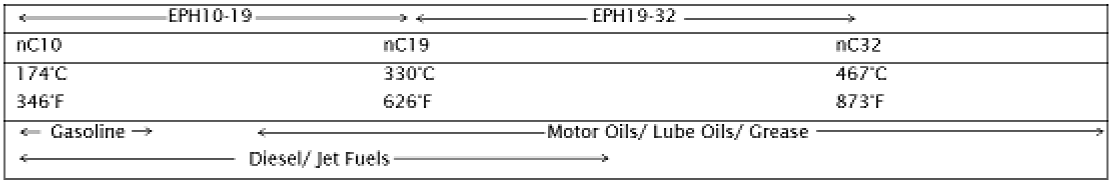
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-16
Client Sample ID: 02927-04





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

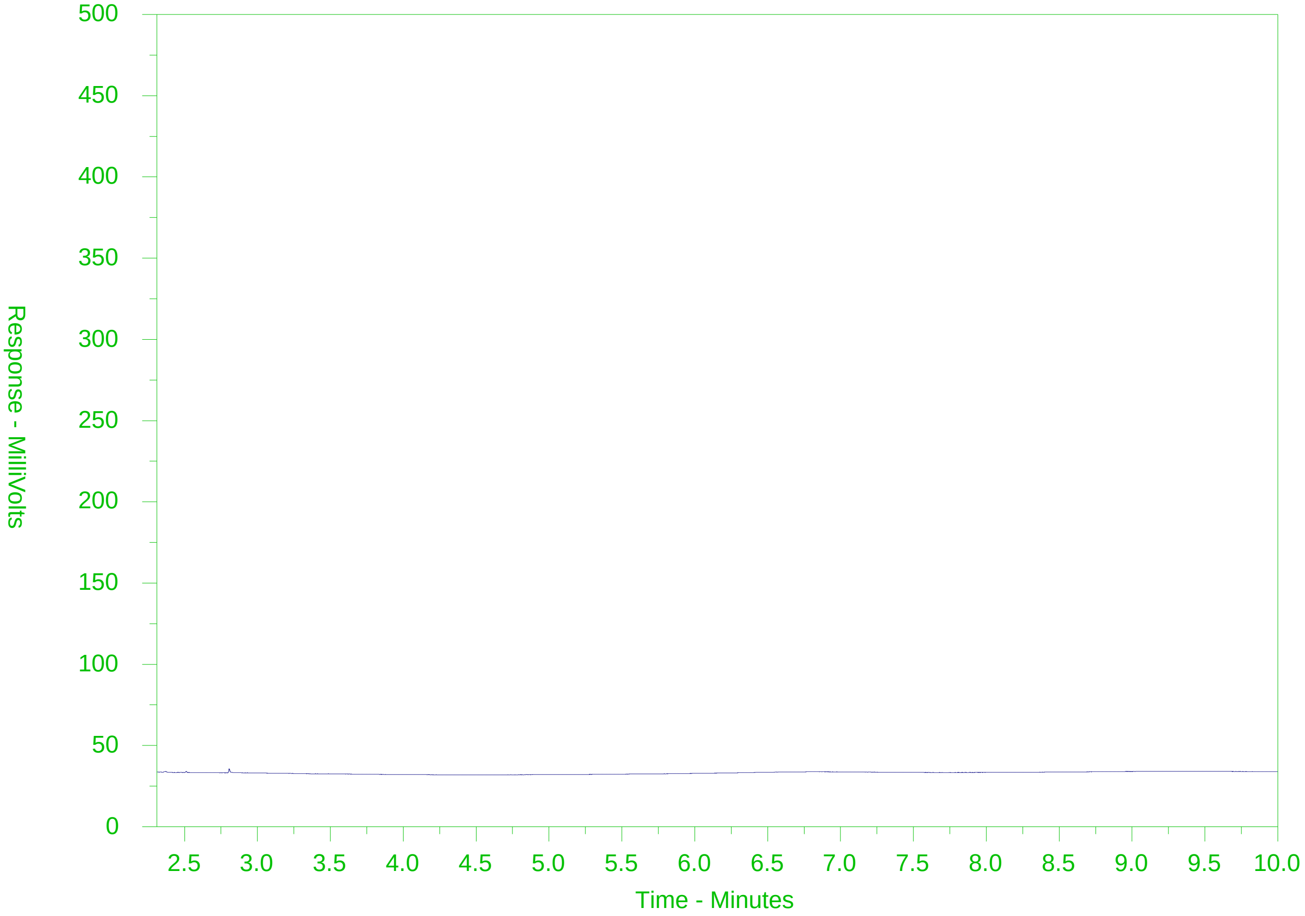
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

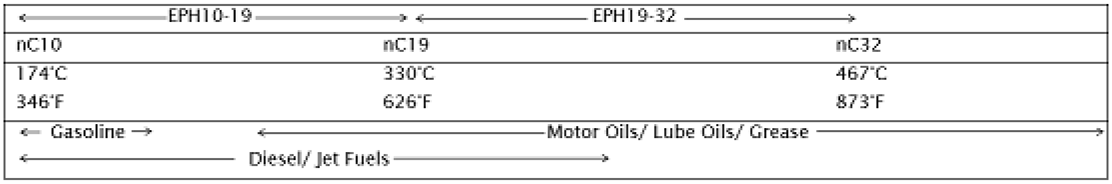
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-17
Client Sample ID: 02927-05





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

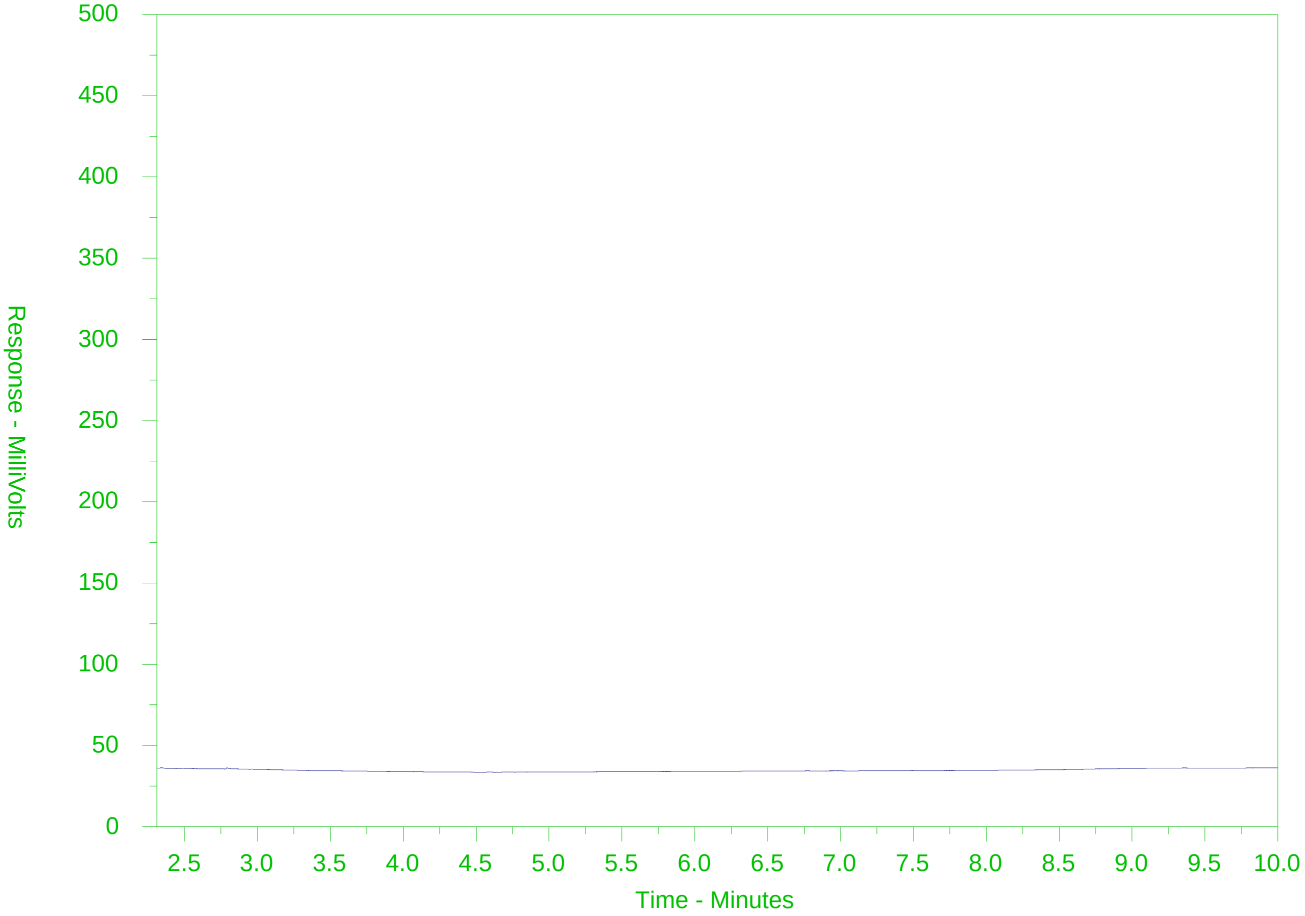
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

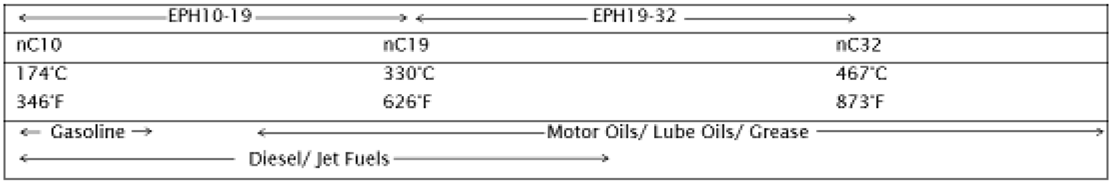
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-18
Client Sample ID: 02927-06





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

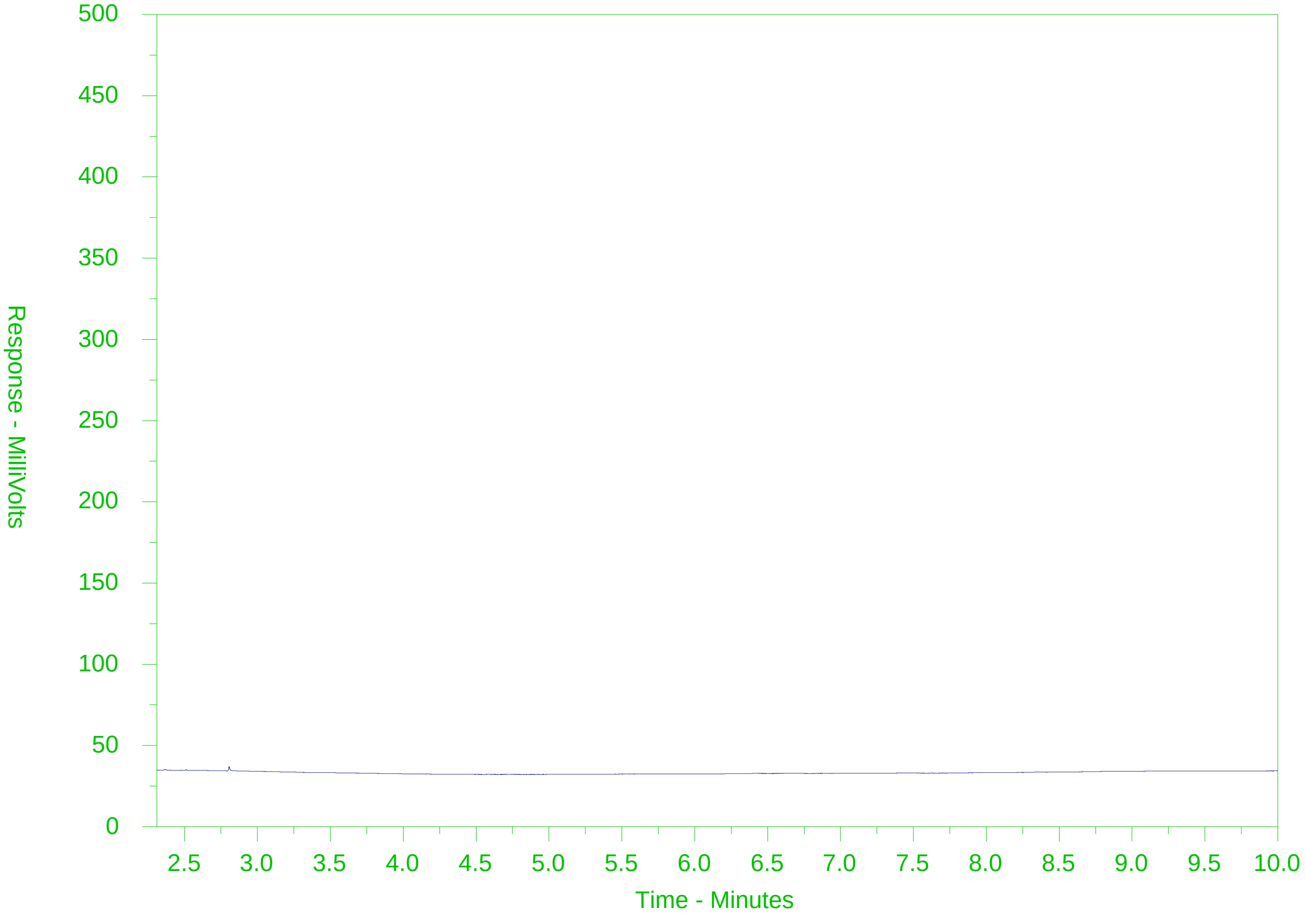
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

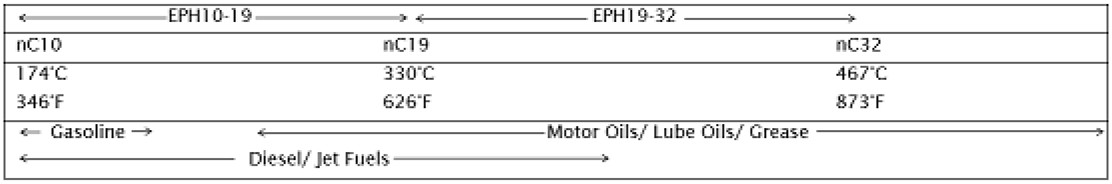
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-19
Client Sample ID: 02927-07





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

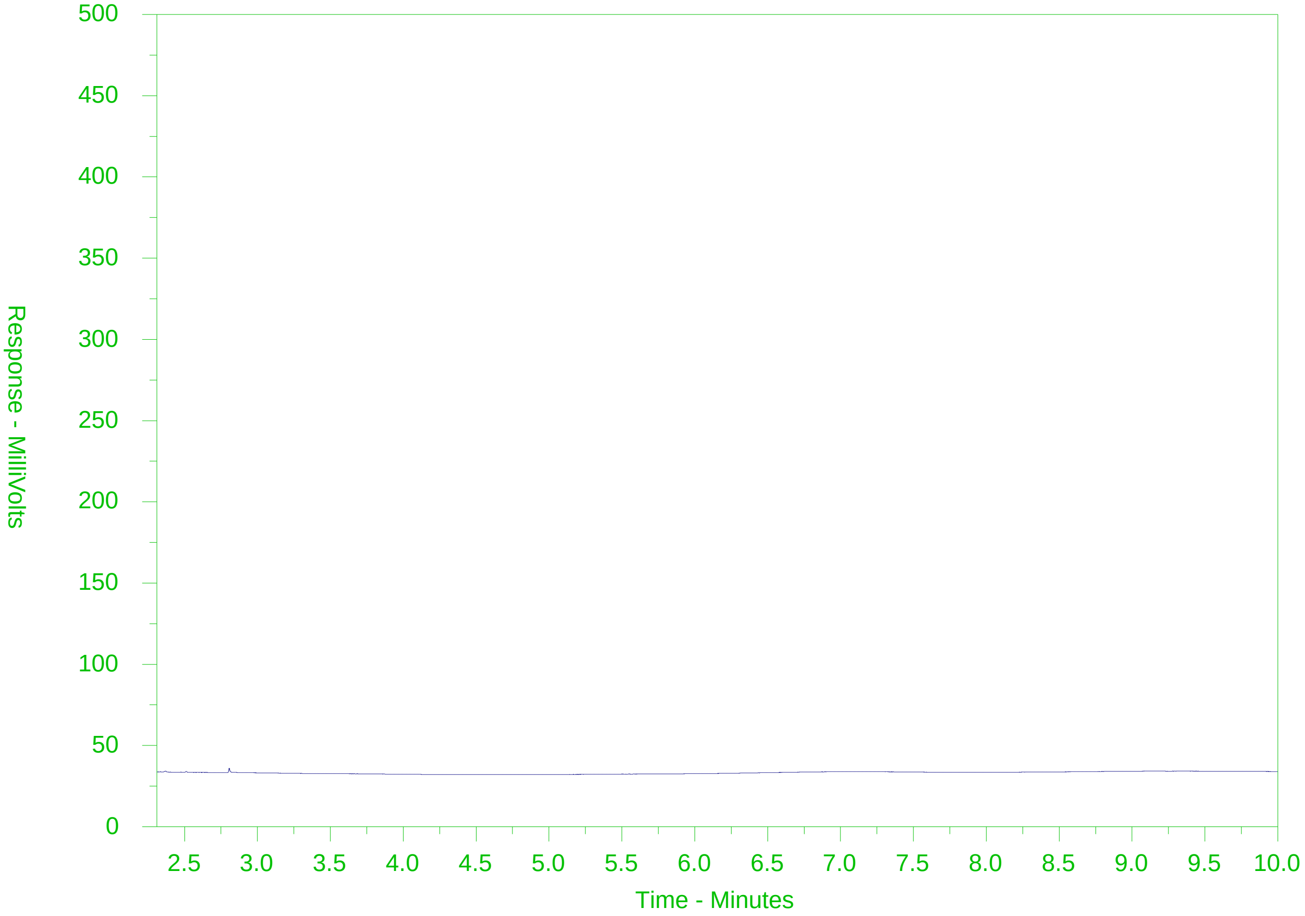
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

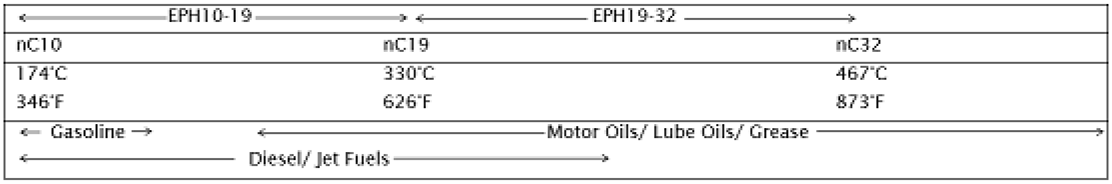
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-20
Client Sample ID: 02931-01





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

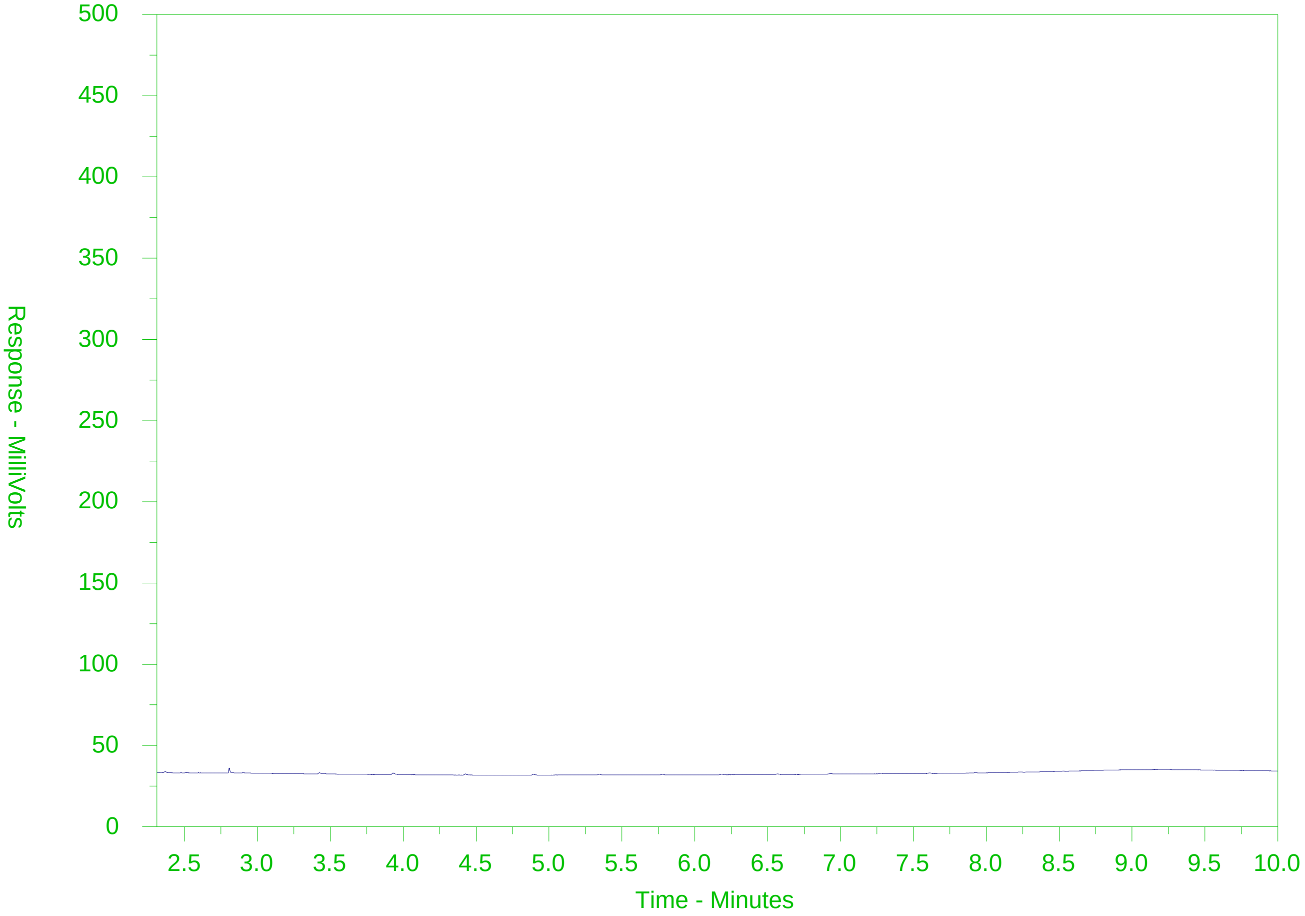
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2460211-21
Client Sample ID: 02931-02



← EPH10-19 → ← EPH19-32 →

| | | |
|---|---|---|
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |

← Gasoline → ← Motor Oils/ Lube Oils/ Grease →
← Diesel/ Jet Fuels →

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

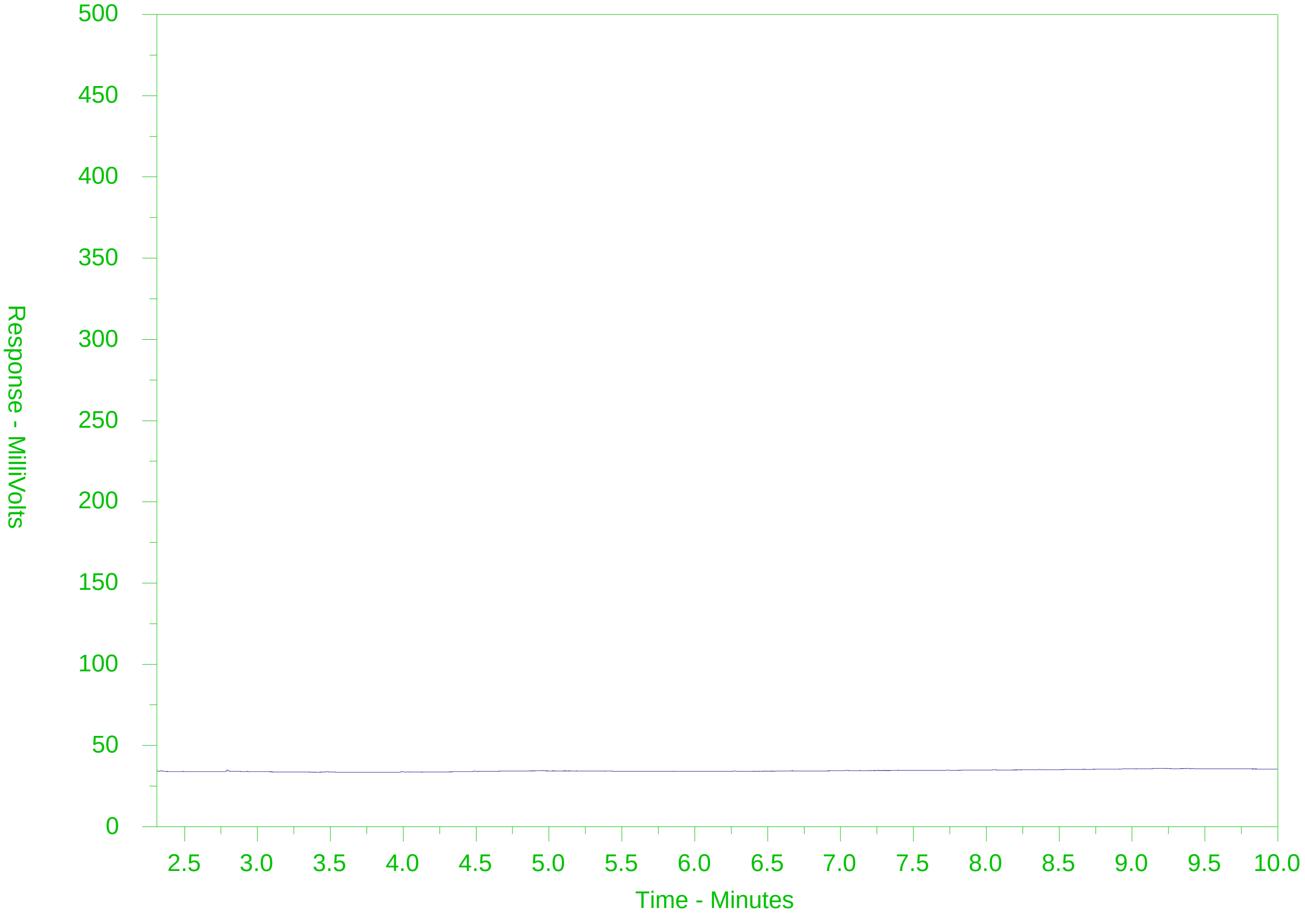
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3348924-3#L2460211-21
Client Sample ID: 02931-02



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C | 330°C | 467°C |
| 346°F | 626°F | 873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

**No.** 02926 page 1 of 3

Project Number: 20145856
Short Title: Snowbird Clean-up
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: Amber Springer

Office Name: Vancouver
**EQuIS Facility Code:** 217832270
**EQuIS upload:** ☒

**Turnaround Time:** ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
**Criteria:** ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 15th 2020

**Note:** Final Reports to be issued by e-mail

**Quote No.:** Q80351

| Sample Control Number (SCN) | Sample Location | Sa. # | Sample Depth ~~(m)~~ ft | Sample Matrix (over) | Date Sampled (D / M / Y) | Time Sampled (HH:MM) | Sample Type (over) | QAQC Code (over) | Related SCN (over) | Number of Containers | Moisture | Grain Size - Sk | 2-methylnaphthalene naphthalene | LEPH / HEPH / VPH | BTEX | n-nonane | Cadmium, chromium, quinoline | 1,2-dibromoethane | PFAS - Health Canada | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02926-01 | MW20-02 | | 3'6"-4' | SO | 11/6/20 | 0800 | Grab | | | 4 | | | | | | | | | | | |
| -02 | | | 6-6'6" | | | | | FDA | 02926-03 | 4 | | | | | | | | | | | *Hold for analysis selection June 12/20 |
| -03 | ↓ | | ↓ | | | | | FD | 02926-02 | 4 | | | | | | | | | | | |
| -04 | MW20-01 | | 2"-6" | | | | | FDA | 02926-06 | 5 | | | X | X | X | | X | X | | | |
| -05 | | | ↓ | | | | | FD | 02926-05 | 4 | | | X | X | X | | X | X | | | *No grain size on dupe |
| -06 | | | 3'-3'6" | | | | | | | 5 | X | X | X | X | X | | X | X | | | |
| -07 | ↓ | | 8'-8'6" | | | | | | | 5 | X | X | | | | | | | | | |
| -08 | BH20-08 | | 2'-6" | | | | | | | 4 | | | | | | | | | | | |
| -09 | | | 3'-3'6" | | | | | FDA | 02926-10 | 4 | | | | | | | | | | | |
| -10 | | | ↓ | | | | | FD | 02926-09 | 4 | | | | | | | | | | | |
| -11 | ↓ | | 8'-8'6" | | | ↓ | | | | 4 | | | | | | | | | | | |
| -12 | MW20-03 | | 13'-13'6" | ↓ | ↓ | 14:30 | ↓ | FDA | 02927-01 | 4 | | | | | | | | | | | |

L2460211-COFC

Sampler's Signature:
Relinquished by: Signature
Company: Golder
Date: 11/6/20
Time: 6:50
Received by: Signature
Company:
Comments: ON ICE Left at Kamloops ALS after hours lock-up
Method of Shipment:
Waybill No.:
Received for Lab by: PT
Date: 12 June 20
Time: 830
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): ~6
Cooler opened by: PT
Date: Jun 13
Time: 9am

**WHITE: Golder Copy YELLOW: Lab Copy**

ESED

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02927 page 2 of 3

Project Number: 20145856

Short Title: Snowbird Clean-up

Golder Contact: Alison Verde

Golder E-mail Address 1: AVERDE @golder.com

Golder E-mail Address 2: JOLSEN @golder.com

Laboratory Name: ALS Burnaby 1 3

Address: 8081 Lougheed Hwy

Telephone/Fax: 604-253-4188

Contact: Amber Springer

Office Name: Vancouver

EQuIS Facility Code: 217832270

EQuIS upload: ☒

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)

Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 15th, 2020

Note: Final Reports to be issued by e-mail

Quote No.: Q80351

Analyses Required

| Sample Control Number (SCN) | Sample Location | Sa. # | Sample Depth ~~(m)~~ ft | Sample Matrix (over) | Date Sampled (D / M / Y) | Time Sampled (HH:MM) | Sample Type (over) | QAQC Code (over) | Related SCN (over) | Number of Containers | Moisture | Grain Size - Sk | 2 - methylnapthalene napthalene | LEPH / HEPH/UPH | BTEX | n-nonane | Cadmium, Chromium Quinoline | 1,2 - dibromoethane | PFAS - Health Canada | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02927 - 01 | MW20-03 | | 13-13'6" | SO | 11/6/20 | 14:30 | Grab | FD | 02926-12 | 4 | | | | | | | | | | | |
| - 02 | | | 18-18'6" | SO | | | | | | 4 | | | | | | | | | | | - Hold for analysis selection June 12/20 |
| - 03 | MW20-01 | | 13-13'6" | | | | | | | 5 | X | X | | | | | | | | | |
| - 04 | | | 18-18'6" | | | | | | | 5 | X | X | | | | | | | | | |
| - 05 | MW20-04 | | 11-12' | | | | | | | 4 | | | | | | | | | | | |
| - 06 | | | 13-15' | | | | | | | 4 | | | | | | | | | | | |
| - 07 | | | 18-18'6" | | | 16:30 | | | | 4 | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2460211-COFC

| | | | | | |
|---|---|---|---|---|---|
| Sampler's Signature: | Relinquished by: Signature | Company Golder | Date 11/6/20 | Time 6:50 | Received by: Signature | Company |

Comments: On Ice
Left at ALS Kamloops
After hours lock-up

Method of Shipment:

Waybill No.:

Received for Lab by: OT

Date 12Jun2020

Time 830

Shipped by:

Shipment Condition:

Seal Intact:

Temp (°C) ~6

Cooler opened by: PT

Date Jun 13

Time 9am

**WHITE: Golder Copy YELLOW: Lab Copy**

ESED

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02931 page 3 of 3

Project Number: 20145856
Short Title: Snowbird Cleanup
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS
Address: 8081 Lougheed Hwy, BBY
Telephone/Fax: 604-253-4188
Contact: Amber Springer

Office Name: Vancouver
EQuIS Facility Code: 2178322 70
EQuIS upload: ☑

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☐ CSR ☐ CCME ☐ BC Water Quality ☒ Other June 15th, 2020

**Note:** Final Reports to be issued by e-mail

Quote No.: Q80351

Analyses Required

| Sample Control Number (SCN) | Sample Location | Sa. # | Sample Depth ~~(m)~~ ft | Sample Matrix (over) | Date Sampled (D / M / Y) | Time Sampled (HH:MM) | Sample Type (over) | QAQC Code (over) | Related SCN (over) | Number of Containers | Grain Size SK | | | | | | | | | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02931 - 01 | MW20-01 | | 15-16' | SO | 11/6/20 | 1300 | Grab | | | 1 | | | | | | | | | | | |
| - 02 | ↓ | | 19-20' | ↓ | ↓ | ↓ | ↓ | | | 1 | | | | | | | | | | | Hold for |
| - 03 | | | | | | | | | | | | | | | | | | | | | analysis |
| - 04 | | | | | | | | | | | | | | | | | | | | | selection |
| - 05 | | | | | | | | | | | | | | | | | | | | | June 12/20 |
| - 06 | | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2460211-COFC

Sampler's Signature:
Relinquished by: Signature
Company: Golder
Date: ~~20~~ 11/6/20
Time: 1650
Received by: Signature
Company:
Comments: On Ice left at ALS Kamloops after hours lock-up
Method of Shipment:
Waybill No.:
Received for Lab by:
Date: 12 June 20
Time: 830
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): ~6
Cooler opened by: PT
Date: Jun 13
Time: 9am

**WHITE: Golder Copy** **YELLOW: Lab Copy**

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

Date Received: 19-JUN-20
Report Date: 08-JUL-20 14:43 (MT)
Version: FINAL REV. 2

Client Phone: 604-297-2036

# Certificate of Analysis

| | |
|---|---|
| Lab Work Order #: | L2463621 |
| Project P.O. #: | NOT SUBMITTED |
| Job Reference: | 20145856/1000 |
| C of C Numbers: | 02933 |
| Legal Site Desc: | |

Comments:

8-JUL-2020 Detection limits have been lowered for some compounds.

Amber Springer

Amber Springer, B.Sc
Account Manager

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID | L2463621-1 | L2463621-2 | L2463621-3 | | |
|---|---|---|---|---|---|---|
| | Description | SV | SV | SV | | |
| | Sampled Date | 18-JUN-20 | 18-JUN-20 | 18-JUN-20 | | |
| | Sampled Time | 16:45 | 16:45 | 18:00 | | |
| | Client ID | 02933-01 | 02933-02 | 02933-03 | | |
| **Grouping** | **Analyte** | | | | | |
| **CANISTER** | | | | | | |
| **Volatile Organic Compounds** | Benzene (ppb(V)) | 3.7 DLHC | 3.9 DLHC | 14.0 DLHC | | |
| | Benzene (ug/m3) | 11.9 DLHC | 12.3 DLHC | 44.7 DLHC | | |
| | 1,3-Butadiene (ppb(V)) | 8.5 DLHC | 7.7 DLHC | 16.6 DLHC | | |
| | 1,3-Butadiene (ug/m3) | 18.7 DLHC | 17.1 DLHC | 36.7 DLHC | | |
| | Decane (ppb(V)) | <5.0 DLHC | <5.0 DLHC | <5.0 DLHC | | |
| | Decane (ug/m3) | <29 DLHC | <29 DLHC | <29 DLHC | | |
| | 1,2-Dibromoethane (ppb(V)) | <0.05 DLHC | <0.05 DLHC | <0.05 DLHC | | |
| | 1,2-Dibromoethane (ug/m3) | <0.38 DLHC | <0.38 DLHC | <0.38 DLHC | | |
| | 1,2-Dichloroethane (ppb(V)) | 0.30 AI | 0.29 AI | 0.88 AI | | |
| | 1,2-Dichloroethane (ug/m3) | 1.20 AI | 1.19 AI | 3.55 AI | | |
| | Ethylbenzene (ppb(V)) | 3.3 DLHC | 3.2 DLHC | 24.4 DLHC | | |
| | Ethylbenzene (ug/m3) | 14.2 DLHC | 14.0 DLHC | 106 DLHC | | |
| | n-Hexane (ppb(V)) | 63 DLA | 66 DLA | 197 DLA | | |
| | n-Hexane (ug/m3) | 223 DLA | 231 DLA | 696 DLA | | |
| | Isopropylbenzene (ppb(V)) | <2.0 DLHC | <2.0 DLHC | 5.8 DLHC | | |
| | Isopropylbenzene (ug/m3) | <9.8 DLHC | <9.8 DLHC | 28.7 DLHC | | |
| | Methylcyclohexane (ppb(V)) | 246 DLA | 261 DLA | 723 DLA | | |
| | Methylcyclohexane (ug/m3) | 990 DLA | 1050 DLA | 2900 DLA | | |
| | MTBE (ppb(V)) | <2.0 DLHC | <2.0 DLHC | <2.0 DLHC | | |
| | MTBE (ug/m3) | <7.2 DLHC | <7.2 DLHC | <7.2 DLHC | | |
| | Naphthalene (ppb(V)) | <0.57 DLA | <0.57 | <0.57 | | |
| | Naphthalene (ug/m3) | <3.0 DLA | <3.0 | <3.0 | | |
| | Styrene (ppb(V)) | <2.0 DLHC | <2.0 DLHC | <2.0 DLHC | | |
| | Styrene (ug/m3) | <8.5 DLHC | <8.5 DLHC | <8.5 DLHC | | |
| | Toluene (ppb(V)) | 8.9 DLHC | 7.9 DLHC | 43.9 DLHC | | |
| | Toluene (ug/m3) | 33.7 DLHC | 29.8 DLHC | 165 DLHC | | |
| | 1,2,4-Trimethylbenzene (ppb(V)) | 0.44 | 0.38 | 1.88 | | |
| | 1,2,4-Trimethylbenzene (ug/m3) | 2.19 | 1.89 | 9.25 | | |
| | 1,3,5-Trimethylbenzene (ppb(V)) | <0.20 | <0.20 | 4.3 DLHC | | |
| | 1,3,5-Trimethylbenzene (ug/m3) | <0.98 | <0.98 | 21.1 DLHC | | |
| | o-Xylene (ppb(V)) | 2.3 DLHC | 2.2 DLHC | 19.6 DLHC | | |
| | o-Xylene (ug/m3) | 10.1 DLHC | 9.6 DLHC | 85.1 DLHC | | |
| | m&p-Xylene (ppb(V)) | <4.0 DLHC | <4.0 DLHC | 40.5 DLHC | | |
| | m&p-Xylene (ug/m3) | <17 DLHC | <17 DLHC | 176 DLHC | | |
| | Xylenes (Total) (ppb(V)) | <4.5 | <4.5 | 60.1 | | |
| | Xylenes (Total) (ug/m3) | <20 | <20 | 261 | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2463621-1 | L2463621-2 | L2463621-3 | | |
|---|---|---|---|---|---|---|
| | **Description** | SV | SV | SV | | |
| | **Sampled Date** | 18-JUN-20 | 18-JUN-20 | 18-JUN-20 | | |
| | **Sampled Time** | 16:45 | 16:45 | 18:00 | | |
| | **Client ID** | 02933-01 | 02933-02 | 02933-03 | | |
| **Grouping** | **Analyte** | | | | | |
| **CANISTER** | | | | | | |
| **Volatile Organic Compounds** | Surrogate: 4-Bromofluorobenzene (%) | 71.4 | 70.6 | 75.5 | | |
| | | 76.0 | 76.0 | 74.8 | | |
| **Hydrocarbons** | VHv(C6-C13) (ug/m3) | 26300 DLHC | 27600 DLHC | 72100 DLHC | | |
| | VPHv(C6-C13) (ug/m3) | 26000 DLHC | 27300 DLHC | 71000 DLHC | | |
| **Miscellaneous** | Batch Proof ID | 200410.326 | 200410.305 | 200410.307 | | |
| | Canister ID | 01400-0489 | 01400-0373 | 01400-0116 | | |
| | Pressure on Receipt (in Hg) | -6.7 | -6.9 | -4.7 | | |
| | Regulator ID | G347 | G347 | G266 | | |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# Reference Information

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| AI | Analytical interferences may be present. Result may be biased high. |
| DLA | Detection Limit adjusted for required dilution |
| DLHC | Detection Limit Raised: Dilution required due to high concentration of test analyte(s). |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **CAN-DATA-WT** | Canister | Canister Information | EPA TO-15 |

Batch Proof ID, Canister ID, Pressure on Receipt, Regulator ID.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **VHV(C6-C13)-MS-BC-WT** | Canister | Total Hydrocarbons (C6-C13) | BC MOE LABORATORY MANUAL (2016) |
| **VOC-GCMS-WT** | Canister | Volatile Organic Compounds | EPA TO-15 |

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **VOC-L-GCMS-WT** | Canister | Volatile Organic Compounds Low Level | EPA TO-15 |

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **VPH-CALC-WT** | Canister | VPHv is VHv minus BTEX/Styrene/nC6/nC10 | EPA TO15, BC Lab Manual |
| **XYLENES-SUM-CALC-WT** | Canister | Sum of Xylene Isomer Concentrations | CALCULATION |

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |

**Chain of Custody Numbers:**

02933

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2463621 Report Date: 08-JUL-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4
Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **CAN-DATA-WT** | **Canister** | | | | | | | |
| **Batch R5130787** | | | | | | | | |
| **WG3348347-1 MB** | | | | | | | | |
| Pressure on Receipt | | | -29.8 | | in Hg | | | 23-JUN-20 |
| **VHV(C6-C13)-MS-BC-WT** | **Canister** | | | | | | | |
| **Batch R5142608** | | | | | | | | |
| **WG3355933-2 LCS** | | | | | | | | |
| VHv(C6-C13) | | | 97.3 | | % | | 50-150 | 03-JUL-20 |
| **WG3355933-3 LCSD** | | **WG3355933-2** | | | | | | |
| VHv(C6-C13) | | 97.3 | 95 | | % | 2.1 | 50 | 03-JUL-20 |
| **WG3355933-1 MB** | | | | | | | | |
| VHv(C6-C13) | | | <100 | | ug/m3 | | 100 | 06-JUL-20 |
| **VOC-GCMS-WT** | **Canister** | | | | | | | |
| **Batch R5142608** | | | | | | | | |
| **WG3355933-2 LCS** | | | | | | | | |
| 1,2,4-Trimethylbenzene | | | 101.2 | | % | | 70-130 | 06-JUL-20 |
| 1,3,5-Trimethylbenzene | | | 99.3 | | % | | 70-130 | 06-JUL-20 |
| 1,3-Butadiene | | | 98.9 | | % | | 70-130 | 06-JUL-20 |
| Benzene | | | 99.5 | | % | | 70-130 | 06-JUL-20 |
| Decane | | | 98.5 | | % | | 70-130 | 06-JUL-20 |
| Ethylbenzene | | | 100.3 | | % | | 70-130 | 06-JUL-20 |
| Isopropylbenzene | | | 91.5 | | % | | 70-130 | 06-JUL-20 |
| m&p-Xylene | | | 102.9 | | % | | 70-130 | 06-JUL-20 |
| Methylcyclohexane | | | 102.1 | | % | | 50-150 | 06-JUL-20 |
| MTBE | | | 101.2 | | % | | 70-130 | 06-JUL-20 |
| n-Hexane | | | 102.1 | | % | | 70-130 | 06-JUL-20 |
| Naphthalene | | | 89.8 | | % | | 70-130 | 06-JUL-20 |
| o-Xylene | | | 100.7 | | % | | 70-130 | 06-JUL-20 |
| Styrene | | | 98.7 | | % | | 70-130 | 06-JUL-20 |
| Toluene | | | 101.9 | | % | | 70-130 | 06-JUL-20 |
| **WG3355933-3 LCSD** | | **WG3355933-2** | | | | | | |
| 1,2,4-Trimethylbenzene | | 101.2 | 93 | | % | 8.2 | 25 | 06-JUL-20 |
| 1,3,5-Trimethylbenzene | | 99.3 | 94 | | % | 5.2 | 25 | 06-JUL-20 |
| 1,3-Butadiene | | 98.9 | 99 | | % | 0.2 | 25 | 06-JUL-20 |
| Benzene | | 99.5 | 99 | | % | 0.3 | 25 | 06-JUL-20 |
| Decane | | 98.5 | 94 | | % | 4.8 | 25 | 06-JUL-20 |
| Ethylbenzene | | 100.3 | 98 | | % | 2.3 | 25 | 06-JUL-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC-GCMS-WT** | **Canister** | | | | | | | |
| **Batch** | **R5142608** | | | | | | | |
| **WG3355933-3 LCSD** | | **WG3355933-2** | | | | | | |
| Isopropylbenzene | | 91.5 | 88 | | % | 4.3 | 25 | 06-JUL-20 |
| m&p-Xylene | | 102.9 | 99 | | % | 3.7 | 25 | 06-JUL-20 |
| Methylcyclohexane | | 102.1 | 102 | | % | 0.2 | 50 | 06-JUL-20 |
| MTBE | | 101.2 | 101 | | % | 0.1 | 25 | 06-JUL-20 |
| n-Hexane | | 102.1 | 100 | | % | 1.8 | 25 | 06-JUL-20 |
| Naphthalene | | 89.8 | 88 | | % | 2.2 | 25 | 06-JUL-20 |
| o-Xylene | | 100.7 | 97 | | % | 3.3 | 25 | 06-JUL-20 |
| Styrene | | 98.7 | 96 | | % | 2.2 | 25 | 06-JUL-20 |
| Toluene | | 101.9 | 99 | | % | 2.7 | 25 | 06-JUL-20 |
| **WG3355933-1 MB** | | | | | | | | |
| 1,2,4-Trimethylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| 1,3,5-Trimethylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| 1,3-Butadiene | | | <0.10 | | ppb(V) | | 0.1 | 06-JUL-20 |
| Benzene | | | <0.10 | | ppb(V) | | 0.1 | 06-JUL-20 |
| Decane | | | <0.50 | | ppb(V) | | 0.5 | 06-JUL-20 |
| Ethylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| Isopropylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| m&p-Xylene | | | <0.40 | | ppb(V) | | 0.4 | 06-JUL-20 |
| Methylcyclohexane | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| MTBE | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| n-Hexane | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| Naphthalene | | | <0.25 | | ppb(V) | | 0.25 | 06-JUL-20 |
| o-Xylene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| Styrene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| Toluene | | | <0.20 | | ppb(V) | | 0.2 | 06-JUL-20 |
| Surrogate: 4-Bromofluorobenzene | | | 88.2 | | % | | 70-130 | 06-JUL-20 |
| **VOC-L-GCMS-WT** | **Canister** | | | | | | | |
| **Batch** | **R5142608** | | | | | | | |
| **WG3355933-2 LCS** | | | | | | | | |
| 1,2-Dibromoethane | | | 94.6 | | % | | 70-130 | 06-JUL-20 |
| 1,2-Dichloroethane | | | 96.2 | | % | | 70-130 | 06-JUL-20 |
| **WG3355933-3 LCSD** | | **WG3355933-2** | | | | | | |
| 1,2-Dibromoethane | | 94.6 | 93 | | % | 1.6 | 25 | 06-JUL-20 |
| 1,2-Dichloroethane | | 96.2 | 93 | | % | 2.9 | 25 | 06-JUL-20 |
| **WG3355933-1 MB** | | | | | | | | |

# Quality Control Report

Workorder: L2463621 Report Date: 08-JUL-20

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC-L-GCMS-WT** | **Canister** | | | | | | | |
| **Batch R5142608** | | | | | | | | |
| **WG3355933-1 MB** | | | | | | | | |
| 1,2-Dibromoethane | | | <0.010 | | ppb(V) | | 0.01 | 06-JUL-20 |
| 1,2-Dichloroethane | | | <0.010 | | ppb(V) | | 0.01 | 06-JUL-20 |
| Surrogate: 4-Bromofluorobenzene | | | 88.2 | | % | | 70-130 | 06-JUL-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# Batch Proof Report

| Batch ID | Canister ID | Parameters | Value | Units | Date | Analyst |
|---|---|---|---|---|---|---|
| B200410.314 | 01400-0431 | 1,1,1-Trichloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1,1,2-Tetrachloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1,2,2-Tetrachloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1,2-Trichloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1-Dichloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1-Dichloroethene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2,4-Trichlorobenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2,4-Trimethylbenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dibromoethane | <0.01 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dichlorobenzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dichloroethane | <0.01 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dichloropropane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,3,5-Trimethylbenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,3-Butadiene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,3-Dichlorobenzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,4-Dichlorobenzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,4-Dioxane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 2-Chlorophenol | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 2-Hexanone | <1.0 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 4-Ethyltoluene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Acetone | <0.50 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Allyl Chloride | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Benzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Benzyl Chloride | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromodichloromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromobenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromoform | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromomethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Carbon Disulfide | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Carbon Tetrachloride | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chlorobenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chloroform | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chloromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | cis-1,2-Dichloroethene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | cis-1,3-Dichloropropene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Cyclohexane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Dibromochloromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Dichlorodifluoromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Ethyl Acetate | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Ethyl Benzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Freon 113 | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Freon 114 | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Hexachlorobutadiene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Isooctane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Isopropyl Alcohol | <1.0 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Isopropylbenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | m&p-Xylene | <0.04 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methyl Ethyl Ketone | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methylcyclohexane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methyl Isobutyl Ketone | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methylene Chloride | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | MTBE | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Naphthalene | <0.05 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | n-Decane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | n-Heptane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | n-Hexane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | o-Xylene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Propylene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Styrene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Tetrachloroethylene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Tetrahydrofuran | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Toluene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | trans-1,2-Dichloroethene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | trans-1,3-Dichloropropene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Trichloroethylene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Trichlorofluoromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Vinyl Acetate | <0.50 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Vinyl Bromide | <0.20 | ppb(V) | 23-Apr-20 | CG2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| B200410.314 | 01400-0431 | Vinyl Chloride | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 4-Bromofluorobenzene | 96.8 | % | 23-Apr-20 | CG2 |

L2463621-COFC

2…
Vancouver, British Columbia, …
Telephone (604) 296-4200 Fax (604) 298-5253

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

**No.** 02933 page 1 of 1

Project Number: 20145856/1000
Short Title: CFB Comox Snowbird
Golder Contact: Alison Verde
Golder E-mail Address 1: averde @golder.com
Golder E-mail Address 2: alanna-umphrey @golder.com
Laboratory Name: ALS Environmental
Address: 8081 Lougheed Hwy Burnaby
Telephone/Fax: 778 370 3259
Contact: Amber Springer

Office Name: Vancouver VIRTUAL WAY
**EQuIS Facility Code:** 21783370
**EQuIS upload:** ☐

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

**Note:** Final Reports to be issued by e-mail
**Quote No.:** Q 80351

**Analyses Required**

| 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 | Gasoline + Diesel Fuel package | | | | | | | | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2933 - 01 | SV20-03 | | 3.8 | SV | 18/06/20 | 16:45 | GRAB | FD | 2933-02 | 1 | X | | | | | | | | | |
| ↓ - 02 | SV20-03 | | 3.8 | SV | ↓ | 16:45 | | FDA | 2933-01 | 1 | X | | | | | | | | | |
| ↓ - 03 | SV20-01 | | 3.5 | SV | ↓ | 18:00 | ↓ | | | | | | | | | | | | | |
| - 04 | | | | | | | | | | | | | | | | | | | | |
| - 05 | | | | | | | | | | | | | | | | | | | | |
| - 06 | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | |

Sampler's Signature: Amy
Relinquished by: Signature
Company: GOLDER
Date: June 19 2020
Time: 19:00
Received by: Signature
Company:
Comments: Detection limit must meet CCME
Method of Shipment:
Waybill No.:
Received for Lab by: TL
Date: Jun 19
Time: 7:19
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): 18
Cooler opened by: TL
Date:
Time:

**WHITE: Golder Copy YELLOW: Lab Copy**

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

Date Received: 26-JUN-20
Report Date: 30-JUN-20 17:49 (MT)
Version: FINAL

Client Phone: 604-297-2036

# Certificate of Analysis

**Lab Work Order #: L2466948**

Project P.O. #: NOT SUBMITTED
Job Reference: 20145856/1000
C of C Numbers: 02945
Legal Site Desc:

Amber Springer

Amber Springer, B.Sc
Account Manager

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | **Sample ID** | L2466948-1 | L2466948-2 | L2466948-3 | L2466948-4 | |
|---|---|---|---|---|---|---|
| | **Description** | SO | SO | SO | SO | |
| | **Sampled Date** | 26-JUN-20 | 26-JUN-20 | 26-JUN-20 | 26-JUN-20 | |
| | **Sampled Time** | 13:30 | 14:00 | 14:15 | 14:15 | |
| | **Client ID** | 02945-01 | 02945-02 | 02945-03 | 02945-04 | |
| **Grouping** | **Analyte** | | | | | |
| **SOIL** | | | | | | |
| **Physical Tests** | Moisture (%) | 4.66 | 2.01 | 2.91 | 2.36 | |
| | pH (1:2 soil:water) (pH) | 7.35 | 7.55 | 7.37 | 7.43 | |
| **Metals** | Cadmium (Cd) (mg/kg) | 0.042 | 0.048 | 0.037 | 0.035 | |
| | Chromium (Cr) (mg/kg) | 17.5 | 18.6 | 19.7 | 16.3 | |
| **Volatile Organic Compounds** | VOC Sample Container | Field MeOH | Field MeOH | Field MeOH | Field MeOH | |
| | Benzene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | |
| | 1,2-Dibromoethane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | |
| | Ethylbenzene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | |
| | Methyl t-butyl ether (MTBE) (mg/kg) | <0.20 | <0.20 | <0.20 | <0.20 | |
| | n-Nonane (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | |
| | Styrene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | |
| | Toluene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | |
| | ortho-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | |
| | meta- & para-Xylene (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 | |
| | Xylenes (mg/kg) | <0.075 | <0.075 | <0.075 | <0.075 | |
| | Surrogate: 4-Bromofluorobenzene (SS) (%) | 104.1 | 105.0 | 97.4 | 104.1 | |
| | Surrogate: 1,4-Difluorobenzene (SS) (%) | 112.3 | 110.4 | 111.9 | 112.6 | |
| **Hydrocarbons** | EPH10-19 (mg/kg) | <200 | <200 | <200 | <200 | |
| | EPH19-32 (mg/kg) | <200 | <200 | <200 | <200 | |
| | LEPH (mg/kg) | <200 | <200 | <200 | <200 | |
| | HEPH (mg/kg) | <200 | <200 | <200 | <200 | |
| | Volatile Hydrocarbons (VH6-10) (mg/kg) | <100 | <100 | <100 | <100 | |
| | VPH (C6-C10) (mg/kg) | <100 | <100 | <100 | <100 | |
| | Surrogate: 2-Bromobenzotrifluoride (%) | 67.8 | 78.1 | 75.1 | 80.1 | |
| | Surrogate: 3,4-Dichlorotoluene (SS) (%) | 110.9 | 116.6 | 110.7 | 118.7 | |
| **Polycyclic Aromatic Hydrocarbons** | Acenaphthene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | |
| | Acenaphthylene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | |
| | Anthracene (mg/kg) | <0.0040 | <0.0040 | <0.0040 | <0.0040 | |
| | Benz(a)anthracene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | |
| | Benzo(a)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | |
| | Benzo(b&j)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | |
| | Benzo(b+j+k)fluoranthene (mg/kg) | <0.015 | <0.015 | <0.015 | <0.015 | |
| | Benzo(g,h,i)perylene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | |
| | Benzo(k)fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | |
| | Chrysene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 | |
| | Dibenz(a,h)anthracene (mg/kg) | <0.0050 | <0.0050 | <0.0050 | <0.0050 | |

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | Sample ID | L2466948-1 | L2466948-2 | L2466948-3 | L2466948-4 |
|---|---|---|---|---|---|
| | Description | SO | SO | SO | SO |
| | Sampled Date | 26-JUN-20 | 26-JUN-20 | 26-JUN-20 | 26-JUN-20 |
| | Sampled Time | 13:30 | 14:00 | 14:15 | 14:15 |
| | Client ID | 02945-01 | 02945-02 | 02945-03 | 02945-04 |
| **Grouping** | **Analyte** | | | | |
| **SOIL** | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | Fluoranthene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | Fluorene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | Indeno(1,2,3-c,d)pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | 1-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | 2-Methylnaphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | Naphthalene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | Phenanthrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | Pyrene (mg/kg) | <0.010 | <0.010 | <0.010 | <0.010 |
| | Quinoline (mg/kg) | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: Chrysene d12 (%) | 77.0 | 83.4 | 79.5 | 84.8 |
| | Surrogate: Naphthalene d8 (%) | 76.1 | 86.6 | 84.3 | 92.5 |
| | Surrogate: Phenanthrene d10 (%) | 75.9 | 82.5 | 80.6 | 87.3 |
| | B(a)P Total Potency Equivalent (mg/kg) | <0.020 | <0.020 | <0.020 | <0.020 |
| | IACR (CCME) | <0.15 | <0.15 | <0.15 | <0.15 |

# Reference Information

## Test Method References:

<table>
<tr><th>ALS Test Code</th><th>Matrix</th><th>Test Description</th><th>Method Reference**</th></tr>
<tr><td>EPH-TUMB-FID-VA</td><td>Soil</td><td>EPH in Solids by Tumbler and GCFID</td><td>BC MOE EPH GCFID</td></tr>
<tr><td colspan="4">Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Solids by GC/FID", v2.1, July 1999. Soil samples are extracted with a 1:1 mixture of hexane and acetone using a rotary extraction technique modified from EPA 3570 prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).</td></tr>
<tr><td>FUELS-HSMS-VA</td><td>Soil</td><td>VOCs in soil by Headspace GCMS</td><td>EPA 5035A/5021A/8260C</td></tr>
<tr><td colspan="4">The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.</td></tr>
<tr><td>LEPH/HEPH-CALC-VA</td><td>Soil</td><td>LEPHs and HEPHs</td><td>BC MOE LEPH/HEPH</td></tr>
<tr><td colspan="4">LEPHs and HEPHs are measures of Light and Heavy Extractable Petroleum Hydrocarbons in soil. Results are calculated by subtraction of applicable PAH concentrations from EPH10-19 and EPH19-32, as per the BC Lab Manual LEPH/HEPH calculation procedure.<br><br>LEPHs = EPH10-19 minus Naphthalene and Phenanthrene.<br><br>HEPHs = EPH19-32 minus Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and Pyrene.</td></tr>
<tr><td>MET-200.2-CCMS-VA</td><td>Soil</td><td>Metals in Soil by CRC ICPMS</td><td>EPA 200.2/6020A (mod)</td></tr>
<tr><td colspan="4">Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.<br><br>Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.</td></tr>
<tr><td>MOISTURE-VA</td><td>Soil</td><td>Moisture content</td><td>CCME PHC in Soil - Tier 1 (mod)</td></tr>
<tr><td colspan="4">This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of two hours.</td></tr>
<tr><td>PAH-TMB-H/A-MS-VA</td><td>Soil</td><td>PAH - Rotary Extraction (Hexane/Acetone)</td><td>EPA 3570/8270</td></tr>
<tr><td colspan="4">This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3570 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.<br><br>Benzo(a)pyrene Total Potency Equivalents [B(a)P TPE] represents the sum of estimated cancer potency relative to B(a)P for all potentially carcinogenic unsubstituted PAHs, and is calculated as per the CCME PAH Soil Quality Guidelines reference document (2010).</td></tr>
<tr><td>PH-1:2-VA</td><td>Soil</td><td>pH in Soil (1:2 Soil:Water Extraction)</td><td>BC WLAP METHOD: PH, ELECTROMETRIC, SOIL</td></tr>
<tr><td colspan="4">This analysis is carried out in accordance with procedures described in "pH, Electrometric in Soil and Sediment - Prescriptive Method", Rev. 2005, Section B Physical, Inorganic and Misc. Constituents, BC Environmental Laboratory Manual. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.</td></tr>
<tr><td>VH-HSFID-VA</td><td>Soil</td><td>VH in soil by Headspace GCFID</td><td>BC Env. Lab Manual (VH in Solids)</td></tr>
<tr><td colspan="4">This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999).</td></tr>
<tr><td>VH-SURR-FID-VA</td><td>Soil</td><td>VH Surrogates for Soils</td><td>BC Env. Lab Manual (VH in Solids)</td></tr>
<tr><td>VOC-M2-HSMS-VA</td><td>Soil</td><td>Misc VOCs in soil by Headspace GCMS</td><td>EPA 5035A/5021A/8260C</td></tr>
<tr><td colspan="4">The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.</td></tr>
<tr><td>VOC7-L-HSMS-VA</td><td>Soil</td><td>VOCs in soil by Headspace GCMS</td><td>EPA 5035A/5021A/8260C</td></tr>
<tr><td colspan="4">The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.</td></tr>
<tr><td>VOC7/VOC-SURR-MS-VA</td><td>Soil</td><td>VOC7 and/or VOC Surrogates for Soils</td><td>EPA 5035A/5021A/8260C</td></tr>
<tr><td>VPH-CALC-VA</td><td>Soil</td><td>VPH is VH minus select aromatics</td><td>BC MOE VPH</td></tr>
<tr><td colspan="4">VPHs measures Volatile Petroleum Hydrocarbons in soil. Results are calculated by subtraction of specific Monocyclic Aromatic Hydrocarbons from VH6-10, as per the BC Lab Manual VPH calculation procedure.<br>VPHs = VH6-10 minus Benzene, Toluene, Ethylbenzene, Xylenes, and Styrene</td></tr>
<tr><td>XYLENES-CALC-VA</td><td>Soil</td><td>Sum of Xylene Isomer Concentrations</td><td>EPA 8260B & 524.2</td></tr>
</table>

# Reference Information

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| VA | ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA |

**Chain of Custody Numbers:**

02945

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2466948 Report Date: 30-JUN-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4

Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **EPH-TUMB-FID-VA** | **Soil** | | | | | | | |
| **Batch R5136000** | | | | | | | | |
| **WG3351628-3 DUP** | | **L2466948-1** | | | | | | |
| EPH10-19 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 30-JUN-20 |
| EPH19-32 | | <200 | <200 | RPD-NA | mg/kg | N/A | 40 | 30-JUN-20 |
| **WG3351628-4 IRM** | | **ALS PHC RM3** | | | | | | |
| EPH10-19 | | | 97.1 | | % | | 70-130 | 30-JUN-20 |
| EPH19-32 | | | 98.2 | | % | | 70-130 | 30-JUN-20 |
| **WG3351628-2 LCS** | | | | | | | | |
| EPH10-19 | | | 96.3 | | % | | 70-130 | 30-JUN-20 |
| EPH19-32 | | | 98.7 | | % | | 70-130 | 30-JUN-20 |
| **WG3351628-1 MB** | | | | | | | | |
| EPH10-19 | | | <200 | | mg/kg | | 200 | 30-JUN-20 |
| EPH19-32 | | | <200 | | mg/kg | | 200 | 30-JUN-20 |
| Surrogate: 2-Bromobenzotrifluoride | | | 81.3 | | % | | 60-140 | 30-JUN-20 |
| **FUELS-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3351696-2 LCS** | | | | | | | | |
| 1,2-Dibromoethane | | | 107.5 | | % | | 70-130 | 28-JUN-20 |
| **WG3351696-1 MB** | | | | | | | | |
| 1,2-Dibromoethane | | | <0.050 | | mg/kg | | 0.05 | 28-JUN-20 |
| **MET-200.2-CCMS-VA** | **Soil** | | | | | | | |
| **Batch R5135986** | | | | | | | | |
| **WG3351629-4 CRM** | | **SCP SS-2** | | | | | | |
| Cadmium (Cd) | | | 103.0 | | % | | 70-130 | 30-JUN-20 |
| Chromium (Cr) | | | 116.3 | | % | | 70-130 | 30-JUN-20 |
| **WG3351629-2 DUP** | | **L2466948-2** | | | | | | |
| Cadmium (Cd) | | 0.048 | 0.041 | | mg/kg | 16 | 30 | 30-JUN-20 |
| Chromium (Cr) | | 18.6 | 16.2 | | mg/kg | 14 | 30 | 30-JUN-20 |
| **WG3351629-3 LCS** | | | | | | | | |
| Cadmium (Cd) | | | 100.7 | | % | | 80-120 | 30-JUN-20 |
| Chromium (Cr) | | | 105.2 | | % | | 80-120 | 30-JUN-20 |
| **WG3351629-1 MB** | | | | | | | | |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 30-JUN-20 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 30-JUN-20 |
| **MOISTURE-VA** | **Soil** | | | | | | | |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **MOISTURE-VA** | **Soil** | | | | | | | |
| **Batch R5135391** | | | | | | | | |
| **WG3351627-3 DUP** | | **L2466948-1** | | | | | | |
| Moisture | | 4.66 | 4.76 | | % | 2.2 | 20 | 27-JUN-20 |
| **WG3351627-2 LCS** | | | | | | | | |
| Moisture | | | 99.8 | | % | | 90-110 | 27-JUN-20 |
| **WG3351627-1 MB** | | | | | | | | |
| Moisture | | | <0.25 | | % | | 0.25 | 27-JUN-20 |
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5138217** | | | | | | | | |
| **WG3351628-3 DUP** | | **L2466948-1** | | | | | | |
| Acenaphthene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Acenaphthylene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Anthracene | | <0.0040 | <0.0040 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benz(a)anthracene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(a)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Benzo(k)fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Chrysene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | <0.0050 | <0.0050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Fluoranthene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Fluorene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| 1-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| 2-Methylnaphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Naphthalene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Phenanthrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Pyrene | | <0.010 | <0.010 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| Quinoline | | <0.050 | <0.050 | RPD-NA | mg/kg | N/A | 50 | 30-JUN-20 |
| **WG3351628-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Acenaphthene | | | 102.8 | | % | | 60-130 | 30-JUN-20 |
| Acenaphthylene | | | 114.4 | | % | | 60-130 | 30-JUN-20 |
| Anthracene | | | 103.9 | | % | | 60-130 | 30-JUN-20 |
| Benz(a)anthracene | | | 99.4 | | % | | 60-130 | 30-JUN-20 |
| Benzo(a)pyrene | | | 114.0 | | % | | 60-130 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | | 92.6 | | % | | 60-130 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | | 101.2 | | % | | 60-130 | 30-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5138217** | | | | | | | | |
| **WG3351628-5 IRM** | | **ALS PAH RM2** | | | | | | |
| Benzo(k)fluoranthene | | | 114.8 | | % | | 60-130 | 30-JUN-20 |
| Chrysene | | | 106.0 | | % | | 60-130 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | | 99.0 | | % | | 60-130 | 30-JUN-20 |
| Fluoranthene | | | 104.2 | | % | | 60-130 | 30-JUN-20 |
| Fluorene | | | 101.1 | | % | | 60-130 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 89.7 | | % | | 60-130 | 30-JUN-20 |
| 1-Methylnaphthalene | | | 101.9 | | % | | 60-130 | 30-JUN-20 |
| 2-Methylnaphthalene | | | 98.0 | | % | | 60-130 | 30-JUN-20 |
| Naphthalene | | | 100.9 | | % | | 50-130 | 30-JUN-20 |
| Phenanthrene | | | 107.5 | | % | | 60-130 | 30-JUN-20 |
| Pyrene | | | 107.2 | | % | | 60-130 | 30-JUN-20 |
| **WG3351628-2 LCS** | | | | | | | | |
| Acenaphthene | | | 99.5 | | % | | 60-130 | 30-JUN-20 |
| Acenaphthylene | | | 95.4 | | % | | 60-130 | 30-JUN-20 |
| Anthracene | | | 89.8 | | % | | 60-130 | 30-JUN-20 |
| Benz(a)anthracene | | | 91.4 | | % | | 60-130 | 30-JUN-20 |
| Benzo(a)pyrene | | | 86.6 | | % | | 60-130 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | | 89.9 | | % | | 60-130 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | | 97.7 | | % | | 60-130 | 30-JUN-20 |
| Benzo(k)fluoranthene | | | 101.5 | | % | | 60-130 | 30-JUN-20 |
| Chrysene | | | 101.9 | | % | | 60-130 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | | 93.6 | | % | | 60-130 | 30-JUN-20 |
| Fluoranthene | | | 97.6 | | % | | 60-130 | 30-JUN-20 |
| Fluorene | | | 97.7 | | % | | 60-130 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | 89.9 | | % | | 60-130 | 30-JUN-20 |
| 1-Methylnaphthalene | | | 95.9 | | % | | 60-130 | 30-JUN-20 |
| 2-Methylnaphthalene | | | 94.1 | | % | | 60-130 | 30-JUN-20 |
| Naphthalene | | | 91.0 | | % | | 50-130 | 30-JUN-20 |
| Phenanthrene | | | 94.0 | | % | | 60-130 | 30-JUN-20 |
| Pyrene | | | 100.9 | | % | | 60-130 | 30-JUN-20 |
| Quinoline | | | 92.2 | | % | | 60-130 | 30-JUN-20 |
| **WG3351628-1 MB** | | | | | | | | |
| Acenaphthene | | | <0.0050 | | mg/kg | | 0.005 | 30-JUN-20 |
| Acenaphthylene | | | <0.0050 | | mg/kg | | 0.005 | 30-JUN-20 |
| Anthracene | | | <0.0040 | | mg/kg | | 0.004 | 30-JUN-20 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **PAH-TMB-H/A-MS-VA** | **Soil** | | | | | | | |
| **Batch R5138217** | | | | | | | | |
| **WG3351628-1 MB** | | | | | | | | |
| Benz(a)anthracene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(a)pyrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(b&j)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(g,h,i)perylene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Benzo(k)fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Chrysene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Dibenz(a,h)anthracene | | | <0.0050 | | mg/kg | | 0.005 | 30-JUN-20 |
| Fluoranthene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Fluorene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Indeno(1,2,3-c,d)pyrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| 1-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| 2-Methylnaphthalene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Naphthalene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Phenanthrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Pyrene | | | <0.010 | | mg/kg | | 0.01 | 30-JUN-20 |
| Quinoline | | | <0.050 | | mg/kg | | 0.05 | 30-JUN-20 |
| Surrogate: Naphthalene d8 | | | 100.2 | | % | | 50-130 | 30-JUN-20 |
| Surrogate: Phenanthrene d10 | | | 94.6 | | % | | 60-130 | 30-JUN-20 |
| Surrogate: Chrysene d12 | | | 95.8 | | % | | 60-130 | 30-JUN-20 |
| **PH-1:2-VA** | **Soil** | | | | | | | |
| **Batch R5135695** | | | | | | | | |
| **WG3351629-2 DUP** | | **L2466948-2** | | | | | | |
| pH (1:2 soil:water) | | 7.55 | 7.37 | J | pH | 0.18 | 0.2 | 29-JUN-20 |
| **VH-HSFID-VA** | **Soil** | | | | | | | |
| **Batch R5117484** | | | | | | | | |
| **WG3351696-2 LCS** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | 112.8 | | % | | 70-130 | 29-JUN-20 |
| **WG3351696-1 MB** | | | | | | | | |
| Volatile Hydrocarbons (VH6-10) | | | <100 | | mg/kg | | 100 | 29-JUN-20 |
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5112127** | | | | | | | | |
| **WG3351696-2 LCS** | | | | | | | | |
| n-Nonane | | | 107.0 | | % | | 70-130 | 30-JUN-20 |
| **WG3351696-1 MB** | | | | | | | | |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC-M2-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5112127** | | | | | | | | |
| **WG3351696-1 MB** | | | | | | | | |
| n-Nonane | | | <0.050 | | mg/kg | | 0.05 | 30-JUN-20 |
| **VOC7-L-HSMS-VA** | **Soil** | | | | | | | |
| **Batch R5117129** | | | | | | | | |
| **WG3351696-2 LCS** | | | | | | | | |
| Benzene | | | 107.4 | | % | | 70-130 | 28-JUN-20 |
| Ethylbenzene | | | 107.2 | | % | | 70-130 | 28-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | 128.0 | | % | | 70-130 | 28-JUN-20 |
| Styrene | | | 99.4 | | % | | 70-130 | 28-JUN-20 |
| Toluene | | | 109.4 | | % | | 70-130 | 28-JUN-20 |
| meta- & para-Xylene | | | 124.7 | | % | | 70-130 | 28-JUN-20 |
| ortho-Xylene | | | 103.8 | | % | | 70-130 | 28-JUN-20 |
| **WG3351696-1 MB** | | | | | | | | |
| Benzene | | | <0.0050 | | mg/kg | | 0.005 | 28-JUN-20 |
| Ethylbenzene | | | <0.015 | | mg/kg | | 0.015 | 28-JUN-20 |
| Methyl t-butyl ether (MTBE) | | | <0.20 | | mg/kg | | 0.2 | 28-JUN-20 |
| Styrene | | | <0.050 | | mg/kg | | 0.05 | 28-JUN-20 |
| Toluene | | | <0.050 | | mg/kg | | 0.05 | 28-JUN-20 |
| meta- & para-Xylene | | | <0.050 | | mg/kg | | 0.05 | 28-JUN-20 |
| ortho-Xylene | | | <0.050 | | mg/kg | | 0.05 | 28-JUN-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| J | Duplicate results and limits are expressed in terms of absolute difference. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

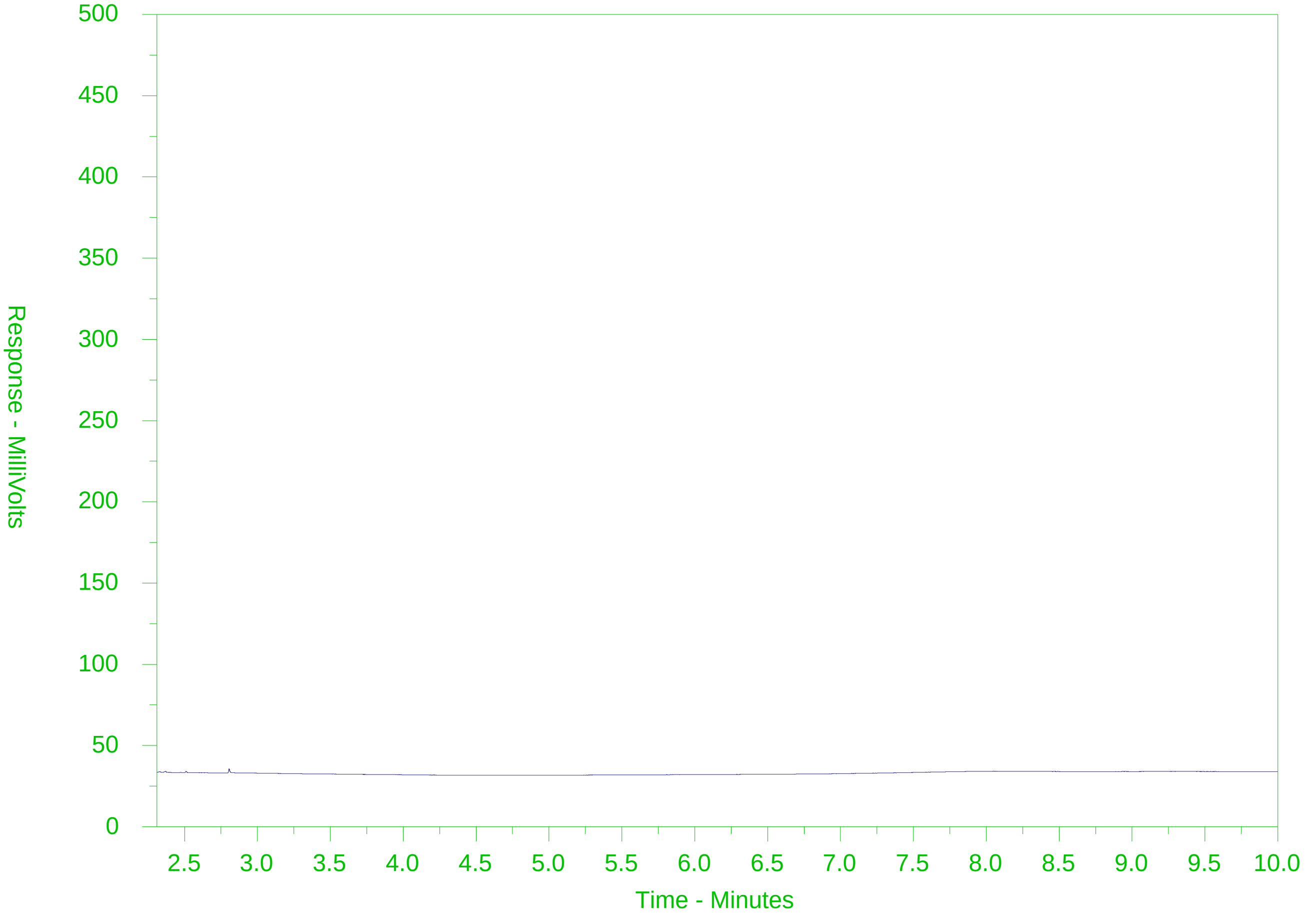
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

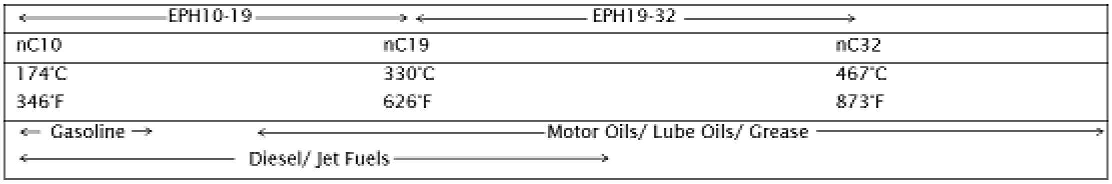
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2466948-1
Client Sample ID: BH20-10 0.5





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

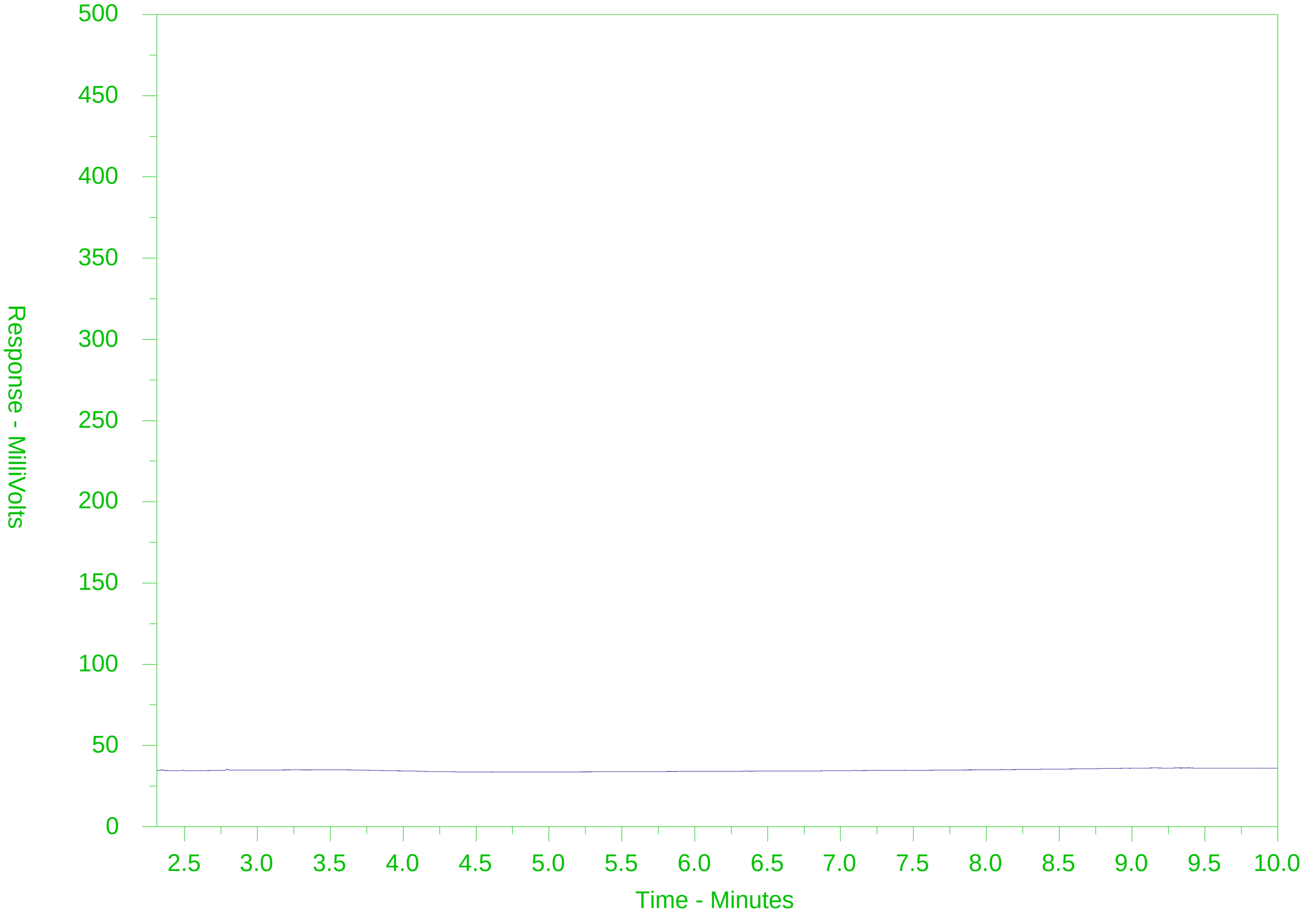
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG3351628-3#L2466948-1
Client Sample ID: BH20-10 0.5



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

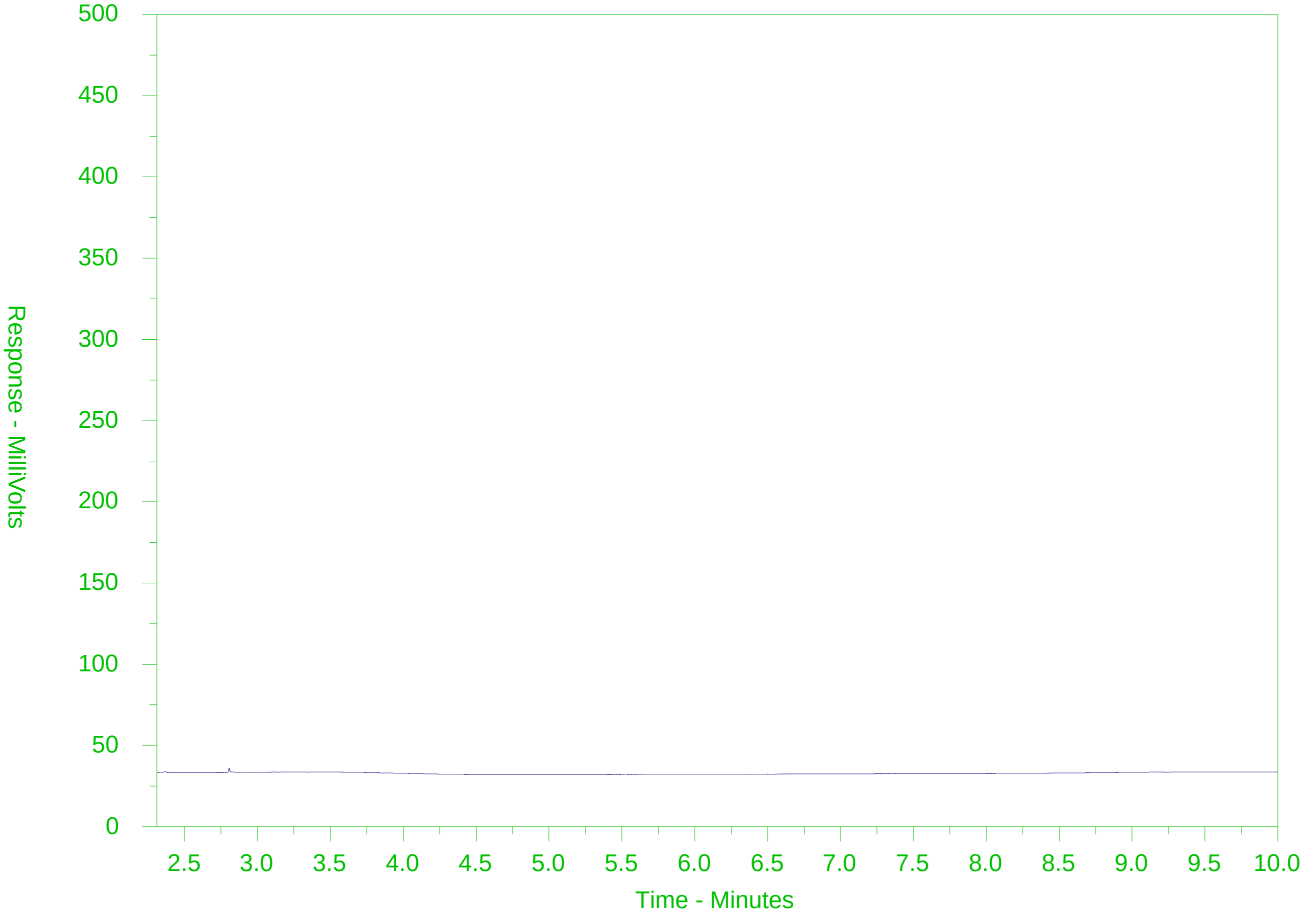
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2466948-2
Client Sample ID: BH20-10 1.5



| | | |
|---|---|---|
| ← EPH10-19 → | ← EPH19-32 → | |
| nC10 | nC19 | nC32 |
| 174°C<br>346°F | 330°C<br>626°F | 467°C<br>873°F |
| ← Gasoline → | ← Motor Oils/ Lube Oils/ Grease → | |
| ← Diesel/ Jet Fuels → | | |

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

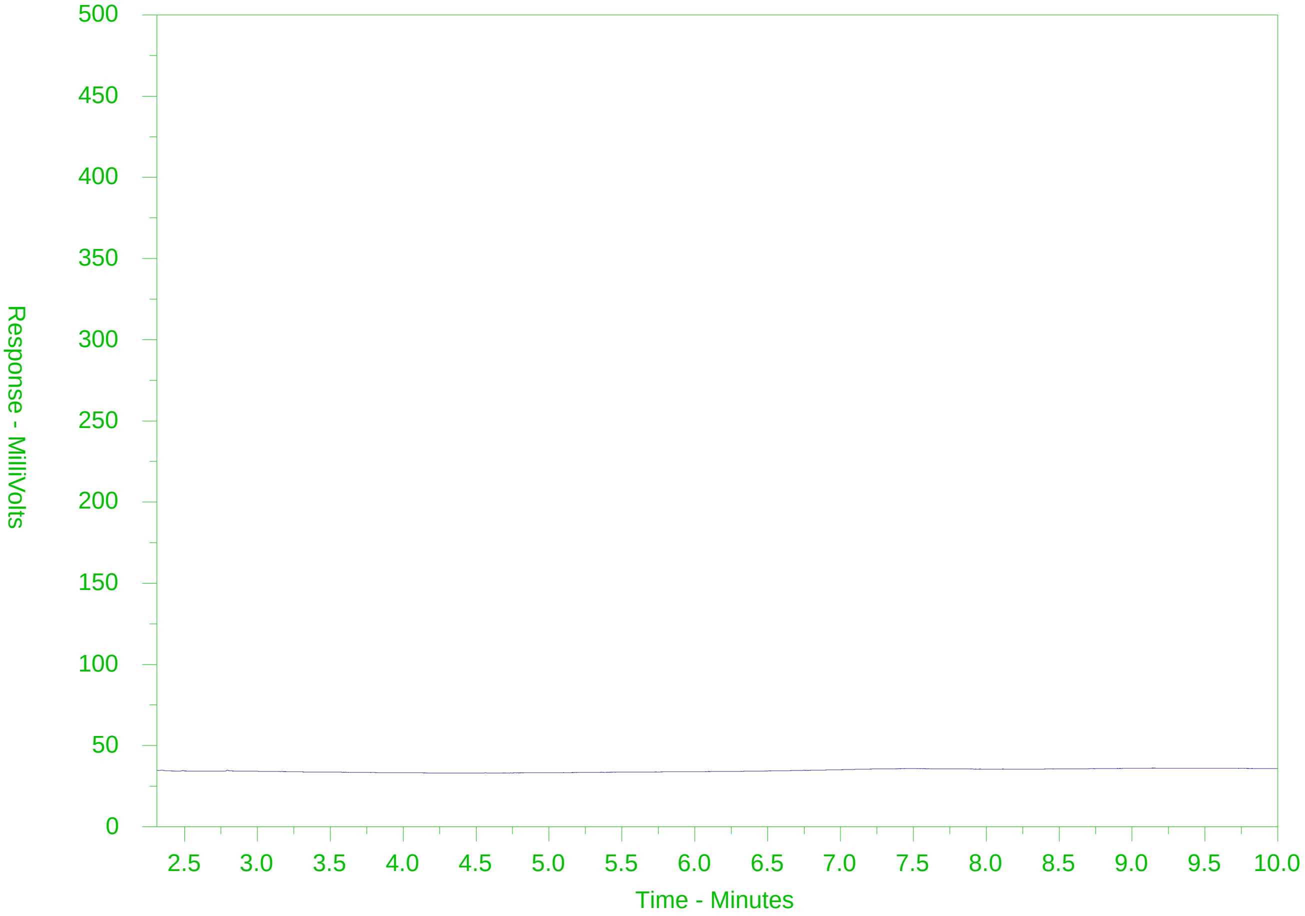
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

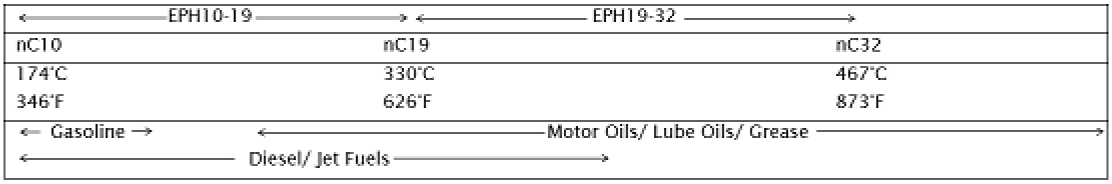
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

| | |
|---|---|
| ALS Sample ID: | L2466948-3 |
| Client Sample ID: | BH20-10 2.5 |





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

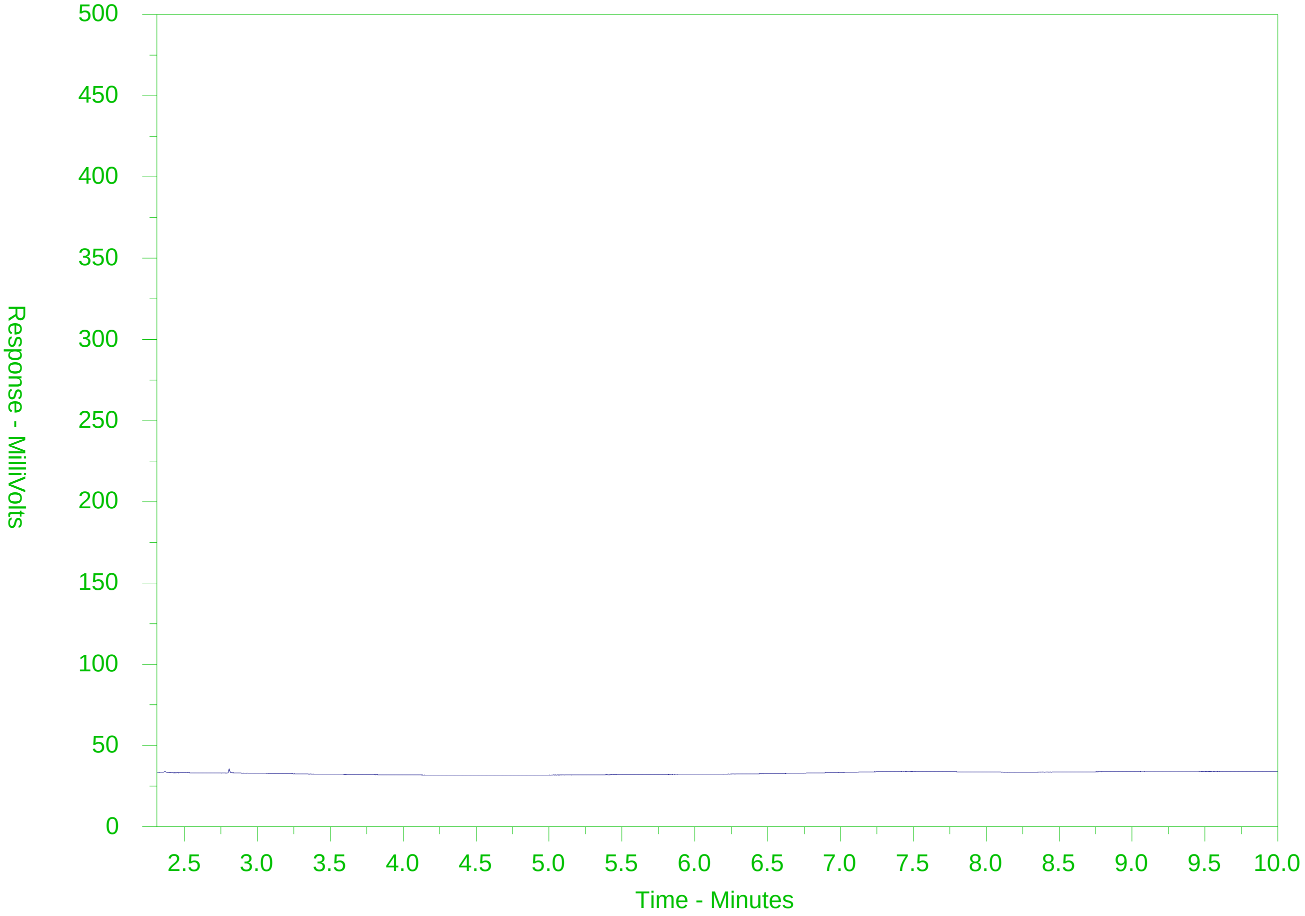
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

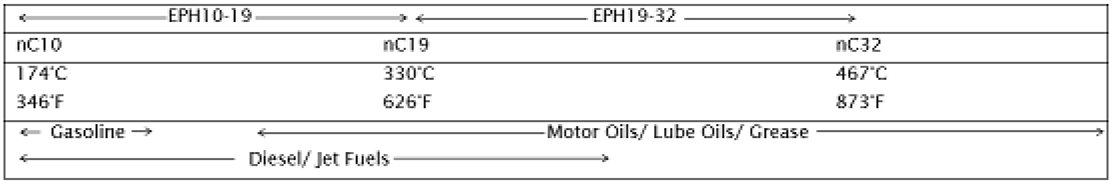
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2466948-4
Client Sample ID: BH20-10 2.5





The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

**No.** 02945 page __ of __

Project Number: 20145856/1000
Short Title: Snowbird Clean UP
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: AUMPHREY @golder.com
Laboratory Name: Als Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: Amber Springer

Office Name: Vancouver
EQuIS Facility Code: 217832270
EQuIS upload: ☑

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

**Note:** Final Reports to be issued by e-mail

**Quote No.:** Q80351

| 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 | LEPH/HEPH | 2-methylnapthalene | napthalene, quinoline | BTEX / VPH | Cadmium, chromium | n-nonane | 1,2 dibromoethane | | | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02945 - 01 | BH20-6 | | 0.5 | SO | 26/6/20 | 13:30 | Grab | | | 4 | X | X | X | X | X | X | X | | | X | |
| - 02 | BH20-6 | | 1.5 | ↓ | ↓ | 14:00 | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | | ↓ | |
| - 03 | BH20-10 | | 2.5 | | | 14:15 | | FDA | 02945-04 | | | | | | | | | | | | |
| - 04 | BH20-10 | | 2.5 | | | 14:15 | | FD | 02945-03 | | | | | | | | | | | | |
| - 05 | | | | | | | | | | | | | | | | | | | | | |
| - 06 | | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2466948-COFC

RUSH

Sampler's Signature: ah
Comments: ON ICE
Detection limit must meet CCME

Relinquished by: Signature ah
Company: Golder
Date: 26/06/2020
Time:
Received by: Signature
Company:
Method of Shipment:
Waybill No.:
Received for Lab by: OT
Date: 26 June 20
Time: 350pm
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): 20
Cooler opened by:
Date:
Time:

**WHITE: Golder Copy YELLOW: Lab Copy**

ESED

GOLDER ASSOCIATES LTD.
ATTN: Alison Verde
200-2920 Virtual Way
Vancouver BC V5M 0C4

Date Received: 26-JUN-20
Report Date: 02-JUL-20 16:22 (MT)
Version: FINAL

Client Phone: 604-297-2036

# Certificate of Analysis

**Lab Work Order #:** **L2466950**
Project P.O. #: NOT SUBMITTED
Job Reference: 20145856/1000
C of C Numbers: 02936
Legal Site Desc:

Amber Springer

Amber Springer, B.Sc
Account Manager

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | |
|---|---|---|
| | **Sample ID** | L2466950-1 |
| | **Description** | SV |
| | **Sampled Date** | 26-JUN-20 |
| | **Sampled Time** | 11:55 |
| | **Client ID** | 02936-01 |
| **Grouping** | **Analyte** | |
| **CANISTER** | | |
| **Volatile Organic Compounds** | Benzene (ppb(V)) | 1.52 DLHC |
| | Benzene (ug/m3) | 4.85 DLHC |
| | 1,3-Butadiene (ppb(V)) | <0.25 DLHC |
| | 1,3-Butadiene (ug/m3) | <0.55 DLHC |
| | Decane (ppb(V)) | <1.3 DLHC |
| | Decane (ug/m3) | <7.3 DLHC |
| | 1,2-Dibromoethane (ppb(V)) | <0.025 DLHC |
| | 1,2-Dibromoethane (ug/m3) | <0.19 DLHC |
| | 1,2-Dichloroethane (ppb(V)) | 0.946 AI |
| | 1,2-Dichloroethane (ug/m3) | 3.83 AI |
| | Ethylbenzene (ppb(V)) | 1.89 DLHC |
| | Ethylbenzene (ug/m3) | 8.2 DLHC |
| | n-Hexane (ppb(V)) | 56.7 DLA |
| | n-Hexane (ug/m3) | 200 DLA |
| | Isopropylbenzene (ppb(V)) | <0.50 DLHC |
| | Isopropylbenzene (ug/m3) | <2.5 DLHC |
| | Methylcyclohexane (ppb(V)) | 414 DLA |
| | Methylcyclohexane (ug/m3) | 1660 DLA |
| | MTBE (ppb(V)) | <0.50 DLHC |
| | MTBE (ug/m3) | <1.8 DLHC |
| | Naphthalene (ppb(V)) | <0.63 DLHC |
| | Naphthalene (ug/m3) | <3.3 DLHC |
| | Styrene (ppb(V)) | <0.50 DLHC |
| | Styrene (ug/m3) | <2.1 DLHC |
| | Toluene (ppb(V)) | 8.97 DLHC |
| | Toluene (ug/m3) | 33.8 DLHC |
| | 1,2,4-Trimethylbenzene (ppb(V)) | 1.91 DLHC |
| | 1,2,4-Trimethylbenzene (ug/m3) | 9.4 DLHC |
| | 1,3,5-Trimethylbenzene (ppb(V)) | 0.51 DLHC |
| | 1,3,5-Trimethylbenzene (ug/m3) | 2.5 DLHC |
| | o-Xylene (ppb(V)) | 2.46 DLHC |
| | o-Xylene (ug/m3) | 10.7 DLHC |
| | m&p-Xylene (ppb(V)) | 6.8 DLHC |
| | m&p-Xylene (ug/m3) | 29.6 DLHC |
| | Xylenes (Total) (ppb(V)) | 9.3 |
| | Xylenes (Total) (ug/m3) | 40.3 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| | | |
|---|---|---|
| | **Sample ID** | L2466950-1 |
| | **Description** | SV |
| | **Sampled Date** | 26-JUN-20 |
| | **Sampled Time** | 11:55 |
| | **Client ID** | 02936-01 |
| **Grouping** | **Analyte** | |
| **CANISTER** | | |
| **Volatile Organic Compounds** | Surrogate: 4-Bromofluorobenzene (%) | 94.0 |
| | | 80.7 |
| **Hydrocarbons** | VHv(C6-C13) (ug/m3) | 13900 |
| | VPHv(C6-C13) (ug/m3) | 13600 |
| **Miscellaneous** | Batch Proof ID | 200410.31 |
| | Canister ID | 01400-0131 |
| | Pressure on Receipt (in Hg) | -3.5 |
| | Regulator ID | G247 |

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# Reference Information

**Qualifiers for Individual Parameters Listed:**

| Qualifier | Description |
|---|---|
| AI | Analytical interferences may be present. Result may be biased high. |
| DLA | Detection Limit adjusted for required dilution |
| DLHC | Detection Limit Raised: Dilution required due to high concentration of test analyte(s). |

## Test Method References:

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **CAN-DATA-WT** | Canister | Canister Information | EPA TO-15 |

Batch Proof ID, Canister ID, Pressure on Receipt, Regulator ID.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **VHV(C6-C13)-MS-BC-WT** | Canister | Total Hydrocarbons (C6-C13) | BC MOE LABORATORY MANUAL (2016) |
| **VOC-GCMS-WT** | Canister | Volatile Organic Compounds | EPA TO-15 |

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **VOC-L-GCMS-WT** | Canister | Volatile Organic Compounds Low Level | EPA TO-15 |

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **VPH-CALC-WT** | Canister | VPHv is VHv minus BTEX/Styrene/nC6/nC10 | EPA TO15, BC Lab Manual |
| **XYLENES-SUM-CALC-WT** | Canister | Sum of Xylene Isomer Concentrations | CALCULATION |

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |

**Chain of Custody Numbers:**

02936

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*
*mg/kg - milligrams per kilogram based on dry weight of sample.*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
*mg/L - milligrams per litre.*
*< - Less than.*
*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

# Quality Control Report

Workorder: L2466950 Report Date: 02-JUL-20

Client: GOLDER ASSOCIATES LTD.
200-2920 Virtual Way
Vancouver BC V5M 0C4
Contact: Alison Verde

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VHV(C6-C13)-MS-BC-WT** | **Canister** | | | | | | | |
| **Batch R5139256** | | | | | | | | |
| **WG3353837-2 LCS** | | | | | | | | |
| VHv(C6-C13) | | | 100.9 | | % | | 50-150 | 30-JUN-20 |
| **WG3353837-3 LCSD** | | **WG3353837-2** | | | | | | |
| VHv(C6-C13) | | 100.9 | 102 | | % | 0.6 | 50 | 30-JUN-20 |
| **WG3353837-1 MB** | | | | | | | | |
| VHv(C6-C13) | | | <100 | | ug/m3 | | 100 | 02-JUL-20 |
| **VOC-GCMS-WT** | **Canister** | | | | | | | |
| **Batch R5139256** | | | | | | | | |
| **WG3353837-2 LCS** | | | | | | | | |
| 1,2,4-Trimethylbenzene | | | 97.3 | | % | | 70-130 | 30-JUN-20 |
| 1,3,5-Trimethylbenzene | | | 98.1 | | % | | 70-130 | 30-JUN-20 |
| 1,3-Butadiene | | | 97.9 | | % | | 70-130 | 30-JUN-20 |
| Benzene | | | 99.1 | | % | | 70-130 | 30-JUN-20 |
| Decane | | | 96.7 | | % | | 70-130 | 30-JUN-20 |
| Ethylbenzene | | | 100.7 | | % | | 70-130 | 30-JUN-20 |
| Isopropylbenzene | | | 91.8 | | % | | 70-130 | 30-JUN-20 |
| m&p-Xylene | | | 102.3 | | % | | 70-130 | 30-JUN-20 |
| Methylcyclohexane | | | 101.0 | | % | | 50-150 | 30-JUN-20 |
| MTBE | | | 103.3 | | % | | 70-130 | 30-JUN-20 |
| n-Hexane | | | 99.98 | | % | | 70-130 | 30-JUN-20 |
| Naphthalene | | | 90.3 | | % | | 70-130 | 30-JUN-20 |
| o-Xylene | | | 101.4 | | % | | 70-130 | 30-JUN-20 |
| Styrene | | | 99.7 | | % | | 70-130 | 30-JUN-20 |
| Toluene | | | 101.1 | | % | | 70-130 | 30-JUN-20 |
| **WG3353837-3 LCSD** | | **WG3353837-2** | | | | | | |
| 1,2,4-Trimethylbenzene | | 97.3 | 98 | | % | 1.2 | 25 | 30-JUN-20 |
| 1,3,5-Trimethylbenzene | | 98.1 | 100 | | % | 2.3 | 25 | 30-JUN-20 |
| 1,3-Butadiene | | 97.9 | 97 | | % | 0.7 | 25 | 30-JUN-20 |
| Benzene | | 99.1 | 99 | | % | 0.3 | 25 | 30-JUN-20 |
| Decane | | 96.7 | 99 | | % | 1.9 | 25 | 30-JUN-20 |
| Ethylbenzene | | 100.7 | 102 | | % | 0.9 | 25 | 30-JUN-20 |
| Isopropylbenzene | | 91.8 | 93 | | % | 0.9 | 25 | 30-JUN-20 |
| m&p-Xylene | | 102.3 | 104 | | % | 1.7 | 25 | 30-JUN-20 |
| Methylcyclohexane | | 101.0 | 102 | | % | 1.0 | 50 | 30-JUN-20 |
| MTBE | | 103.3 | 102 | | % | 1.5 | 25 | 30-JUN-20 |
| n-Hexane | | 99.98 | 98 | | % | 1.7 | 25 | 30-JUN-20 |

# Quality Control Report

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| **VOC-GCMS-WT** | **Canister** | | | | | | | |
| **Batch** | **R5139256** | | | | | | | |
| **WG3353837-3** | **LCSD** | **WG3353837-2** | | | | | | |
| Naphthalene | | 90.3 | 91 | | % | 0.6 | 25 | 30-JUN-20 |
| o-Xylene | | 101.4 | 103 | | % | 1.3 | 25 | 30-JUN-20 |
| Styrene | | 99.7 | 101 | | % | 1.2 | 25 | 30-JUN-20 |
| Toluene | | 101.1 | 101 | | % | 0.2 | 25 | 30-JUN-20 |
| **WG3353837-1** | **MB** | | | | | | | |
| 1,2,4-Trimethylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| 1,3,5-Trimethylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| 1,3-Butadiene | | | <0.10 | | ppb(V) | | 0.1 | 02-JUL-20 |
| Benzene | | | <0.10 | | ppb(V) | | 0.1 | 02-JUL-20 |
| Decane | | | <0.50 | | ppb(V) | | 0.5 | 02-JUL-20 |
| Ethylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| Isopropylbenzene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| m&p-Xylene | | | <0.40 | | ppb(V) | | 0.4 | 02-JUL-20 |
| Methylcyclohexane | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| MTBE | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| n-Hexane | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| Naphthalene | | | <0.25 | | ppb(V) | | 0.25 | 02-JUL-20 |
| o-Xylene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| Styrene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| Toluene | | | <0.20 | | ppb(V) | | 0.2 | 02-JUL-20 |
| Surrogate: 4-Bromofluorobenzene | | | 86.8 | | % | | 70-130 | 02-JUL-20 |
| **VOC-L-GCMS-WT** | **Canister** | | | | | | | |
| **Batch** | **R5139256** | | | | | | | |
| **WG3353837-2** | **LCS** | | | | | | | |
| 1,2-Dibromoethane | | | 107.2 | | % | | 70-130 | 02-JUL-20 |
| 1,2-Dichloroethane | | | 108.4 | | % | | 70-130 | 02-JUL-20 |
| **WG3353837-3** | **LCSD** | **WG3353837-2** | | | | | | |
| 1,2-Dibromoethane | | 107.2 | 109 | | % | 1.5 | 25 | 02-JUL-20 |
| 1,2-Dichloroethane | | 108.4 | 108 | | % | 0.1 | 25 | 02-JUL-20 |
| **WG3353837-1** | **MB** | | | | | | | |
| 1,2-Dibromoethane | | | <0.010 | | ppb(V) | | 0.01 | 02-JUL-20 |
| 1,2-Dichloroethane | | | <0.010 | | ppb(V) | | 0.01 | 02-JUL-20 |
| Surrogate: 4-Bromofluorobenzene | | | 98.6 | | % | | 70-130 | 02-JUL-20 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# Batch Proof Report

| Batch ID | Canister ID | Parameters | Value | Units | Date | Analyst |
|---|---|---|---|---|---|---|
| B200410.314 | 01400-0431 | 1,1,1-Trichloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1,1,2-Tetrachloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1,2,2-Tetrachloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1,2-Trichloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1-Dichloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,1-Dichloroethene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2,4-Trichlorobenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2,4-Trimethylbenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dibromoethane | <0.01 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dichlorobenzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dichloroethane | <0.01 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,2-Dichloropropane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,3,5-Trimethylbenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,3-Butadiene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,3-Dichlorobenzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,4-Dichlorobenzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 1,4-Dioxane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 2-Chlorophenol | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 2-Hexanone | <1.0 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 4-Ethyltoluene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Acetone | <0.50 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Allyl Chloride | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Benzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Benzyl Chloride | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromodichloromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromobenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromoform | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Bromomethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Carbon Disulfide | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Carbon Tetrachloride | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chlorobenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chloroethane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chloroform | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Chloromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | cis-1,2-Dichloroethene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | cis-1,3-Dichloropropene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Cyclohexane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Dibromochloromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Dichlorodifluoromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Ethyl Acetate | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Ethyl Benzene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Freon 113 | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Freon 114 | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Hexachlorobutadiene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Isooctane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Isopropyl Alcohol | <1.0 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Isopropylbenzene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | m&p-Xylene | <0.04 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methyl Ethyl Ketone | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methylcyclohexane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methyl Isobutyl Ketone | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Methylene Chloride | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | MTBE | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Naphthalene | <0.05 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | n-Decane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | n-Heptane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | n-Hexane | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | o-Xylene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Propylene | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Styrene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Tetrachloroethylene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Tetrahydrofuran | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Toluene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | trans-1,2-Dichloroethene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | trans-1,3-Dichloropropene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Trichloroethylene | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Trichlorofluoromethane | <0.20 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Vinyl Acetate | <0.50 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | Vinyl Bromide | <0.20 | ppb(V) | 23-Apr-20 | CG2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| B200410.314 | 01400-0431 | Vinyl Chloride | <0.02 | ppb(V) | 23-Apr-20 | CG2 |
| B200410.314 | 01400-0431 | 4-Bromofluorobenzene | 96.8 | % | 23-Apr-20 | CG2 |

Golder Associates

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02936 page 1 of 1

Project Number: 20145856/1000
Short Title: Snowbird Cleanup
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: Amber Springer

Office Name: Vancouver
EQuIS Facility Code: 21783 2270
EQuIS upload: ☒
Turnaround Time: ☒ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other
Note: Final Reports to be issued by e-mail
Quote No.: Q80351

| | | | | | | | | | | | Analyses Required | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | GAS + DIESEL FUEL PACKAGE | | | | | | | | | RUSH (Select TAT above) | Remarks (over) |
| 02936 - 01 | SW20-09 | | 0.15 | SV | 26/6/20 | 11:55 | Grab | | | 1 | X | | | | | | | | | X | |
| - 02 | | | | | | | | | | | | | | | | | | | | | |
| - 03 | | | | | | | | | | | | | | | | | | | | | |
| - 04 | | | | | | | | | | | | | | | | | | | | | |
| - 05 | | | | | | | | | | | | | | | | | | | | | |
| - 06 | | | | | | | | | | | | | | | | | | | | | |
| - 07 | | | | | | | | | | | | | | | | | | | | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

L2466950-COFC

RUSH

Sampler's Signature:
Relinquished by: Signature
Company: Golder
Date: 26/06/2020
Time:
Received by: Signature
Company:
Comments: ~~[illegible]~~ Detection limits must meet CCME
Method of Shipment:
Waybill No.:
Received for Lab by:
Date: 26 June 20
Time: 350pm
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C): 25
Cooler opened by:
Date:
Time:

Send Report to AUMPHREY@GOLDER.COM

WHITE: Golder Copy YELLOW: Lab Copy Ambient

ESED

ALS Environmental

# CERTIFICATE OF ANALYSIS

**Work Order** : **VA20A8304**
**Amendment** : **1**
Client : **Golder Associates Ltd.**
Contact : Alison Verde
Address : 200-2920 Virtual Way
Vancouver BC Canada V5M 0C4
Telephone : 604 297 2036
Project : 20145856
PO : ----
C-O-C number : 02928
Sampler : ----
Site : ----
Quote number : Q80351
No. of samples received : 7
No. of samples analysed : 5

Page : 1 of 5
Laboratory : Vancouver - Environmental
Account Manager : Amber Springer
Address : 8081 Lougheed Highway
Burnaby BC Canada V5A 1W9
Telephone : +1 604 253 4188
Date Samples Received : 13-Jun-2020 13:03
Date Analysis Commenced : 13-Jun-2020
Issue Date : 18-Jun-2020 18:09

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

| *Signatories* | *Position* | *Laboratory Department* |
|---|---|---|
| Brieanna Allen | Department Manager - Organics | Organics, Burnaby, British Columbia |
| Kim Jensen | Department Manager - Metals | Metals, Burnaby, British Columbia |
| Ophelia Chiu | Supervisor - Organics Instrumentation | Organics, Burnaby, British Columbia |
| Paul Cushing | Team Leader - Organics | Organics, Burnaby, British Columbia |

## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

| *Unit* | *Description* |
|---|---|
| % | percent |
| µg/L | micrograms per litre |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per litre |
| pH units | pH units |

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

## Workorder Comments

Additional data is included for VA20A8304-4.

## Qualifiers

| *Qualifier* | *Description* |
|---|---|
| *DLCI* | *Detection Limit Raised: Chromatographic interference due to co-elution.* |
| *DLQ* | *Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.* |
| *SMI* | *Surrogate recovery could not be measured due to sample matrix interference.* |

## *Analytical Results*

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

| | | | | *Client sample ID* | **02928-01** | **02928-02** | **02928-03** | **02928-04** | **02928-05** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Client sampling date / time* | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8304-001** | **VA20A8304-002** | **VA20A8304-003** | **VA20A8304-004** | **VA20A8304-005** |
| | | | | | Result | Result | Result | Result | Result |
| **Physical Tests** | | | | | | | | | |
| **moisture** | ---- | E144 | 0.25 | % | 11.3 | 14.3 | 13.0 | 11.7 | 4.80 |
| **pH (1:2 soil:water)** | ---- | E108 | 0.10 | pH units | 7.19 | 7.29 | 7.39 | ---- | 8.31 |
| **Metals** | | | | | | | | | |
| **cadmium** | 7440-43-9 | E440 | 0.020 | mg/kg | 0.118 | 0.097 | 0.039 | ---- | 0.032 |
| **chromium** | 7440-47-3 | E440 | 0.50 | mg/kg | 21.6 | 23.0 | 20.2 | ---- | 11.3 |
| **TCLP VOCs** | | | | | | | | | |
| **benzene, TCLP** | 71-43-2 | E615A | 0.0050 | mg/L | <0.0050 | ---- | ---- | ---- | ---- |
| **ethylbenzene, TCLP** | 100-41-4 | E615A | 0.0050 | mg/L | 0.0816 | ---- | ---- | ---- | ---- |
| **toluene, TCLP** | 108-88-3 | E615A | 0.0050 | mg/L | 0.0428 | ---- | ---- | ---- | ---- |
| **xylene, m+p-, TCLP** | 179601-23-1 | E615A | 0.0050 | mg/L | 0.363 | ---- | ---- | ---- | ---- |
| **xylene, o-, TCLP** | 95-47-6 | E615A | 0.0050 | mg/L | 0.216 | ---- | ---- | ---- | ---- |
| **xylenes, total, TCLP** | 1330-20-7 | E615A | 0.0075 | mg/L | 0.580 | ---- | ---- | ---- | ---- |
| **TCLP VOCs Surrogates** | | | | | | | | | |
| **bromofluorobenzene, 4-, TCLP** | 460-00-4 | E615A | 2.5 | % | 108 | ---- | ---- | ---- | ---- |
| **difluorobenzene, 1,4-, TCLP** | 540-36-3 | E615A | 2.5 | % | 93.7 | ---- | ---- | ---- | ---- |
| **Volatile Organic Compounds** | | | | | | | | | |
| **benzene** | 71-43-2 | E611A | 0.0050 | mg/kg | 0.345 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| **dibromoethane, 1,2-** | 106-93-4 | E611H | 0.050 | mg/kg | <0.400 DLCI | <0.050 | <0.050 | ---- | <0.050 |
| **ethylbenzene** | 100-41-4 | E611A | 0.015 | mg/kg | 12.8 | 0.114 | <0.015 | <0.015 | <0.015 |
| **methyl-tert-butyl ether [MTBE]** | 1634-04-4 | E611A | 0.050 | mg/kg | ---- | ---- | ---- | <0.050 | ---- |
| **methyl-tert-butyl ether [MTBE]** | 1634-04-4 | E611A | 0.200 | mg/kg | <0.200 | <0.200 | <0.200 | ---- | <0.200 |
| **nonane, n-** | 111-84-2 | E611H | 0.050 | mg/kg | 80.5 | 2.30 | <0.050 | <0.050 | <0.050 |
| **styrene** | 100-42-5 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| **toluene** | 108-88-3 | E611A | 0.050 | mg/kg | 8.12 | 0.053 | <0.050 | <0.050 | <0.050 |
| **xylene, m+p-** | 179601-23-1 | E611A | 0.050 | mg/kg | 51.9 | 0.554 | <0.050 | <0.050 | <0.050 |
| **xylene, o-** | 95-47-6 | E611A | 0.050 | mg/kg | 20.2 | 0.330 | <0.050 | <0.050 | <0.050 |
| **xylenes, total** | 1330-20-7 | E611A | 0.075 | mg/kg | 72.1 | 0.884 | <0.075 | <0.075 | <0.075 |
| **Volatile Organic Compounds Surrogates** | | | | | | | | | |
| **bromofluorobenzene, 4-** | 460-00-4 | E611A | 0.050 | % | 110 | 101 | 101 | 89.7 | 109 |
| **bromofluorobenzene, 4-** | 460-00-4 | E611H | 0.050 | % | 110 | 101 | 101 | 89.7 | 109 |

## *Analytical Results*

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

| | | | | *Client sample ID* | **02928-01** | **02928-02** | **02928-03** | **02928-04** | **02928-05** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Client sampling date / time* | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8304-001** | **VA20A8304-002** | **VA20A8304-003** | **VA20A8304-004** | **VA20A8304-005** |
| | | | | | Result | Result | Result | Result | Result |
| **Volatile Organic Compounds Surrogates** | | | | | | | | | |
| **difluorobenzene, 1,4-** | 540-36-3 | E611A | 0.050 | % | 106 | 99.8 | 93.8 | 94.1 | 105 |
| **difluorobenzene, 1,4-** | 540-36-3 | E611H | 0.050 | % | 106 | 99.8 | 93.8 | 94.1 | 105 |
| **Hydrocarbons** | | | | | | | | | |
| **EPH (C10-C19)** | ---- | E601A | 200 | mg/kg | 2300 | 2780 | <200 | <200 | <200 |
| **EPH (C19-C32)** | ---- | E601A | 200 | mg/kg | <200 | <200 | <200 | <200 | <200 |
| **VHs (C6-C10)** | ---- | E581.VH+F1 | 10 | mg/kg | 1600 | 37 | <10 | ---- | <10 |
| **HEPHs** | ---- | EC600A | 200 | mg/kg | <200 | <200 | <200 | <200 | <200 |
| **LEPHs** | ---- | EC600A | 200 | mg/kg | 2300 | 2780 | <200 | <200 | <200 |
| **VPHs** | ---- | EC580A | 10 | mg/kg | 1510 | 36 | <10 | ---- | <10 |
| **Hydrocarbons Surrogates** | | | | | | | | | |
| **bromobenzotrifluoride, 2- (EPH surr)** | 392-83-6 | E601A | 5.0 | % | 118 | 126 | 88.1 | 82.5 | 85.9 |
| **dichlorotoluene, 3,4-** | 97-75-0 | E581.VH+F1 | 1.0 | % | ND SMI | 104 | 107 | ---- | 99.2 |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | |
| **acenaphthene** | 83-32-9 | E641A-L | 0.0050 | mg/kg | <0.200 DLCI | <0.200 DLCI | <0.0060 DLCI | <0.0050 | <0.0050 |
| **acenaphthylene** | 208-96-8 | E641A-L | 0.0050 | mg/kg | <0.0300 DLCI | <0.0400 DLCI | <0.0050 | <0.0050 | <0.0050 |
| **acridine** | 260-94-6 | E641A-L | 0.010 | mg/kg | <0.050 DLCI | <0.060 DLCI | <0.010 | <0.010 | <0.010 |
| **anthracene** | 120-12-7 | E641A-L | 0.0040 | mg/kg | <0.0100 DLQ | <0.0100 DLQ | <0.0040 | <0.0040 | <0.0040 |
| **benz(a)anthracene** | 56-55-3 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(a)pyrene** | 50-32-8 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(b+j)fluoranthene** | ---- | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(b+j+k)fluoranthene** | ---- | E641A-L | 0.015 | mg/kg | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| **benzo(g,h,i)perylene** | 191-24-2 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(k)fluoranthene** | 207-08-9 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **chrysene** | 218-01-9 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **dibenz(a,h)anthracene** | 53-70-3 | E641A-L | 0.0050 | mg/kg | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| **fluoranthene** | 206-44-0 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **fluorene** | 86-73-7 | E641A-L | 0.010 | mg/kg | <0.300 DLQ | 0.240 | <0.010 | <0.010 | <0.010 |
| **indeno(1,2,3-c,d)pyrene** | 193-39-5 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **methylnaphthalene, 1-** | 90-12-0 | E641A-L | 0.010 | mg/kg | 2.24 | 2.50 | 0.050 | 0.014 | <0.010 |
| **methylnaphthalene, 2-** | 91-57-6 | E641A-L | 0.010 | mg/kg | 3.22 | 3.57 | 0.064 | <0.010 | <0.010 |
| **naphthalene** | 91-20-3 | E641A-L | 0.010 | mg/kg | <2.00 DLQ | <2.00 DLQ | <0.020 DLQ | <0.010 | <0.010 |

## Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid)**

| | | | | Client sample ID | **02928-01** | **02928-02** | **02928-03** | **02928-04** | **02928-05** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 | 12-Jun-2020 14:30 |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8304-001** | **VA20A8304-002** | **VA20A8304-003** | **VA20A8304-004** | **VA20A8304-005** |
| | | | | | Result | Result | Result | Result | Result |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | |
| **phenanthrene** | 85-01-8 | E641A-L | 0.010 | mg/kg | <0.090 DLQ | <0.100 DLQ | <0.010 | <0.010 | <0.010 |
| **pyrene** | 129-00-0 | E641A-L | 0.010 | mg/kg | 0.014 | 0.018 | <0.010 | <0.010 | <0.010 |
| **quinoline** | 6027-02-7 | E641A-L | 0.010 | mg/kg | <0.300 DLCI | <0.400 DLCI | <0.010 | <0.010 | <0.010 |
| **B(a)P total potency equivalents [B(a)P TPE]** | ---- | E641A-L | 0.020 | mg/kg | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **IACR (CCME)** | ---- | E641A-L | 0.15 | mg/kg | <0.11 | <0.11 | <0.11 | <0.11 | <0.11 |
| **Polycyclic Aromatic Hydrocarbons Surrogates** | | | | | | | | | |
| **acridine-d9** | 34749-75-2 | E641A-L | 0.010 | % | 94.4 | 88.0 | 97.2 | 80.6 | 79.7 |
| **chrysene-d12** | 1719-03-5 | E641A-L | 0.010 | % | 104 | 97.9 | 110 | 94.8 | 92.2 |
| **naphthalene-d8** | 1146-65-2 | E641A-L | 0.010 | % | 96.0 | 96.1 | 100 | 91.4 | 86.3 |
| **phenanthrene-d10** | 1517-22-2 | E641A-L | 0.010 | % | 106 | 97.6 | 108 | 95.0 | 89.9 |

Please refer to the General Comments section for an explanation of any qualifiers detected.

# QUALITY CONTROL REPORT

|  |  |  |  |
|---|---|---|---|
| **Work Order** | : **VA20A8304** | Page | : 1 of 14 |
| **Amendment** | : **1** |  |  |
| Client | : Golder Associates Ltd. | Laboratory | : Vancouver - Environmental |
| Contact | : Alison Verde | Account Manager | : Amber Springer |
| Address | : 200-2920 Virtual Way<br>Vancouver BC Canada V5M 0C4 | Address | : 8081 Lougheed Highway<br>Burnaby, British Columbia Canada V5A 1W9 |
| Telephone | : 604 297 2036 | Telephone | : +1 604 253 4188 |
| Project | : 20145856 | Date Samples Received | : 13-Jun-2020 13:03 |
| PO | : ---- | Date Analysis Commenced | : 13-Jun-2020 |
| C-O-C number | : 02928 | Issue Date | : 18-Jun-2020 18:09 |
| Sampler | : ---- |  |  |
| Site | : ---- |  |  |
| Quote number | : Q80351 |  |  |
| No. of samples received | : 7 |  |  |
| No. of samples analysed | : 5 |  |  |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

| *Signatories* | *Position* | *Laboratory Department* |
|---|---|---|
| Brieanna Allen | Department Manager - Organics | Organics, Burnaby, British Columbia |
| Kim Jensen | Department Manager - Metals | Metals, Burnaby, British Columbia |
| Ophelia Chiu | Supervisor - Organics Instrumentation | Organics, Burnaby, British Columbia |
| Paul Cushing | Team Leader - Organics | Organics, Burnaby, British Columbia |

## General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

## *Laboratory Duplicate (DUP) Report*

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Soil/Solid**

| | | | | | *Laboratory Duplicate (DUP) Report* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD(%) or Difference* | *Duplicate Limits* | *Qualifier* |
| **Physical Tests (QC Lot: 49441)** | | | | | | | | | | | |
| VA20A8304-001 | 02928-01 | pH (1:2 soil:water) | ---- | E108 | 0.10 | pH units | 7.19 | 7.05 | 1.97% | 5% | ---- |
| **Physical Tests (QC Lot: 49442)** | | | | | | | | | | | |
| VA20A8190-001 | Anonymous | moisture | ---- | E144 | 0.25 | % | 6.56 | 6.30 | 4.19% | 20% | ---- |
| **Physical Tests (QC Lot: 50627)** | | | | | | | | | | | |
| VA20A8168-001 | Anonymous | moisture | ---- | E144 | 0.25 | % | 8.55 | 8.66 | 1.29% | 20% | ---- |
| **Metals (QC Lot: 49440)** | | | | | | | | | | | |
| VA20A8304-001 | 02928-01 | cadmium | 7440-43-9 | E440 | 0.020 | mg/kg | 0.118 | 0.088 | 0.030 | Diff <2x LOR | ---- |
| | | chromium | 7440-47-3 | E440 | 0.50 | mg/kg | 21.6 | 19.5 | 10.3% | 30% | ---- |
| **Volatile Organic Compounds (QC Lot: 49486)** | | | | | | | | | | | |
| KS2000662-001 | Anonymous | benzene | 71-43-2 | E611A | 0.0050 | mg/kg | <0.0050 | <0.0050 | 0 | Diff <2x LOR | ---- |
| | | ethylbenzene | 100-41-4 | E611A | 0.015 | mg/kg | <0.015 | <0.015 | 0 | Diff <2x LOR | ---- |
| | | methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 0.200 | mg/kg | <0.200 | <0.200 | 0 | Diff <2x LOR | ---- |
| | | styrene | 100-42-5 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | toluene | 108-88-3 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | xylene, m+p- | 179601-23-1 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | xylene, o- | 95-47-6 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| **Volatile Organic Compounds (QC Lot: 49488)** | | | | | | | | | | | |
| VA20A8304-001 | 02928-01 | dibromoethane, 1,2- | 106-93-4 | E611H | 0.400 | mg/kg | <0.400 | <0.400 | 0 | Diff <2x LOR | ---- |
| | | nonane, n- | 111-84-2 | E611H | 0.275 | mg/kg | 80.5 | 48.6 | 49.5% | 50% | ---- |
| **Volatile Organic Compounds (QC Lot: 50705)** | | | | | | | | | | | |
| VA20A8304-004 | 02928-04 | benzene | 71-43-2 | E611A | 0.0050 | mg/kg | <0.0050 | <0.0050 | 0 | Diff <2x LOR | ---- |
| | | ethylbenzene | 100-41-4 | E611A | 0.015 | mg/kg | <0.015 | <0.015 | 0 | Diff <2x LOR | ---- |
| | | methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | styrene | 100-42-5 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | toluene | 108-88-3 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | xylene, m+p- | 179601-23-1 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | xylene, o- | 95-47-6 | E611A | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| **Volatile Organic Compounds (QC Lot: 50706)** | | | | | | | | | | | |
| VA20A8304-004 | 02928-04 | dibromoethane, 1,2- | 106-93-4 | E611H | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| | | nonane, n- | 111-84-2 | E611H | 0.050 | mg/kg | <0.050 | <0.050 | 0 | Diff <2x LOR | ---- |
| **Hydrocarbons (QC Lot: 49439)** | | | | | | | | | | | |

Sub-Matrix: **Soil/Solid**

| | | | | | *Laboratory Duplicate (DUP) Report* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Laboratory sample ID*** | ***Client sample ID*** | ***Analyte*** | ***CAS Number*** | ***Method*** | ***LOR*** | ***Unit*** | ***Original Result*** | ***Duplicate Result*** | ***RPD(%) or Difference*** | ***Duplicate Limits*** | ***Qualifier*** |
| **Hydrocarbons (QC Lot: 49439) - continued** | | | | | | | | | | | |
| VA20A8190-001 | Anonymous | EPH (C10-C19) | ---- | E601A | 200 | mg/kg | <200 | <200 | 0 | Diff <2x LOR | ---- |
| | | EPH (C19-C32) | ---- | E601A | 200 | mg/kg | <200 | <200 | 0 | Diff <2x LOR | ---- |
| **Hydrocarbons (QC Lot: 49485)** | | | | | | | | | | | |
| KS2000662-001 | Anonymous | VHs (C6-C10) | ---- | E581.VH+F1 | 10 | mg/kg | <10 | <10 | 0 | Diff <2x LOR | ---- |
| **Hydrocarbons (QC Lot: 50623)** | | | | | | | | | | | |
| VA20A8168-001 | Anonymous | EPH (C10-C19) | ---- | E601A | 200 | mg/kg | 790 | 930 | 140 | Diff <2x LOR | ---- |
| | | EPH (C19-C32) | ---- | E601A | 200 | mg/kg | 300 | 340 | 40 | Diff <2x LOR | ---- |
| **Polycyclic Aromatic Hydrocarbons (QC Lot: 49438)** | | | | | | | | | | | |
| VA20A8190-001 | Anonymous | acenaphthene | 83-32-9 | E641A-L | 0.0050 | mg/kg | <0.0050 | <0.0050 | 0 | Diff <2x LOR | ---- |
| | | acenaphthylene | 208-96-8 | E641A-L | 0.0050 | mg/kg | <0.0050 | <0.0050 | 0 | Diff <2x LOR | ---- |
| | | acridine | 260-94-6 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | anthracene | 120-12-7 | E641A-L | 0.0040 | mg/kg | <0.0040 | <0.0040 | 0 | Diff <2x LOR | ---- |
| | | benz(a)anthracene | 56-55-3 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(a)pyrene | 50-32-8 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(b+j)fluoranthene | ---- | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | chrysene | 218-01-9 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | dibenz(a,h)anthracene | 53-70-3 | E641A-L | 0.0050 | mg/kg | <0.0050 | <0.0050 | 0 | Diff <2x LOR | ---- |
| | | fluoranthene | 206-44-0 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | fluorene | 86-73-7 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | methylnaphthalene, 1- | 90-12-0 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | methylnaphthalene, 2- | 91-57-6 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | naphthalene | 91-20-3 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | phenanthrene | 85-01-8 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | pyrene | 129-00-0 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | quinoline | 6027-02-7 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| **Polycyclic Aromatic Hydrocarbons (QC Lot: 50622)** | | | | | | | | | | | |
| VA20A8168-001 | Anonymous | acenaphthene | 83-32-9 | E641A-L | 0.0090 | mg/kg | <0.0090 | <0.0075 | 0.0015 | Diff <2x LOR | ---- |
| | | acenaphthylene | 208-96-8 | E641A-L | 0.0060 | mg/kg | <0.0060 | <0.0080 | 0.0020 | Diff <2x LOR | ---- |
| | | acridine | 260-94-6 | E641A-L | 0.030 | mg/kg | <0.030 | <0.040 | 0.010 | Diff <2x LOR | ---- |
| | | anthracene | 120-12-7 | E641A-L | 0.0200 | mg/kg | <0.0200 | <0.0200 | 0 | Diff <2x LOR | ---- |
| | | benz(a)anthracene | 56-55-3 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(a)pyrene | 50-32-8 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |

Sub-Matrix: **Soil/Solid**

| | | | | | Laboratory Duplicate (DUP) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD(%) or Difference* | *Duplicate Limits* | *Qualifier* |
| **Polycyclic Aromatic Hydrocarbons (QC Lot: 50622) - continued** | | | | | | | | | | | |
| VA20A8168-001 | Anonymous | benzo(b+j)fluoranthene | ---- | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | chrysene | 218-01-9 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | dibenz(a,h)anthracene | 53-70-3 | E641A-L | 0.0050 | mg/kg | <0.0050 | <0.0050 | 0 | Diff <2x LOR | ---- |
| | | fluoranthene | 206-44-0 | E641A-L | 0.030 | mg/kg | <0.030 | <0.030 | 0 | Diff <2x LOR | ---- |
| | | fluorene | 86-73-7 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | methylnaphthalene, 1- | 90-12-0 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | methylnaphthalene, 2- | 91-57-6 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | naphthalene | 91-20-3 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | phenanthrene | 85-01-8 | E641A-L | 0.010 | mg/kg | <0.010 | <0.020 | 0.010 | Diff <2x LOR | ---- |
| | | pyrene | 129-00-0 | E641A-L | 0.010 | mg/kg | 0.202 | 0.192 | 5.21% | 50% | ---- |
| | | quinoline | 6027-02-7 | E641A-L | 0.010 | mg/kg | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |

## Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

| Analyte | CAS Number | Method | LOR | Unit | Result | Qualifier |
|---|---|---|---|---|---|---|
| **Physical Tests (QCLot: 49442)** | | | | | | |
| moisture | ---- | E144 | 0.25 | % | <0.25 | ---- |
| **Physical Tests (QCLot: 50627)** | | | | | | |
| moisture | ---- | E144 | 0.25 | % | <0.25 | ---- |
| **Metals (QCLot: 49440)** | | | | | | |
| cadmium | 7440-43-9 | E440 | 0.02 | mg/kg | <0.020 | ---- |
| chromium | 7440-47-3 | E440 | 0.5 | mg/kg | <0.50 | ---- |
| **TCLP VOCs (QCLot: 49450)** | | | | | | |
| benzene, TCLP | 71-43-2 | E615A | 5 | µg/L | <5.0 | ---- |
| ethylbenzene, TCLP | 100-41-4 | E615A | 5 | µg/L | <5.0 | ---- |
| toluene, TCLP | 108-88-3 | E615A | 5 | µg/L | <5.0 | ---- |
| xylene, m+p-, TCLP | 179601-23-1 | E615A | 5 | µg/L | <5.0 | ---- |
| xylene, o-, TCLP | 95-47-6 | E615A | 5 | µg/L | <5.0 | ---- |
| **Volatile Organic Compounds (QCLot: 49486)** | | | | | | |
| benzene | 71-43-2 | E611A | 0.005 | mg/kg | <0.0050 | ---- |
| ethylbenzene | 100-41-4 | E611A | 0.015 | mg/kg | <0.015 | ---- |
| methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| styrene | 100-42-5 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| toluene | 108-88-3 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| xylene, m+p- | 179601-23-1 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| xylene, o- | 95-47-6 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| **Volatile Organic Compounds (QCLot: 49488)** | | | | | | |
| dibromoethane, 1,2- | 106-93-4 | E611H | 0.05 | mg/kg | <0.050 | ---- |
| nonane, n- | 111-84-2 | E611H | 0.05 | mg/kg | <0.050 | ---- |
| **Volatile Organic Compounds (QCLot: 50705)** | | | | | | |
| benzene | 71-43-2 | E611A | 0.005 | mg/kg | <0.0050 | ---- |
| ethylbenzene | 100-41-4 | E611A | 0.015 | mg/kg | <0.015 | ---- |
| methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| styrene | 100-42-5 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| toluene | 108-88-3 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| xylene, m+p- | 179601-23-1 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| xylene, o- | 95-47-6 | E611A | 0.05 | mg/kg | <0.050 | ---- |
| **Volatile Organic Compounds (QCLot: 50706)** | | | | | | |
| dibromoethane, 1,2- | 106-93-4 | E611H | 0.05 | mg/kg | <0.050 | ---- |

Sub-Matrix: **Soil/Solid**

| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Result* | *Qualifier* |
|---|---|---|---|---|---|---|
| **Volatile Organic Compounds (QCLot: 50706) - continued** | | | | | | |
| nonane, n- | 111-84-2 | E611H | 0.05 | mg/kg | <0.050 | ---- |
| **Hydrocarbons (QCLot: 49439)** | | | | | | |
| EPH (C10-C19) | ---- | E601A | 200 | mg/kg | <200 | ---- |
| EPH (C19-C32) | ---- | E601A | 200 | mg/kg | <200 | ---- |
| **Hydrocarbons (QCLot: 49485)** | | | | | | |
| VHs (C6-C10) | ---- | E581.VH+F1 | 10 | mg/kg | <10 | ---- |
| **Hydrocarbons (QCLot: 50623)** | | | | | | |
| EPH (C10-C19) | ---- | E601A | 200 | mg/kg | <200 | ---- |
| EPH (C19-C32) | ---- | E601A | 200 | mg/kg | <200 | ---- |
| | | | | | <200 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 49438)** | | | | | | |
| acenaphthene | 83-32-9 | E641A-L | 0.005 | mg/kg | <0.0050 | ---- |
| | | | | | <0.0050 | ---- |
| acenaphthylene | 208-96-8 | E641A-L | 0.005 | mg/kg | <0.0050 | ---- |
| | | | | | <0.0050 | ---- |
| acridine | 260-94-6 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| anthracene | 120-12-7 | E641A-L | 0.004 | mg/kg | <0.0040 | ---- |
| benz(a)anthracene | 56-55-3 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(a)pyrene | 50-32-8 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(b+j)fluoranthene | ---- | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| chrysene | 218-01-9 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| | | | | | <0.010 | ---- |
| dibenz(a,h)anthracene | 53-70-3 | E641A-L | 0.005 | mg/kg | <0.0050 | ---- |
| fluoranthene | 206-44-0 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| | | | | | <0.010 | ---- |
| fluorene | 86-73-7 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| methylnaphthalene, 1- | 90-12-0 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| methylnaphthalene, 2- | 91-57-6 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| naphthalene | 91-20-3 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| | | | | | <0.010 | ---- |
| phenanthrene | 85-01-8 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| pyrene | 129-00-0 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| quinoline | 6027-02-7 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 50622)** | | | | | | |

Sub-Matrix: **Soil/Solid**

| Analyte | CAS Number | Method | LOR | Unit | Result | Qualifier |
|---|---|---|---|---|---|---|
| **Polycyclic Aromatic Hydrocarbons (QCLot: 50622) - continued** | | | | | | |
| acenaphthene | 83-32-9 | E641A-L | 0.005 | mg/kg | <0.0050 | ---- |
| | | | | | <0.0050 | ---- |
| acenaphthylene | 208-96-8 | E641A-L | 0.005 | mg/kg | <0.0050 | ---- |
| acridine | 260-94-6 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| anthracene | 120-12-7 | E641A-L | 0.004 | mg/kg | <0.0040 | ---- |
| benz(a)anthracene | 56-55-3 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(a)pyrene | 50-32-8 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(b+j)fluoranthene | ---- | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| chrysene | 218-01-9 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| | | | | | <0.010 | ---- |
| dibenz(a,h)anthracene | 53-70-3 | E641A-L | 0.005 | mg/kg | <0.0050 | ---- |
| fluoranthene | 206-44-0 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| fluorene | 86-73-7 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| methylnaphthalene, 1- | 90-12-0 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| methylnaphthalene, 2- | 91-57-6 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| naphthalene | 91-20-3 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| | | | | | <0.010 | ---- |
| phenanthrene | 85-01-8 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| pyrene | 129-00-0 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |
| quinoline | 6027-02-7 | E641A-L | 0.01 | mg/kg | <0.010 | ---- |

## Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

| | | | | | Laboratory Control Sample (LCS) Report | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Recovery (%) | Recovery Limits (%) | | |
| **Analyte** | **CAS Number** | **Method** | **LOR** | **Unit** | **Concentration** | **LCS** | **Low** | **High** | **Qualifier** |
| **Physical Tests (QCLot: 49441)** | | | | | | | | | |
| pH (1:2 soil:water) | ---- | E108 | ---- | pH units | 6 pH units | 100 | 95.0 | 105 | ---- |
| **Physical Tests (QCLot: 49442)** | | | | | | | | | |
| moisture | ---- | E144 | 0.25 | % | 50 % | 100 | 90.0 | 110 | ---- |
| **Physical Tests (QCLot: 50627)** | | | | | | | | | |
| moisture | ---- | E144 | 0.25 | % | 50 % | 99.4 | 90.0 | 110 | ---- |
| **Metals (QCLot: 49440)** | | | | | | | | | |
| cadmium | 7440-43-9 | E440 | 0.02 | mg/kg | 10 mg/kg | 93.9 | 80.0 | 120 | ---- |
| chromium | 7440-47-3 | E440 | 0.5 | mg/kg | 25 mg/kg | 96.5 | 80.0 | 120 | ---- |
| **Volatile Organic Compounds (QCLot: 49486)** | | | | | | | | | |
| benzene | 71-43-2 | E611A | 0.005 | mg/kg | 2.5 mg/kg | 89.4 | 70.0 | 130 | ---- |
| ethylbenzene | 100-41-4 | E611A | 0.015 | mg/kg | 2.5 mg/kg | 93.0 | 70.0 | 130 | ---- |
| methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 0.05 | mg/kg | 5 mg/kg | 97.5 | 70.0 | 130 | ---- |
| styrene | 100-42-5 | E611A | 0.05 | mg/kg | 2.5 mg/kg | 82.5 | 70.0 | 130 | ---- |
| toluene | 108-88-3 | E611A | 0.05 | mg/kg | 2.5 mg/kg | 100 | 70.0 | 130 | ---- |
| xylene, m+p- | 179601-23-1 | E611A | 0.05 | mg/kg | 5 mg/kg | 93.3 | 70.0 | 130 | ---- |
| xylene, o- | 95-47-6 | E611A | 0.05 | mg/kg | 2.5 mg/kg | 95.7 | 70.0 | 130 | ---- |
| **Volatile Organic Compounds (QCLot: 49488)** | | | | | | | | | |
| dibromoethane, 1,2- | 106-93-4 | E611H | 0.05 | mg/kg | 2.5 mg/kg | 104 | 70.0 | 130 | ---- |
| nonane, n- | 111-84-2 | E611H | 0.05 | mg/kg | 2.5 mg/kg | 105 | 70.0 | 130 | ---- |
| **Volatile Organic Compounds (QCLot: 50705)** | | | | | | | | | |
| benzene | 71-43-2 | E611A | 0.005 | mg/kg | 2.5 mg/kg | 94.2 | 70.0 | 130 | ---- |
| ethylbenzene | 100-41-4 | E611A | 0.015 | mg/kg | 2.5 mg/kg | 99.6 | 70.0 | 130 | ---- |
| methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 0.05 | mg/kg | 5 mg/kg | 99.2 | 70.0 | 130 | ---- |
| styrene | 100-42-5 | E611A | 0.05 | mg/kg | 2.5 mg/kg | 82.4 | 70.0 | 130 | ---- |
| toluene | 108-88-3 | E611A | 0.05 | mg/kg | 2.5 mg/kg | 99.5 | 70.0 | 130 | ---- |
| xylene, m+p- | 179601-23-1 | E611A | 0.05 | mg/kg | 5 mg/kg | 104 | 70.0 | 130 | ---- |
| xylene, o- | 95-47-6 | E611A | 0.05 | mg/kg | 2.5 mg/kg | 99.4 | 70.0 | 130 | ---- |
| **Volatile Organic Compounds (QCLot: 50706)** | | | | | | | | | |
| dibromoethane, 1,2- | 106-93-4 | E611H | 0.05 | mg/kg | 2.5 mg/kg | 102 | 70.0 | 130 | ---- |
| nonane, n- | 111-84-2 | E611H | 0.05 | mg/kg | 2.5 mg/kg | 99.8 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 49439)** | | | | | | | | | |

Sub-Matrix: **Soil/Solid**

| | | | | | *Laboratory Control Sample (LCS) Report* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Spike* | *Recovery (%)* | *Recovery Limits (%)* | | |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Concentration* | *LCS* | *Low* | *High* | *Qualifier* |
| **Hydrocarbons (QCLot: 49439) - continued** | | | | | | | | | |
| EPH (C10-C19) | ---- | E601A | 200 | mg/kg | 1134.37 mg/kg | 101 | 70.0 | 130 | ---- |
| EPH (C19-C32) | ---- | E601A | 200 | mg/kg | 575.98 mg/kg | 104 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 49485)** | | | | | | | | | |
| VHs (C6-C10) | ---- | E581.VH+F1 | 10 | mg/kg | 85.8 mg/kg | 102 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 50623)** | | | | | | | | | |
| EPH (C10-C19) | ---- | E601A | 200 | mg/kg | 1134.37 mg/kg | 97.6 | 70.0 | 130 | ---- |
| EPH (C19-C32) | ---- | E601A | 200 | mg/kg | 575.98 mg/kg | 94.4 | 70.0 | 130 | ---- |
| | | | | | 10183 mg/kg | 89.7 | 70.0 | 130 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 49438)** | | | | | | | | | |
| acenaphthene | 83-32-9 | E641A-L | 0.005 | mg/kg | 0.5 mg/kg | 107 | 60.0 | 130 | ---- |
| | | | | | 0.638 mg/kg | 90.8 | 60.0 | 130 | ---- |
| acenaphthylene | 208-96-8 | E641A-L | 0.005 | mg/kg | 0.5 mg/kg | 105 | 60.0 | 130 | ---- |
| | | | | | 0.2 mg/kg | 114 | 60.0 | 130 | ---- |
| acridine | 260-94-6 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 102 | 60.0 | 130 | ---- |
| anthracene | 120-12-7 | E641A-L | 0.004 | mg/kg | 0.5 mg/kg | 109 | 60.0 | 130 | ---- |
| benz(a)anthracene | 56-55-3 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 106 | 60.0 | 130 | ---- |
| benzo(a)pyrene | 50-32-8 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 93.1 | 60.0 | 130 | ---- |
| benzo(b+j)fluoranthene | ---- | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 114 | 60.0 | 130 | ---- |
| benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 130 | 60.0 | 130 | ---- |
| benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 99.7 | 60.0 | 130 | ---- |
| chrysene | 218-01-9 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 106 | 60.0 | 130 | ---- |
| | | | | | 0.666 mg/kg | 104 | 60.0 | 130 | ---- |
| dibenz(a,h)anthracene | 53-70-3 | E641A-L | 0.005 | mg/kg | 0.5 mg/kg | 95.9 | 60.0 | 130 | ---- |
| fluoranthene | 206-44-0 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 107 | 60.0 | 130 | ---- |
| | | | | | 1.757 mg/kg | 89.1 | 60.0 | 130 | ---- |
| fluorene | 86-73-7 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 107 | 60.0 | 130 | ---- |
| indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 116 | 60.0 | 130 | ---- |
| methylnaphthalene, 1- | 90-12-0 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 104 | 60.0 | 130 | ---- |
| methylnaphthalene, 2- | 91-57-6 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 103 | 60.0 | 130 | ---- |
| naphthalene | 91-20-3 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 99.1 | 50.0 | 130 | ---- |
| | | | | | 1.03 mg/kg | 91.0 | 50.0 | 130 | ---- |
| phenanthrene | 85-01-8 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 107 | 60.0 | 130 | ---- |
| pyrene | 129-00-0 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 110 | 60.0 | 130 | ---- |
| quinoline | 6027-02-7 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 100 | 60.0 | 130 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 50622)** | | | | | | | | | |
| acenaphthene | 83-32-9 | E641A-L | 0.005 | mg/kg | 0.5 mg/kg | 90.5 | 60.0 | 130 | ---- |
| | | | | | 0.638 mg/kg | 81.7 | 60.0 | 130 | ---- |

Sub-Matrix: **Soil/Solid**

*Laboratory Control Sample (LCS) Report*

| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Spike* | *Recovery (%)* | *Recovery Limits (%)* | | *Qualifier* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Concentration* | *LCS* | *Low* | *High* | |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 50622) - continued** | | | | | | | | | |
| acenaphthylene | 208-96-8 | E641A-L | 0.005 | mg/kg | 0.5 mg/kg | 88.8 | 60.0 | 130 | ---- |
| acridine | 260-94-6 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 80.5 | 60.0 | 130 | ---- |
| anthracene | 120-12-7 | E641A-L | 0.004 | mg/kg | 0.5 mg/kg | 86.1 | 60.0 | 130 | ---- |
| benz(a)anthracene | 56-55-3 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 85.8 | 60.0 | 130 | ---- |
| benzo(a)pyrene | 50-32-8 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 87.8 | 60.0 | 130 | ---- |
| benzo(b+j)fluoranthene | ---- | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 85.2 | 60.0 | 130 | ---- |
| benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 84.8 | 60.0 | 130 | ---- |
| benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 90.0 | 60.0 | 130 | ---- |
| chrysene | 218-01-9 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 90.1 | 60.0 | 130 | ---- |
| | | | | | 0.666 mg/kg | 86.5 | 60.0 | 130 | ---- |
| dibenz(a,h)anthracene | 53-70-3 | E641A-L | 0.005 | mg/kg | 0.5 mg/kg | 87.7 | 60.0 | 130 | ---- |
| fluoranthene | 206-44-0 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 90.3 | 60.0 | 130 | ---- |
| fluorene | 86-73-7 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 88.9 | 60.0 | 130 | ---- |
| indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 81.7 | 60.0 | 130 | ---- |
| methylnaphthalene, 1- | 90-12-0 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 90.8 | 60.0 | 130 | ---- |
| methylnaphthalene, 2- | 91-57-6 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 89.9 | 60.0 | 130 | ---- |
| naphthalene | 91-20-3 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 90.7 | 50.0 | 130 | ---- |
| | | | | | 1.03 mg/kg | 84.4 | 50.0 | 130 | ---- |
| phenanthrene | 85-01-8 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 88.4 | 60.0 | 130 | ---- |
| pyrene | 129-00-0 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 91.9 | 60.0 | 130 | ---- |
| quinoline | 6027-02-7 | E641A-L | 0.01 | mg/kg | 0.5 mg/kg | 83.8 | 60.0 | 130 | ---- |

## Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias.

Sub-Matrix: **Soil/Solid**

| | | | | | *Matrix Spike (MS) Report* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Spike* | *Recovery (%)* | *Recovery Limits (%)* | | |
| *Laboratory sample ID* | *Client sample ID* | *Analyte* | *CAS Number* | *Method* | *Concentration* | *MS* | *Low* | *High* | *Qualifier* |
| **TCLP VOCs (QCLot: 49450)** | | | | | | | | | |
| VA20A8304-001 | 02928-01 | benzene, TCLP | 71-43-2 | E615A | 250 µg/L | 92.0 | 50.0 | 140 | ---- |
| | | ethylbenzene, TCLP | 100-41-4 | E615A | 250 µg/L | 114 | 50.0 | 140 | ---- |
| | | toluene, TCLP | 108-88-3 | E615A | 250 µg/L | 101 | 50.0 | 140 | ---- |
| | | xylene, m+p-, TCLP | 179601-23-1 | E615A | 500 µg/L | 115 | 50.0 | 140 | ---- |
| | | xylene, o-, TCLP | 95-47-6 | E615A | 250 µg/L | 112 | 50.0 | 140 | ---- |
| **Volatile Organic Compounds (QCLot: 49486)** | | | | | | | | | |
| KS2000662-001 | Anonymous | benzene | 71-43-2 | E611A | 3.125 mg/kg | 94.5 | 60.0 | 140 | ---- |
| | | ethylbenzene | 100-41-4 | E611A | 3.125 mg/kg | 101 | 60.0 | 140 | ---- |
| | | methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 3.125 mg/kg | 98.9 | 60.0 | 140 | ---- |
| | | styrene | 100-42-5 | E611A | 3.125 mg/kg | 85.5 | 60.0 | 140 | ---- |
| | | toluene | 108-88-3 | E611A | 3.125 mg/kg | 101 | 60.0 | 140 | ---- |
| | | xylene, m+p- | 179601-23-1 | E611A | 6.25 mg/kg | 100 | 60.0 | 140 | ---- |
| | | xylene, o- | 95-47-6 | E611A | 3.125 mg/kg | 99.1 | 60.0 | 140 | ---- |
| **Volatile Organic Compounds (QCLot: 49488)** | | | | | | | | | |
| VA20A8304-001 | 02928-01 | dibromoethane, 1,2- | 106-93-4 | E611H | 3.125 mg/kg | 89.6 | 60.0 | 140 | ---- |
| | | nonane, n- | 111-84-2 | E611H | 3.125 mg/kg | ND | 60.0 | 140 | ---- |
| **Volatile Organic Compounds (QCLot: 50705)** | | | | | | | | | |
| VA20A8304-004 | 02928-04 | benzene | 71-43-2 | E611A | 3.125 mg/kg | 95.5 | 60.0 | 140 | ---- |
| | | ethylbenzene | 100-41-4 | E611A | 3.125 mg/kg | 102 | 60.0 | 140 | ---- |
| | | methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611A | 6.25 mg/kg | 101 | 60.0 | 140 | ---- |
| | | styrene | 100-42-5 | E611A | 3.125 mg/kg | 87.7 | 60.0 | 140 | ---- |
| | | toluene | 108-88-3 | E611A | 3.125 mg/kg | 81.0 | 60.0 | 140 | ---- |
| | | xylene, m+p- | 179601-23-1 | E611A | 6.25 mg/kg | 104 | 60.0 | 140 | ---- |
| | | xylene, o- | 95-47-6 | E611A | 3.125 mg/kg | 101 | 60.0 | 140 | ---- |
| **Volatile Organic Compounds (QCLot: 50706)** | | | | | | | | | |
| VA20A8304-004 | 02928-04 | dibromoethane, 1,2- | 106-93-4 | E611H | 3.125 mg/kg | 103 | 60.0 | 140 | ---- |
| | | nonane, n- | 111-84-2 | E611H | 3.125 mg/kg | 113 | 60.0 | 140 | ---- |
| **Hydrocarbons (QCLot: 49485)** | | | | | | | | | |
| KS2000662-001 | Anonymous | VHs (C6-C10) | ---- | E581.VH+F1 | 171.9 mg/kg | 100 | 60.0 | 140 | ---- |

## *Reference Material (RM) Report*

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: **Soil/Solid**

| *Laboratory sample ID* | *Reference Material ID* | *Analyte* | *CAS Number* | *Method* | *Reference Material (RM) Report* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *RM Target Concentration* | *Recovery (%) RM* | *Recovery Limits (%) Low* | *High* | *Qualifier* |
| **Metals (QCLot: 49440)** | | | | | | | | | |
| QC-49440-003 | SCP SS-2 | cadmium | 7440-43-9 | E440 | 0.91 mg/kg | 95.4 | 70.0 | 130 | ---- |
| QC-49440-003 | SCP SS-2 | chromium | 7440-47-3 | E440 | 101 mg/kg | 97.6 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 49439)** | | | | | | | | | |
| QC-49439-003 | Petroleum Hydrocarbon IRM | EPH (C10-C19) | ---- | E601A | 7113 mg/kg | 94.9 | 70.0 | 130 | ---- |
| QC-49439-003 | Petroleum Hydrocarbon IRM | EPH (C19-C32) | ---- | E601A | 10183 mg/kg | 97.0 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 50623)** | | | | | | | | | |
| QC-50623-003 | Petroleum Hydrocarbon IRM | EPH (C10-C19) | ---- | E601A | 7113 mg/kg | 85.2 | 70.0 | 130 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 49438)** | | | | | | | | | |
| QC-49438-003 | RM | anthracene | 120-12-7 | E641A-L | 0.32 mg/kg | 117 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | benz(a)anthracene | 56-55-3 | E641A-L | 0.545 mg/kg | 98.9 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | benzo(a)pyrene | 50-32-8 | E641A-L | 0.135 mg/kg | 84.7 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | benzo(b+j)fluoranthene | ---- | E641A-L | 0.793 mg/kg | 89.6 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.377 mg/kg | 113 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.34 mg/kg | 78.2 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | dibenz(a,h)anthracene | 53-70-3 | E641A-L | 1.196 mg/kg | 90.1 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | fluorene | 86-73-7 | E641A-L | 0.989 mg/kg | 92.8 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.445 mg/kg | 101 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | methylnaphthalene, 1- | 90-12-0 | E641A-L | 1.256 mg/kg | 90.2 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | methylnaphthalene, 2- | 91-57-6 | E641A-L | 1.088 mg/kg | 88.2 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | phenanthrene | 85-01-8 | E641A-L | 1.13 mg/kg | 90.6 | 60.0 | 130 | ---- |
| QC-49438-003 | RM | pyrene | 129-00-0 | E641A-L | 1.325 mg/kg | 90.5 | 60.0 | 130 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 50622)** | | | | | | | | | |
| QC-50622-003 | RM | acenaphthylene | 208-96-8 | E641A-L | 0.2 mg/kg | 95.1 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | anthracene | 120-12-7 | E641A-L | 0.32 mg/kg | 89.1 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | benz(a)anthracene | 56-55-3 | E641A-L | 0.545 mg/kg | 79.0 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | benzo(a)pyrene | 50-32-8 | E641A-L | 0.135 mg/kg | 81.6 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | benzo(b+j)fluoranthene | ---- | E641A-L | 0.793 mg/kg | 78.0 | 60.0 | 130 | ---- |

Sub-Matrix: **Soil/Solid**

| | | | | | Reference Material (RM) Report | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | RM Target | Recovery (%) | Recovery Limits (%) | | |
| *Laboratory sample ID* | *Reference Material ID* | *Analyte* | *CAS Number* | *Method* | *Concentration* | *RM* | *Low* | *High* | *Qualifier* |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 50622) - continued** | | | | | | | | | |
| QC-50622-003 | RM | benzo(g,h,i)perylene | 191-24-2 | E641A-L | 0.377 mg/kg | 84.1 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | benzo(k)fluoranthene | 207-08-9 | E641A-L | 0.34 mg/kg | 72.6 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | dibenz(a,h)anthracene | 53-70-3 | E641A-L | 1.196 mg/kg | 82.0 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | fluoranthene | 206-44-0 | E641A-L | 1.757 mg/kg | 81.3 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | fluorene | 86-73-7 | E641A-L | 0.989 mg/kg | 82.0 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A-L | 0.445 mg/kg | 79.2 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | methylnaphthalene, 1- | 90-12-0 | E641A-L | 1.256 mg/kg | 83.0 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | methylnaphthalene, 2- | 91-57-6 | E641A-L | 1.088 mg/kg | 80.6 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | phenanthrene | 85-01-8 | E641A-L | 1.13 mg/kg | 81.2 | 60.0 | 130 | ---- |
| QC-50622-003 | RM | pyrene | 129-00-0 | E641A-L | 1.325 mg/kg | 82.4 | 60.0 | 130 | ---- |

# QUALITY CONTROL INTERPRETIVE REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **VA20A8304** | Page | : 1 of 10 |
| **Amendment** | : **1** | | |
| Client | : **Golder Associates Ltd.** | Laboratory | : Vancouver - Environmental |
| Contact | : Alison Verde | Account Manager | : Amber Springer |
| Address | : 200-2920 Virtual Way<br>Vancouver BC Canada V5M 0C4 | Address | : 8081 Lougheed Highway<br>Burnaby, British Columbia Canada V5A 1W9 |
| Telephone | : 604 297 2036 | Telephone | : +1 604 253 4188 |
| Project | : 20145856 | Date Samples Received | : 13-Jun-2020 13:03 |
| PO | : ---- | Issue Date | : 18-Jun-2020 18:09 |
| C-O-C number | : 02928 | | |
| Sampler | : ---- | | |
| Site | : ---- | | |
| Quote number | : Q80351 | | |
| No. of samples received | : 7 | | |
| No. of samples analysed | : 5 | | |

**This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.**

**Key**

**Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.**
**CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.**
**DQO: Data Quality Objective.**
**LOR: Limit of Reporting (detection limit).**
**RPD: Relative Percent Difference.**

## *Summary of Outliers*

### *Outliers : Quality Control Samples*

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### *Outliers: Reference Material (RM) Samples*

- No Reference Material (RM) Sample outliers occur.

### *Outliers : Analysis Holding Time Compliance (Breaches)*

- No Analysis Holding Time Outliers exist.

### *Outliers : Frequency of Quality Control Samples*

- No Quality Control Sample Frequency Outliers occur.

## *Analysis Holding Time Compliance*

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-01 | E601A | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 1 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-02 | E601A | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 1 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-03 | E601A | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 1 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-05 | E601A | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 1 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-04 | E601A | 12-Jun-2020 | 17-Jun-2020 | 14 days | 5 days | ✓ | 18-Jun-2020 | 40 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-01 | E581.VH+F1 | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-02 | E581.VH+F1 | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-03 | E581.VH+F1 | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-05 | E581.VH+F1 | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Metals : Metals in Soil/Solid by CRC ICPMS** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-01 | E440 | 12-Jun-2020 | 14-Jun-2020 | 180 days | 1 days | ✓ | 14-Jun-2020 | 178 days | 0 days | ✓ |
| **Metals : Metals in Soil/Solid by CRC ICPMS** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-02 | E440 | 12-Jun-2020 | 14-Jun-2020 | 180 days | 1 days | ✓ | 14-Jun-2020 | 178 days | 0 days | ✓ |
| **Metals : Metals in Soil/Solid by CRC ICPMS** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-03 | E440 | 12-Jun-2020 | 14-Jun-2020 | 180 days | 1 days | ✓ | 14-Jun-2020 | 178 days | 0 days | ✓ |
| **Metals : Metals in Soil/Solid by CRC ICPMS** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-05 | E440 | 12-Jun-2020 | 14-Jun-2020 | 180 days | 1 days | ✓ | 14-Jun-2020 | 178 days | 0 days | ✓ |
| **Physical Tests : Moisture Content by Gravimetry** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-01 | E144 | 12-Jun-2020 | ---- | ---- | ---- | | 13-Jun-2020 | 14 days | 0 days | ✓ |
| **Physical Tests : Moisture Content by Gravimetry** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-02 | E144 | 12-Jun-2020 | ---- | ---- | ---- | | 13-Jun-2020 | 14 days | 0 days | ✓ |
| **Physical Tests : Moisture Content by Gravimetry** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-03 | E144 | 12-Jun-2020 | ---- | ---- | ---- | | 13-Jun-2020 | 14 days | 0 days | ✓ |

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Physical Tests : Moisture Content by Gravimetry** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-05 | E144 | 12-Jun-2020 | ---- | ---- | ---- | | 13-Jun-2020 | 14 days | 0 days | ✓ |
| **Physical Tests : Moisture Content by Gravimetry** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-04 | E144 | 12-Jun-2020 | ---- | ---- | ---- | | 17-Jun-2020 | 14 days | 5 days | ✓ |
| **Physical Tests : pH by Meter (1:2 Soil:Water Extraction)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-01 | E108 | 12-Jun-2020 | 14-Jun-2020 | 30 days | 1 days | ✓ | 15-Jun-2020 | 28 days | 1 days | ✓ |
| **Physical Tests : pH by Meter (1:2 Soil:Water Extraction)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-02 | E108 | 12-Jun-2020 | 14-Jun-2020 | 30 days | 1 days | ✓ | 15-Jun-2020 | 28 days | 1 days | ✓ |
| **Physical Tests : pH by Meter (1:2 Soil:Water Extraction)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-03 | E108 | 12-Jun-2020 | 14-Jun-2020 | 30 days | 1 days | ✓ | 15-Jun-2020 | 28 days | 1 days | ✓ |
| **Physical Tests : pH by Meter (1:2 Soil:Water Extraction)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-05 | E108 | 12-Jun-2020 | 14-Jun-2020 | 30 days | 1 days | ✓ | 15-Jun-2020 | 28 days | 1 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-01 | E641A-L | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-02 | E641A-L | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-03 | E641A-L | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 0 days | ✓ |

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-05 | E641A-L | 12-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)** | | | | | | | | | | |
| **Glass soil jar/Teflon lined cap**<br>02928-04 | E641A-L | 12-Jun-2020 | 17-Jun-2020 | 14 days | 5 days | ✓ | 18-Jun-2020 | 40 days | 0 days | ✓ |
| **TCLP VOCs : BTEX by Headspace GC-MS (TCLP)** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02928-01 | E615A | 13-Jun-2020 | 14-Jun-2020 | 14 days | 1 days | ✓ | 15-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : BTEX by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-01 | E611A | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : BTEX by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-02 | E611A | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : BTEX by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-03 | E611A | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : BTEX by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-05 | E611A | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : BTEX by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-04 | E611A | 12-Jun-2020 | 17-Jun-2020 | 40 days | 5 days | ✓ | 18-Jun-2020 | 34 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-01 | E611H | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-02 | E611H | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-03 | E611H | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-05 | E611H | 12-Jun-2020 | 14-Jun-2020 | 40 days | 1 days | ✓ | 15-Jun-2020 | 38 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass soil methanol vial**<br>02928-04 | E611H | 12-Jun-2020 | 17-Jun-2020 | 40 days | 5 days | ✓ | 18-Jun-2020 | 34 days | 0 days | ✓ |

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).

## *Quality Control Parameter Frequency Compliance*

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

| Quality Control Sample Type | | | Count | | Frequency (%) | | |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC Lot #* | *QC* | *Regular* | *Actual* | *Expected* | *Evaluation* |
| Laboratory Duplicates (DUP) | | | | | | | |
| BC PHC - EPH by GC-FID | E601A | 49439 | 2 | 16 | 12.5 | 5.0 | ✓ |
| BTEX by Headspace GC-MS | E611A | 49486 | 2 | 16 | 12.5 | 5.0 | ✓ |
| Metals in Soil/Solid by CRC ICPMS | E440 | 49440 | 1 | 4 | 25.0 | 5.0 | ✓ |
| Moisture Content by Gravimetry | E144 | 49442 | 2 | 30 | 6.6 | 5.0 | ✓ |
| PAHs by Hex:Ace GC-MS (Low Level CCME) | E641A-L | 49438 | 2 | 28 | 7.1 | 5.0 | ✓ |
| pH by Meter (1:2 Soil:Water Extraction) | E108 | 49441 | 1 | 4 | 25.0 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 49485 | 1 | 19 | 5.2 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 49488 | 2 | 8 | 25.0 | 5.0 | ✓ |
| Laboratory Control Samples (LCS) | | | | | | | |
| BC PHC - EPH by GC-FID | E601A | 49439 | 4 | 16 | 25.0 | 10.0 | ✓ |
| BTEX by Headspace GC-MS | E611A | 49486 | 2 | 16 | 12.5 | 5.0 | ✓ |
| Metals in Soil/Solid by CRC ICPMS | E440 | 49440 | 2 | 4 | 50.0 | 10.0 | ✓ |
| Moisture Content by Gravimetry | E144 | 49442 | 2 | 30 | 6.6 | 5.0 | ✓ |
| PAHs by Hex:Ace GC-MS (Low Level CCME) | E641A-L | 49438 | 4 | 28 | 14.2 | 10.0 | ✓ |
| pH by Meter (1:2 Soil:Water Extraction) | E108 | 49441 | 1 | 4 | 25.0 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 49485 | 1 | 19 | 5.2 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 49488 | 2 | 8 | 25.0 | 5.0 | ✓ |
| Method Blanks (MB) | | | | | | | |
| BC PHC - EPH by GC-FID | E601A | 49439 | 2 | 16 | 12.5 | 5.0 | ✓ |
| BTEX by Headspace GC-MS | E611A | 49486 | 2 | 16 | 12.5 | 5.0 | ✓ |
| BTEX by Headspace GC-MS (TCLP) | E615A | 49450 | 1 | 1 | 100.0 | 5.0 | ✓ |
| Metals in Soil/Solid by CRC ICPMS | E440 | 49440 | 1 | 4 | 25.0 | 5.0 | ✓ |
| Moisture Content by Gravimetry | E144 | 49442 | 2 | 30 | 6.6 | 5.0 | ✓ |
| PAHs by Hex:Ace GC-MS (Low Level CCME) | E641A-L | 49438 | 2 | 28 | 7.1 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 49485 | 1 | 19 | 5.2 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 49488 | 2 | 8 | 25.0 | 5.0 | ✓ |
| Matrix Spikes (MS) | | | | | | | |
| BTEX by Headspace GC-MS | E611A | 49486 | 2 | 16 | 12.5 | 5.0 | ✓ |
| BTEX by Headspace GC-MS (TCLP) | E615A | 49450 | 1 | 1 | 100.0 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 49485 | 1 | 19 | 5.2 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 49488 | 2 | 8 | 25.0 | 5.0 | ✓ |

## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

| Analytical Methods | Method / Lab | Matrix | Method Reference | Method Descriptions |
|---|---|---|---|---|
| pH by Meter (1:2 Soil:Water Extraction) | E108<br>Vancouver - Environmental | Soil/Solid | BC Lab Manual | pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe. |
| Moisture Content by Gravimetry | E144<br>Vancouver - Environmental | Soil/Solid | CCME PHC in Soil - Tier 1 | Moisture is measured gravimetrically by drying the sample at 105°C for a minimum of six hours or to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage. |
| Metals in Soil/Solid by CRC ICPMS | E440<br>Vancouver - Environmental | Soil/Solid | EPA 6020B (mod) | Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS. |
| VH and F1 by Headspace GC-FID | E581.VH+F1<br>Vancouver - Environmental | Soil/Solid | BC MOE Lab Manual / CCME PHC in Soil - Tier 1 (mod) | Volatile Hydrocarbons (VH and F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. |
| BC PHC - EPH by GC-FID | E601A<br>Vancouver - Environmental | Soil/Solid | BC MOE Lab Manual (EPH in Solids by GC/FID) (mod) | Extractable Petroleum Hydrocarbons (EPH) are analyzed by GC-FID. |
| BTEX by Headspace GC-MS | E611A<br>Vancouver - Environmental | Soil/Solid | EPA 8260D (mod) | Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. |
| VOCs (BC Special List) by Headspace GC-MS | E611H<br>Vancouver - Environmental | Soil/Solid | EPA 8260D (mod) | Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. |
| BTEX by Headspace GC-MS (TCLP) | E615A<br>Vancouver - Environmental | Soil/Solid | EPA 8260D (mod) | Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. |
| PAHs by Hex:Ace GC-MS (Low Level CCME) | E641A-L<br>Vancouver - Environmental | Soil/Solid | EPA 8270E (mod) | Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by GC-MS. |

| Analytical Methods | Method / Lab | Matrix | Method Reference | Method Descriptions |
|---|---|---|---|---|
| VPH: VH-BTEX-Styrene | EC580A<br>Vancouver - Environmental | Soil/Solid | BC MOE Lab Manual (VPH in Water and Solids) (mod) | Volatile Petroleum Hydrocarbons (VPH) is calculated as follows: VH-BTEX = Volatile Hydrocarbons (VH6-10) minus benzene, toluene, ethylbenzene, xylenes (BTEX) and styrene. |
| LEPH and HEPH: EPH-PAH | EC600A<br>Vancouver - Environmental | Soil/Solid | BC MOE Lab Manual (LEPH and HEPH) (mod) | Light Extractable Petroleum Hydrocarbons (LEPH) and Heavy Extractable Petroleum Hydrocarbons (HEPH) are calculated as follows: LEPH = Extractable Petroleum Hydrocarbons (EPH10-19) minus Naphthalene and Phenanthrene; HEPH = Extractable Petroleum Hydrocarbons (EPH19-32) minus Benz(a)anthracene, Benzo(b+j+k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Pyrene. |

| Preparation Methods | Method / Lab | Matrix | Method Reference | Method Descriptions |
|---|---|---|---|---|
| Leach 1:2 Soil:Water for pH | EP108<br>Vancouver - Environmental | Soil/Solid | BC WLAP METHOD: PH, ELECTROMETRIC, SOIL | The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. |
| Digestion for Metals and Mercury | EP440<br>Vancouver - Environmental | Soil/Solid | EPA 200.2 (mod) | Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available. |
| VOCs Methanol Extraction for Headspace Analysis | EP581<br>Vancouver - Environmental | Soil/Solid | EPA 5035A (mod) | VOCs in samples are extracted with methanol. Extracts are then prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. |
| VOCs Preparation for Headspace Analysis (TCLP) | EP582<br>Vancouver - Environmental | Soil/Solid | EPA 5021A (mod) | Liquid obtained after the TCLP process is prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. |
| PHCs and PAHs Hexane-Acetone Tumbler Extraction | EP601<br>Vancouver - Environmental | Soil/Solid | CCME PHC in Soil - Tier 1 (mod) | Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor. |
| TCLP Leachate Preparation (VOCs) | EPP582<br>Vancouver - Environmental | Soil/Solid | EPA 1311 | An extract produced by the Toxicity Characteristic Leaching Procedure (TCLP) as per EPA 1311. |

Environmental Division
Vancouver
Work Order Reference
VA20A8304

Telephone : +1 604 253 4188

5M 0C4
298-5253

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02928 page 1 of 1

Project Number: 20145856
Short Title: Snowbird Clean-up
Golder Contact: Alison Verde
Golder E-mail Address 1: AVERDE @golder.com
Golder E-mail Address 2: JOLSEN @golder.com
Laboratory Name: ALS Burnaby
Address: 8081 Lougheed Hwy
Telephone/Fax: 604-253-4188
Contact: Amber Springer

EQuIS Facility Code: 217832270
EQuIS upload: ☒

Turnaround Time: ☐ 24 hr ☐ 48 hr ☐ 72 hr ☐ Regular (5 Days)
Criteria: ☒ CSR ☒ CCME ☐ BC Water Quality ☒ Other June 15th, 2020

Note: Final Reports to be issued by e-mail

Quote No.: Q80351

| 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 | Moisture | Leachable BETX Groundwater | 2-methylnaphthalene naphthalene | LEPH/HEPH/VPH | BTEX | n-nonane | Cadmium, Chromium Quinoline | 1,2-dibromoethane | PFAS - Health Hold | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02928 - 01 | MW20-02 | | 12-13' | So | 12/6/20 | 14:30 | Grab | FDA | 02928-02 | 4 | | X | X | X | X | X | X | X | | | |
| ↓ - 02 | ↓ | | ↓ | ↓ | ↓ | ↓ | ↓ | FD | 02928-01 | 4 | | | X | X | X | X | X | X | | | |
| ↓ - 03 | ↓ | | 15-15'6" | ↓ | ↓ | ↓ | ↓ | | | 4 | | | X | X | X | X | X | X | | | |
| ↓ - 04 | ↓ | | 19-19'6" | ↓ | ↓ | ↓ | ↓ | | | 4 | | | | | | | | | X | X | |
| ↓ - 05 | BH20-08 | | 13-14' | ↓ | ↓ | ↓ | ↓ | FDA | 02928-06 | 4 | | | X | X | X | X | X | X | | | |
| ↓ - 06 | ↓ | | ↓ ~~[illegible]~~ | ↓ | ↓ | ↓ | ↓ | FD | 02928-05 | 4 | | | | | | | | | X | | |
| ↓ - 07 | ↓ | | 18-18'6" | ↓ | ↓ | 17:30 | ↓ | | | 4 | | | | | | | | | X | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

Sampler's Signature:
Relinquished by: Signature
Company Golder
Date 13/6/20
Time 13:00
Received by: Signature
Company

Comments: On Ice
Method of Shipment:
Waybill No.:
Received for Lab by: TC
Date June 13
Time 1:03

Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C) 2
Cooler opened by:
Date
Time

WHITE: Golder Copy YELLOW: Lab Copy

Ice-Cub

ESED

ALS Environmental

# CERTIFICATE OF ANALYSIS

**Work Order** : **VA20A8760**
Client : **Golder Associates Ltd.**
Contact : Alison Verde
Address : 200-2920 Virtual Way
Vancouver BC Canada V5M 0C4
Telephone : 604 297 2036
Project : 20145856/1000
PO : ----
C-O-C number : 02934
Sampler : ----
Site : ----
Quote number : Q80351
No. of samples received : 7
No. of samples analysed : 7

Page : 1 of 8
Laboratory : Vancouver - Environmental
Account Manager : Amber Springer
Address : 8081 Lougheed Highway
Burnaby BC Canada V5A 1W9
Telephone : +1 604 253 4188
Date Samples Received : 19-Jun-2020 19:19
Date Analysis Commenced : 19-Jun-2020
Issue Date : 26-Jun-2020 13:07

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

| *Signatories* | *Position* | *Laboratory Department* |
|---|---|---|
| Angela Ren | Team Leader - Metals | Metals, Burnaby, British Columbia |
| Angelo Salandanan | Lab Assistant | Metals, Burnaby, British Columbia |
| Cristina Alexandre | Supervisor - Metals ICP Instrumentation | Metals, Burnaby, British Columbia |
| Jashan Kaur | Lab Assistant | Metals, Burnaby, British Columbia |
| Kim Jensen | Department Manager - Metals | Metals, Burnaby, British Columbia |
| Ophelia Chiu | Supervisor - Organics Instrumentation | Organics, Burnaby, British Columbia |
| Sandra Cummings | Interim Department Manager - LCMS | LCMS, Waterloo, Ontario |

## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

| *Unit* | *Description* |
|---|---|
| - | No Unit |
| µg/L | micrograms per litre |
| mg/L | milligrams per litre |

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

## Qualifiers

| *Qualifier* | *Description* |
|---|---|
| *DLCI* | *Detection Limit Raised: Chromatographic interference due to co-elution.* |

## *Analytical Results*

Sub-Matrix: **Groundwater**

(Matrix: **Water**)

| | | | | *Client sample ID* | **02934-01** | **02934-02** | **02934-03** | **02934-04** | **02934-05** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Client sampling date / time* | 19-Jun-2020 10:55 | 19-Jun-2020 11:55 | 19-Jun-2020 12:35 | 19-Jun-2020 13:20 | 19-Jun-2020 13:20 |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8760-001** | **VA20A8760-002** | **VA20A8760-003** | **VA20A8760-004** | **VA20A8760-005** |
| | | | | | Result | Result | Result | Result | Result |
| **Dissolved Metals** | | | | | | | | | |
| **aluminum, dissolved** | 7429-90-5 | E421 | 0.0010 | mg/L | 0.0019 | 0.0022 | 0.0034 | 0.0022 | 0.0026 |
| **antimony, dissolved** | 7440-36-0 | E421 | 0.00010 | mg/L | <0.00010 | 0.00010 | 0.00010 | <0.00010 | <0.00010 |
| **cadmium, dissolved** | 7440-43-9 | E421 | 0.0000050 | mg/L | 0.0000236 | 0.0000820 | 0.000133 | 0.000111 | 0.000118 |
| **chromium, dissolved** | 7440-47-3 | E421 | 0.00050 | mg/L | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| **cobalt, dissolved** | 7440-48-4 | E421 | 0.00010 | mg/L | 0.00077 | 0.00151 | 0.00364 | 0.00164 | 0.00156 |
| **lead, dissolved** | 7439-92-1 | E421 | 0.000050 | mg/L | 0.000248 | <0.000050 | <0.000050 | <0.000050 | <0.000050 |
| **titanium, dissolved** | 7440-32-6 | E421 | 0.00030 | mg/L | <0.00030 | <0.00030 | <0.00030 | <0.00030 | <0.00030 |
| **zinc, dissolved** | 7440-66-6 | E421 | 0.0010 | mg/L | 0.0017 | 0.0017 | 0.0036 | 0.0032 | 0.0031 |
| **dissolved metals filtration location** | ---- | EP421 | - | - | Field | Field | Field | Field | Field |
| **Volatile Organic Compounds** | | | | | | | | | |
| **benzene** | 71-43-2 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| **dibromoethane, 1,2-** | 106-93-4 | E611H | 0.2 | µg/L | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| **ethylbenzene** | 100-41-4 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| **methyl-tert-butyl ether [MTBE]** | 1634-04-4 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| **nonane, n-** | 111-84-2 | E611H | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **styrene** | 100-42-5 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| **toluene** | 108-88-3 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| **trimethylbenzene, 1,2,4-** | 95-63-6 | E611H | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **xylene, m+p-** | 179601-23-1 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| **xylene, o-** | 95-47-6 | E611H | 0.50 | µg/L | <0.50 | <0.50 | <0.50 | 0.86 | 0.80 |
| **xylenes, total** | 1330-20-7 | E611H | 0.75 | µg/L | <0.75 | <0.75 | <0.75 | 0.86 | 0.80 |
| **Volatile Organic Compounds Surrogates** | | | | | | | | | |
| **bromofluorobenzene, 4-** | 460-00-4 | E611H | 1.0 | % | 103 | 106 | 99.7 | 106 | 102 |
| **difluorobenzene, 1,4-** | 540-36-3 | E611H | 1.0 | % | 110 | 110 | 105 | 109 | 109 |
| **Hydrocarbons** | | | | | | | | | |
| **EPH (C10-C19)** | ---- | E601A | 250 | µg/L | <250 | <250 | <250 | <250 | <250 |
| **EPH (C19-C32)** | ---- | E601A | 250 | µg/L | <250 | <250 | <250 | <250 | <250 |
| **VHw (C6-C10)** | ---- | E581.VH+F1 | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| **VPHw** | ---- | EC580A | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| **HEPHw** | ---- | EC600A | 250 | µg/L | <250 | <250 | <250 | <250 | <250 |

## Analytical Results

Sub-Matrix: **Groundwater**

(Matrix: **Water**)

| | | | | *Client sample ID* | **02934-01** | **02934-02** | **02934-03** | **02934-04** | **02934-05** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Client sampling date / time* | 19-Jun-2020 10:55 | 19-Jun-2020 11:55 | 19-Jun-2020 12:35 | 19-Jun-2020 13:20 | 19-Jun-2020 13:20 |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8760-001** | **VA20A8760-002** | **VA20A8760-003** | **VA20A8760-004** | **VA20A8760-005** |
| | | | | | Result | Result | Result | Result | Result |
| **Hydrocarbons** | | | | | | | | | |
| **LEPHw** | ---- | EC600A | 250 | µg/L | <250 | <250 | <250 | <250 | <250 |
| **Hydrocarbons Surrogates** | | | | | | | | | |
| **bromobenzotrifluoride, 2- (EPH surr)** | 392-83-6 | E601A | 50 | % | 98.2 | 104 | 99.0 | 98.2 | 106 |
| **dichlorotoluene, 3,4-** | 97-75-0 | E581.VH+F1 | 1.0 | % | 106 | 107 | 84.4 | 107 | 93.0 |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | |
| **acenaphthene** | 83-32-9 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.020 DLCI | <0.020 DLCI |
| **acenaphthylene** | 208-96-8 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **acridine** | 260-94-6 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **anthracene** | 120-12-7 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benz(a)anthracene** | 56-55-3 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(a)pyrene** | 50-32-8 | E641A | 0.0050 | µg/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| **benzo(b+j)fluoranthene** | ---- | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(b+j+k)fluoranthene** | ---- | E641A | 0.015 | µg/L | <0.015 | <0.015 | <0.015 | <0.015 | <0.015 |
| **benzo(g,h,i)perylene** | 191-24-2 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **benzo(k)fluoranthene** | 207-08-9 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **chrysene** | 218-01-9 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **dibenz(a,h)anthracene** | 53-70-3 | E641A | 0.0050 | µg/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| **fluoranthene** | 206-44-0 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **fluorene** | 86-73-7 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.020 DLCI | <0.020 DLCI |
| **indeno(1,2,3-c,d)pyrene** | 193-39-5 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **methylnaphthalene, 1-** | 90-12-0 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | 0.113 | 0.135 |
| **methylnaphthalene, 2-** | 91-57-6 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | 0.072 | 0.081 |
| **naphthalene** | 91-20-3 | E641A | 0.050 | µg/L | <0.050 | <0.050 | <0.050 | <0.080 DLCI | <0.090 DLCI |
| **phenanthrene** | 85-01-8 | E641A | 0.020 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| **pyrene** | 129-00-0 | E641A | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **quinoline** | 6027-02-7 | E641A | 0.050 | µg/L | <0.050 | <0.050 | <0.050 | <0.080 DLCI | <0.100 DLCI |
| **Polycyclic Aromatic Hydrocarbons Surrogates** | | | | | | | | | |
| **acridine-d9** | 34749-75-2 | E641A | 0.010 | % | 112 | 113 | 110 | 116 | 113 |
| **chrysene-d12** | 1719-03-5 | E641A | 0.010 | % | 105 | 107 | 101 | 104 | 108 |
| **naphthalene-d8** | 1146-65-2 | E641A | 0.010 | % | 93.1 | 101 | 98.2 | 99.2 | 102 |
| **phenanthrene-d10** | 1517-22-2 | E641A | 0.010 | % | 114 | 117 | 114 | 119 | 117 |

## Analytical Results

Sub-Matrix: **Groundwater**

(Matrix: **Water**)

| Analyte | CAS Number | Method | LOR | Unit | 02934-01 | 02934-02 | 02934-03 | 02934-04 | 02934-05 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 19-Jun-2020 10:55 | 19-Jun-2020 11:55 | 19-Jun-2020 12:35 | 19-Jun-2020 13:20 | 19-Jun-2020 13:20 |
| | | | | | VA20A8760-001 | VA20A8760-002 | VA20A8760-003 | VA20A8760-004 | VA20A8760-005 |
| | | | | | Result | Result | Result | Result | Result |
| **Perfluoroalkyl Substances (PFAS)** | | | | | | | | | |
| **fluorotelomer sulfonic acid, 6:2 [6:2 FTS]** | 27619-97-2 | E745C | 0.010 | µg/L | 0.024 | <0.010 | <0.010 | 0.024 | 0.032 |
| **fluorotelomer sulfonic acid, 8:2 [8:2 FTS]** | 39108-34-4 | E745C | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **perfluorobutane sulfonic acid [PFBS]** | 375-73-5 | E745C | 0.010 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| **perfluorobutanoic acid [PFBA]** | 375-22-4 | E745C | 0.10 | µg/L | <0.80 | <0.80 | <0.80 | <0.80 | <0.80 |
| **perfluoroheptanoic acid [PFHpA]** | 375-85-9 | E745C | 0.010 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| **perfluorohexane sulfonic acid [PFHxS]** | 355-46-4 | E745C | 0.010 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| **perfluorohexanoic acid [PFHxA]** | 307-24-4 | E745C | 0.010 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| **perfluorononanoic acid [PFNA]** | 375-95-1 | E745C | 0.010 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| **perfluorooctane sulfonic acid [PFOS]** | 1763-23-1 | E745C | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **perfluorooctanoic acid [PFOA]** | 335-67-1 | E745C | 0.010 | µg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| **perfluoropentanoic acid [PFPeA]** | 2706-90-3 | E745C | 0.010 | µg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: **Groundwater**

(Matrix: **Water**)

| | | | | Client sample ID | **02934-06** | **02934-07** | **----** | **----** | **----** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 19-Jun-2020 13:50 | 19-Jun-2020 19:00 | ---- | ---- | ---- |
| Analyte | CAS Number | Method | LOR | Unit | **VA20A8760-006** | **VA20A8760-007** | **--------** | **--------** | **--------** |
| | | | | | Result | Result | ---- | ---- | ---- |
| **Dissolved Metals** | | | | | | | | | |
| **aluminum, dissolved** | 7429-90-5 | E421 | 0.0010 | mg/L | <0.0010 | <0.0010 | ---- | ---- | ---- |
| **antimony, dissolved** | 7440-36-0 | E421 | 0.00010 | mg/L | <0.00010 | <0.00010 | ---- | ---- | ---- |
| **cadmium, dissolved** | 7440-43-9 | E421 | 0.0000050 | mg/L | <0.0000050 | <0.0000050 | ---- | ---- | ---- |
| **chromium, dissolved** | 7440-47-3 | E421 | 0.00050 | mg/L | <0.00050 | <0.00050 | ---- | ---- | ---- |
| **cobalt, dissolved** | 7440-48-4 | E421 | 0.00010 | mg/L | <0.00010 | <0.00010 | ---- | ---- | ---- |
| **lead, dissolved** | 7439-92-1 | E421 | 0.000050 | mg/L | <0.000050 | <0.000050 | ---- | ---- | ---- |
| **titanium, dissolved** | 7440-32-6 | E421 | 0.00030 | mg/L | <0.00030 | <0.00030 | ---- | ---- | ---- |
| **zinc, dissolved** | 7440-66-6 | E421 | 0.0010 | mg/L | <0.0010 | <0.0010 | ---- | ---- | ---- |
| **dissolved metals filtration location** | ---- | EP421 | - | - | Field | Field | ---- | ---- | ---- |
| **Volatile Organic Compounds** | | | | | | | | | |
| **benzene** | 71-43-2 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **dibromoethane, 1,2-** | 106-93-4 | E611H | 0.2 | µg/L | <0.2 | <0.2 | ---- | ---- | ---- |
| **ethylbenzene** | 100-41-4 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **methyl-tert-butyl ether [MTBE]** | 1634-04-4 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **nonane, n-** | 111-84-2 | E611H | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| **styrene** | 100-42-5 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **toluene** | 108-88-3 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **trimethylbenzene, 1,2,4-** | 95-63-6 | E611H | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| **xylene, m+p-** | 179601-23-1 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **xylene, o-** | 95-47-6 | E611H | 0.50 | µg/L | <0.50 | <0.50 | ---- | ---- | ---- |
| **xylenes, total** | 1330-20-7 | E611H | 0.75 | µg/L | <0.75 | <0.75 | ---- | ---- | ---- |
| **Volatile Organic Compounds Surrogates** | | | | | | | | | |
| **bromofluorobenzene, 4-** | 460-00-4 | E611H | 1.0 | % | 108 | 106 | ---- | ---- | ---- |
| **difluorobenzene, 1,4-** | 540-36-3 | E611H | 1.0 | % | 106 | 107 | ---- | ---- | ---- |
| **Hydrocarbons** | | | | | | | | | |
| **EPH (C10-C19)** | ---- | E601A | 250 | µg/L | <250 | <250 | ---- | ---- | ---- |
| **EPH (C19-C32)** | ---- | E601A | 250 | µg/L | <250 | <250 | ---- | ---- | ---- |
| **VHw (C6-C10)** | ---- | E581.VH+F1 | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| **VPHw** | ---- | EC580A | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| **HEPHw** | ---- | EC600A | 250 | µg/L | <250 | <250 | ---- | ---- | ---- |
| **LEPHw** | ---- | EC600A | 250 | µg/L | <250 | <250 | ---- | ---- | ---- |

## *Analytical Results*

Sub-Matrix: **Groundwater**

(Matrix: **Water**)

| | | | | *Client sample ID* | **02934-06** | **02934-07** | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Client sampling date / time* | 19-Jun-2020 13:50 | 19-Jun-2020 19:00 | ---- | ---- | ---- |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8760-006** | **VA20A8760-007** | -------- | -------- | -------- |
| | | | | | Result | Result | ---- | ---- | ---- |
| **Hydrocarbons Surrogates** | | | | | | | | | |
| **bromobenzotrifluoride, 2- (EPH surr)** | 392-83-6 | E601A | 50 | % | 96.2 | 104 | ---- | ---- | ---- |
| **dichlorotoluene, 3,4-** | 97-75-0 | E581.VH+F1 | 1.0 | % | 118 | 113 | ---- | ---- | ---- |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | |
| **acenaphthene** | 83-32-9 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **acenaphthylene** | 208-96-8 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **acridine** | 260-94-6 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **anthracene** | 120-12-7 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **benz(a)anthracene** | 56-55-3 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **benzo(a)pyrene** | 50-32-8 | E641A | 0.0050 | µg/L | <0.0050 | <0.0050 | ---- | ---- | ---- |
| **benzo(b+j)fluoranthene** | ---- | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **benzo(b+j+k)fluoranthene** | ---- | E641A | 0.015 | µg/L | <0.015 | <0.015 | ---- | ---- | ---- |
| **benzo(g,h,i)perylene** | 191-24-2 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **benzo(k)fluoranthene** | 207-08-9 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **chrysene** | 218-01-9 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **dibenz(a,h)anthracene** | 53-70-3 | E641A | 0.0050 | µg/L | <0.0050 | <0.0050 | ---- | ---- | ---- |
| **fluoranthene** | 206-44-0 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **fluorene** | 86-73-7 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **indeno(1,2,3-c,d)pyrene** | 193-39-5 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **methylnaphthalene, 1-** | 90-12-0 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **methylnaphthalene, 2-** | 91-57-6 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **naphthalene** | 91-20-3 | E641A | 0.050 | µg/L | <0.050 | <0.050 | ---- | ---- | ---- |
| **phenanthrene** | 85-01-8 | E641A | 0.020 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |
| **pyrene** | 129-00-0 | E641A | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **quinoline** | 6027-02-7 | E641A | 0.050 | µg/L | <0.050 | <0.050 | ---- | ---- | ---- |
| **Polycyclic Aromatic Hydrocarbons Surrogates** | | | | | | | | | |
| **acridine-d9** | 34749-75-2 | E641A | 0.010 | % | 107 | 110 | ---- | ---- | ---- |
| **chrysene-d12** | 1719-03-5 | E641A | 0.010 | % | 102 | 104 | ---- | ---- | ---- |
| **naphthalene-d8** | 1146-65-2 | E641A | 0.010 | % | 95.7 | 102 | ---- | ---- | ---- |
| **phenanthrene-d10** | 1517-22-2 | E641A | 0.010 | % | 112 | 116 | ---- | ---- | ---- |
| **Perfluoroalkyl Substances (PFAS)** | | | | | | | | | |
| **fluorotelomer sulfonic acid, 6:2 [6:2 FTS]** | 27619-97-2 | E745C | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |

## *Analytical Results*

Sub-Matrix: **Groundwater**

(Matrix: **Water**)

| | | | | *Client sample ID* | **02934-06** | **02934-07** | **----** | **----** | **----** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Client sampling date / time* | 19-Jun-2020 13:50 | 19-Jun-2020 19:00 | ---- | ---- | ---- |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | **VA20A8760-006** | **VA20A8760-007** | **--------** | **--------** | **--------** |
| | | | | | Result | Result | ---- | ---- | ---- |
| **Perfluoroalkyl Substances (PFAS)** | | | | | | | | | |
| **fluorotelomer sulfonic acid, 8:2 [8:2 FTS]** | 39108-34-4 | E745C | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **perfluorobutane sulfonic acid [PFBS]** | 375-73-5 | E745C | 0.010 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |
| **perfluorobutanoic acid [PFBA]** | 375-22-4 | E745C | 0.10 | µg/L | <0.80 | <0.80 | ---- | ---- | ---- |
| **perfluoroheptanoic acid [PFHpA]** | 375-85-9 | E745C | 0.010 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |
| **perfluorohexane sulfonic acid [PFHxS]** | 355-46-4 | E745C | 0.010 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |
| **perfluorohexanoic acid [PFHxA]** | 307-24-4 | E745C | 0.010 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |
| **perfluorononanoic acid [PFNA]** | 375-95-1 | E745C | 0.010 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |
| **perfluorooctane sulfonic acid [PFOS]** | 1763-23-1 | E745C | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **perfluorooctanoic acid [PFOA]** | 335-67-1 | E745C | 0.010 | µg/L | <0.010 | <0.010 | ---- | ---- | ---- |
| **perfluoropentanoic acid [PFPeA]** | 2706-90-3 | E745C | 0.010 | µg/L | <0.020 | <0.020 | ---- | ---- | ---- |

Please refer to the General Comments section for an explanation of any qualifiers detected.

# QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | :**VA20A8760** | Page | : 1 of 10 |
| Client | :Golder Associates Ltd. | Laboratory | :Vancouver - Environmental |
| Contact | :Alison Verde | Account Manager | :Amber Springer |
| Address | :200-2920 Virtual Way<br>Vancouver BC Canada V5M 0C4 | Address | :8081 Lougheed Highway<br>Burnaby, British Columbia Canada V5A 1W9 |
| Telephone | :604 297 2036 | Telephone | :+1 604 253 4188 |
| Project | :20145856/1000 | Date Samples Received | :19-Jun-2020 19:19 |
| PO | :---- | Date Analysis Commenced | :19-Jun-2020 |
| C-O-C number | :02934 | Issue Date | :26-Jun-2020 13:07 |
| Sampler | :---- | | |
| Site | :---- | | |
| Quote number | :Q80351 | | |
| No. of samples received | :7 | | |
| No. of samples analysed | :7 | | |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

| *Signatories* | *Position* | *Laboratory Department* |
|---|---|---|
| Angela Ren | Team Leader - Metals | Metals, Burnaby, British Columbia |
| Angelo Salandanan | Lab Assistant | Metals, Burnaby, British Columbia |
| Cristina Alexandre | Supervisor - Metals ICP Instrumentation | Metals, Burnaby, British Columbia |
| Jashan Kaur | Lab Assistant | Metals, Burnaby, British Columbia |
| Kim Jensen | Department Manager - Metals | Metals, Burnaby, British Columbia |
| Ophelia Chiu | Supervisor - Organics Instrumentation | Organics, Burnaby, British Columbia |
| Sandra Cummings | Interim Department Manager - LCMS | LCMS, Waterloo, Ontario |

## *General Comments*

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

## *Laboratory Duplicate (DUP) Report*

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Water**

| | | | | | *Laboratory Duplicate (DUP) Report* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD(%) or Difference* | *Duplicate Limits* | *Qualifier* |
| **Dissolved Metals (QC Lot: 51963)** | | | | | | | | | | | |
| VA20A8250-002 | Anonymous | aluminum, dissolved | 7429-90-5 | E421 | 0.0010 | mg/L | 0.0215 | 0.0213 | 0.835% | 20% | ---- |
| | | antimony, dissolved | 7440-36-0 | E421 | 0.00010 | mg/L | 0.00038 | 0.00037 | 0.000009 | Diff <2x LOR | ---- |
| | | cadmium, dissolved | 7440-43-9 | E421 | 0.0000050 | mg/L | 0.0000318 | 0.0000267 | 0.0000050 | Diff <2x LOR | ---- |
| | | chromium, dissolved | 7440-47-3 | E421 | 0.00050 | mg/L | 0.00478 | 0.00467 | 0.00011 | Diff <2x LOR | ---- |
| | | cobalt, dissolved | 7440-48-4 | E421 | 0.00010 | mg/L | 0.00032 | 0.00031 | 0.000010 | Diff <2x LOR | ---- |
| | | lead, dissolved | 7439-92-1 | E421 | 0.000050 | mg/L | <0.000050 | <0.000050 | 0 | Diff <2x LOR | ---- |
| | | titanium, dissolved | 7440-32-6 | E421 | 0.00030 | mg/L | <0.00030 | <0.00030 | 0 | Diff <2x LOR | ---- |
| | | zinc, dissolved | 7440-66-6 | E421 | 0.0010 | mg/L | 0.0095 | 0.0101 | 0.0006 | Diff <2x LOR | ---- |
| **Volatile Organic Compounds (QC Lot: 51876)** | | | | | | | | | | | |
| VA20A8760-001 | 02934-01 | benzene | 71-43-2 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| | | dibromoethane, 1,2- | 106-93-4 | E611H | 0.2 | µg/L | <0.2 | <0.2 | 0 | Diff <2x LOR | ---- |
| | | ethylbenzene | 100-41-4 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| | | methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| | | nonane, n- | 111-84-2 | E611H | 1.0 | µg/L | <1.0 | <1.0 | 0 | Diff <2x LOR | ---- |
| | | styrene | 100-42-5 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| | | toluene | 108-88-3 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| | | trimethylbenzene, 1,2,4- | 95-63-6 | E611H | 1.0 | µg/L | <1.0 | <1.0 | 0 | Diff <2x LOR | ---- |
| | | xylene, m+p- | 179601-23-1 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| | | xylene, o- | 95-47-6 | E611H | 0.50 | µg/L | <0.50 | <0.50 | 0 | Diff <2x LOR | ---- |
| **Hydrocarbons (QC Lot: 51875)** | | | | | | | | | | | |
| VA20A8250-002 | Anonymous | VHw (C6-C10) | ---- | E581.VH+F1 | 100 | µg/L | <100 | <100 | 0.00% | 30% | ---- |
| **Perfluoroalkyl Substances (PFAS) (QC Lot: 54228)** | | | | | | | | | | | |
| VA20A8760-007 | 02934-07 | fluorotelomer sulfonic acid, 6:2 [6:2 FTS] | 27619-97-2 | E745C | 0.010 | µg/L | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | fluorotelomer sulfonic acid, 8:2 [8:2 FTS] | 39108-34-4 | E745C | 0.010 | µg/L | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | perfluorobutane sulfonic acid [PFBS] | 375-73-5 | E745C | 0.020 | µg/L | <0.020 | <0.010 | 0.010 | Diff <2x LOR | ---- |
| | | perfluorobutanoic acid [PFBA] | 375-22-4 | E745C | 0.80 | µg/L | <0.80 | 0.20 | 0.60 | Diff <2x LOR | ---- |
| | | perfluoroheptanoic acid [PFHpA] | 375-85-9 | E745C | 0.020 | µg/L | <0.020 | <0.010 | 0.010 | Diff <2x LOR | ---- |
| | | perfluorohexane sulfonic acid [PFHxS] | 355-46-4 | E745C | 0.020 | µg/L | <0.020 | <0.010 | 0.010 | Diff <2x LOR | ---- |
| | | perfluorohexanoic acid [PFHxA] | 307-24-4 | E745C | 0.020 | µg/L | <0.020 | <0.010 | 0.010 | Diff <2x LOR | ---- |
| | | perfluorononanoic acid [PFNA] | 375-95-1 | E745C | 0.020 | µg/L | <0.020 | <0.010 | 0.010 | Diff <2x LOR | ---- |

Sub-Matrix: **Water**

| Laboratory sample ID | Client sample ID | Analyte | CAS Number | Method | Laboratory Duplicate (DUP) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | LOR | Unit | Original Result | Duplicate Result | RPD(%) or Difference | Duplicate Limits | Qualifier |
| **Perfluoroalkyl Substances (PFAS) (QC Lot: 54228) - continued** | | | | | | | | | | | |
| VA20A8760-007 | 02934-07 | perfluorooctane sulfonic acid [PFOS] | 1763-23-1 | E745C | 0.010 | µg/L | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | perfluorooctanoic acid [PFOA] | 335-67-1 | E745C | 0.010 | µg/L | <0.010 | <0.010 | 0 | Diff <2x LOR | ---- |
| | | perfluoropentanoic acid [PFPeA] | 2706-90-3 | E745C | 0.020 | µg/L | <0.020 | <0.010 | 0.010 | Diff <2x LOR | ---- |

## Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

| Analyte | CAS Number | Method | LOR | Unit | Result | Qualifier |
|---|---|---|---|---|---|---|
| **Dissolved Metals (QCLot: 51963)** | | | | | | |
| aluminum, dissolved | 7429-90-5 | E421 | 0.001 | mg/L | <0.0010 | ---- |
| antimony, dissolved | 7440-36-0 | E421 | 0.0001 | mg/L | <0.00010 | ---- |
| cadmium, dissolved | 7440-43-9 | E421 | 0.000005 | mg/L | <0.0000050 | ---- |
| chromium, dissolved | 7440-47-3 | E421 | 0.0005 | mg/L | <0.00050 | ---- |
| cobalt, dissolved | 7440-48-4 | E421 | 0.0001 | mg/L | <0.00010 | ---- |
| lead, dissolved | 7439-92-1 | E421 | 0.00005 | mg/L | <0.000050 | ---- |
| titanium, dissolved | 7440-32-6 | E421 | 0.0003 | mg/L | <0.00030 | ---- |
| zinc, dissolved | 7440-66-6 | E421 | 0.001 | mg/L | <0.0010 | ---- |
| **Volatile Organic Compounds (QCLot: 51876)** | | | | | | |
| benzene | 71-43-2 | E611H | 0.5 | µg/L | <0.50 | ---- |
| dibromoethane, 1,2- | 106-93-4 | E611H | 0.2 | µg/L | <0.2 | ---- |
| ethylbenzene | 100-41-4 | E611H | 0.5 | µg/L | <0.50 | ---- |
| methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611H | 0.5 | µg/L | <0.50 | ---- |
| nonane, n- | 111-84-2 | E611H | 1 | µg/L | NR | ---- |
| styrene | 100-42-5 | E611H | 0.5 | µg/L | <0.50 | ---- |
| toluene | 108-88-3 | E611H | 0.5 | µg/L | <0.50 | ---- |
| trimethylbenzene, 1,2,4- | 95-63-6 | E611H | 1 | µg/L | <1.0 | ---- |
| xylene, m+p- | 179601-23-1 | E611H | 0.5 | µg/L | <0.50 | ---- |
| xylene, o- | 95-47-6 | E611H | 0.5 | µg/L | <0.50 | ---- |
| **Hydrocarbons (QCLot: 51823)** | | | | | | |
| EPH (C10-C19) | ---- | E601A | 250 | µg/L | <250 | ---- |
| EPH (C19-C32) | ---- | E601A | 250 | µg/L | <250 | ---- |
| **Hydrocarbons (QCLot: 51875)** | | | | | | |
| VHw (C6-C10) | ---- | E581.VH+F1 | 100 | µg/L | <100 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 51824)** | | | | | | |
| acenaphthene | 83-32-9 | E641A | 0.01 | µg/L | <0.010 | ---- |
| acenaphthylene | 208-96-8 | E641A | 0.01 | µg/L | <0.010 | ---- |
| acridine | 260-94-6 | E641A | 0.01 | µg/L | <0.010 | ---- |
| anthracene | 120-12-7 | E641A | 0.01 | µg/L | <0.010 | ---- |
| benz(a)anthracene | 56-55-3 | E641A | 0.01 | µg/L | <0.010 | ---- |
| benzo(a)pyrene | 50-32-8 | E641A | 0.005 | µg/L | <0.0050 | ---- |
| benzo(b+j)fluoranthene | ---- | E641A | 0.01 | µg/L | <0.010 | ---- |
| benzo(b+j+k)fluoranthene | ---- | E641A | 0.015 | µg/L | <0.015 | ---- |

Sub-Matrix: **Water**

| Analyte | CAS Number | Method | LOR | Unit | Result | Qualifier |
|---|---|---|---|---|---|---|
| **Polycyclic Aromatic Hydrocarbons (QCLot: 51824) - continued** | | | | | | |
| benzo(g,h,i)perylene | 191-24-2 | E641A | 0.01 | µg/L | <0.010 | ---- |
| benzo(k)fluoranthene | 207-08-9 | E641A | 0.01 | µg/L | <0.010 | ---- |
| chrysene | 218-01-9 | E641A | 0.01 | µg/L | <0.010 | ---- |
| dibenz(a,h)anthracene | 53-70-3 | E641A | 0.005 | µg/L | <0.0050 | ---- |
| fluoranthene | 206-44-0 | E641A | 0.01 | µg/L | <0.010 | ---- |
| fluorene | 86-73-7 | E641A | 0.01 | µg/L | <0.010 | ---- |
| indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A | 0.01 | µg/L | <0.010 | ---- |
| methylnaphthalene, 1- | 90-12-0 | E641A | 0.01 | µg/L | <0.010 | ---- |
| methylnaphthalene, 2- | 91-57-6 | E641A | 0.01 | µg/L | <0.010 | ---- |
| naphthalene | 91-20-3 | E641A | 0.05 | µg/L | <0.050 | ---- |
| phenanthrene | 85-01-8 | E641A | 0.02 | µg/L | <0.020 | ---- |
| pyrene | 129-00-0 | E641A | 0.01 | µg/L | <0.010 | ---- |
| quinoline | 6027-02-7 | E641A | 0.05 | µg/L | <0.050 | ---- |
| **Perfluoroalkyl Substances (PFAS) (QCLot: 54228)** | | | | | | |
| fluorotelomer sulfonic acid, 6:2 [6:2 FTS] | 27619-97-2 | E745C | 0.01 | µg/L | <0.010 | ---- |
| fluorotelomer sulfonic acid, 8:2 [8:2 FTS] | 39108-34-4 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorobutane sulfonic acid [PFBS] | 375-73-5 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorobutanoic acid [PFBA] | 375-22-4 | E745C | 0.1 | µg/L | # 0.22 | MB-LOR |
| perfluoroheptanoic acid [PFHpA] | 375-85-9 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorohexane sulfonic acid [PFHxS] | 355-46-4 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorohexanoic acid [PFHxA] | 307-24-4 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorononanoic acid [PFNA] | 375-95-1 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorooctane sulfonic acid [PFOS] | 1763-23-1 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluorooctanoic acid [PFOA] | 335-67-1 | E745C | 0.01 | µg/L | <0.010 | ---- |
| perfluoropentanoic acid [PFPeA] | 2706-90-3 | E745C | 0.01 | µg/L | <0.010 | ---- |

## *Qualifiers*

| *Qualifier* | *Description* |
|---|---|
| *MB-LOR* | *Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.* |

## Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

|  |  |  |  |  | Laboratory Control Sample (LCS) Report |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Spike | Recovery (%) | Recovery Limits (%) |  |  |
| Analyte | CAS Number | Method | LOR | Unit | Concentration | LCS | Low | High | Qualifier |
| **Dissolved Metals (QCLot: 51963)** |  |  |  |  |  |  |  |  |  |
| aluminum, dissolved | 7429-90-5 | E421 | 0.001 | mg/L | 2 mg/L | 107 | 80.0 | 120 | ---- |
| antimony, dissolved | 7440-36-0 | E421 | 0.0001 | mg/L | 1 mg/L | 105 | 80.0 | 120 | ---- |
| cadmium, dissolved | 7440-43-9 | E421 | 0.000005 | mg/L | 0.1 mg/L | 105 | 80.0 | 120 | ---- |
| chromium, dissolved | 7440-47-3 | E421 | 0.0005 | mg/L | 0.25 mg/L | 106 | 80.0 | 120 | ---- |
| cobalt, dissolved | 7440-48-4 | E421 | 0.0001 | mg/L | 0.25 mg/L | 106 | 80.0 | 120 | ---- |
| lead, dissolved | 7439-92-1 | E421 | 0.00005 | mg/L | 0.5 mg/L | 105 | 80.0 | 120 | ---- |
| titanium, dissolved | 7440-32-6 | E421 | 0.0003 | mg/L | 0.25 mg/L | 97.8 | 80.0 | 120 | ---- |
| zinc, dissolved | 7440-66-6 | E421 | 0.001 | mg/L | 0.5 mg/L | 105 | 80.0 | 120 | ---- |
| **Volatile Organic Compounds (QCLot: 51876)** |  |  |  |  |  |  |  |  |  |
| benzene | 71-43-2 | E611H | 0.5 | µg/L | 100 µg/L | 96.7 | 70.0 | 130 | ---- |
| dibromoethane, 1,2- | 106-93-4 | E611H | 0.2 | µg/L | 100 µg/L | 102 | 70.0 | 130 | ---- |
| ethylbenzene | 100-41-4 | E611H | 0.5 | µg/L | 100 µg/L | 102 | 70.0 | 130 | ---- |
| methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611H | 0.5 | µg/L | 200 µg/L | 103 | 70.0 | 130 | ---- |
| styrene | 100-42-5 | E611H | 0.5 | µg/L | 100 µg/L | 86.7 | 70.0 | 130 | ---- |
| toluene | 108-88-3 | E611H | 0.5 | µg/L | 100 µg/L | 97.3 | 70.0 | 130 | ---- |
| trimethylbenzene, 1,2,4- | 95-63-6 | E611H | 1 | µg/L | 100 µg/L | 104 | 70.0 | 130 | ---- |
| xylene, m+p- | 179601-23-1 | E611H | 0.5 | µg/L | 200 µg/L | 103 | 70.0 | 130 | ---- |
| xylene, o- | 95-47-6 | E611H | 0.5 | µg/L | 100 µg/L | 99.9 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 51823)** |  |  |  |  |  |  |  |  |  |
| EPH (C10-C19) | ---- | E601A | 250 | µg/L | 6491 µg/L | 114 | 70.0 | 130 | ---- |
| EPH (C19-C32) | ---- | E601A | 250 | µg/L | 3363 µg/L | 114 | 70.0 | 130 | ---- |
| **Hydrocarbons (QCLot: 51875)** |  |  |  |  |  |  |  |  |  |
| VHw (C6-C10) | ---- | E581.VH+F1 | 100 | µg/L | 6310 µg/L | 90.1 | 70.0 | 130 | ---- |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 51824)** |  |  |  |  |  |  |  |  |  |
| acenaphthene | 83-32-9 | E641A | 0.01 | µg/L | 0.5 µg/L | 110 | 60.0 | 130 | ---- |
| acenaphthylene | 208-96-8 | E641A | 0.01 | µg/L | 0.5 µg/L | 115 | 60.0 | 130 | ---- |
| acridine | 260-94-6 | E641A | 0.01 | µg/L | 0.5 µg/L | 121 | 60.0 | 130 | ---- |
| anthracene | 120-12-7 | E641A | 0.01 | µg/L | 0.5 µg/L | 128 | 60.0 | 130 | ---- |
| benz(a)anthracene | 56-55-3 | E641A | 0.01 | µg/L | 0.5 µg/L | 119 | 60.0 | 130 | ---- |
| benzo(a)pyrene | 50-32-8 | E641A | 0.005 | µg/L | 0.5 µg/L | 115 | 60.0 | 130 | ---- |
| benzo(b+j)fluoranthene | ---- | E641A | 0.01 | µg/L | 0.5 µg/L | 113 | 60.0 | 130 | ---- |

Sub-Matrix: **Water**

| | | | | | *Laboratory Control Sample (LCS) Report* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Spike* | *Recovery (%)* | *Recovery Limits (%)* | | |
| *Analyte* | *CAS Number* | *Method* | *LOR* | *Unit* | *Concentration* | *LCS* | *Low* | *High* | *Qualifier* |
| **Polycyclic Aromatic Hydrocarbons (QCLot: 51824) - continued** | | | | | | | | | |
| benzo(b+j+k)fluoranthene | ---- | E641A | 0.015 | µg/L | 1 µg/L | 113 | 60.0 | 130 | ---- |
| benzo(g,h,i)perylene | 191-24-2 | E641A | 0.01 | µg/L | 0.5 µg/L | 106 | 60.0 | 130 | ---- |
| benzo(k)fluoranthene | 207-08-9 | E641A | 0.01 | µg/L | 0.5 µg/L | 113 | 60.0 | 130 | ---- |
| chrysene | 218-01-9 | E641A | 0.01 | µg/L | 0.5 µg/L | 112 | 60.0 | 130 | ---- |
| dibenz(a,h)anthracene | 53-70-3 | E641A | 0.005 | µg/L | 0.5 µg/L | 116 | 60.0 | 130 | ---- |
| fluoranthene | 206-44-0 | E641A | 0.01 | µg/L | 0.5 µg/L | 120 | 60.0 | 130 | ---- |
| fluorene | 86-73-7 | E641A | 0.01 | µg/L | 0.5 µg/L | 118 | 60.0 | 130 | ---- |
| indeno(1,2,3-c,d)pyrene | 193-39-5 | E641A | 0.01 | µg/L | 0.5 µg/L | 118 | 60.0 | 130 | ---- |
| methylnaphthalene, 1- | 90-12-0 | E641A | 0.01 | µg/L | 0.5 µg/L | 104 | 60.0 | 130 | ---- |
| methylnaphthalene, 2- | 91-57-6 | E641A | 0.01 | µg/L | 0.5 µg/L | 104 | 60.0 | 130 | ---- |
| naphthalene | 91-20-3 | E641A | 0.05 | µg/L | 0.5 µg/L | 104 | 50.0 | 130 | ---- |
| phenanthrene | 85-01-8 | E641A | 0.02 | µg/L | 0.5 µg/L | 121 | 60.0 | 130 | ---- |
| pyrene | 129-00-0 | E641A | 0.01 | µg/L | 0.5 µg/L | 123 | 60.0 | 130 | ---- |
| quinoline | 6027-02-7 | E641A | 0.05 | µg/L | 0.5 µg/L | 119 | 60.0 | 130 | ---- |
| **Perfluoroalkyl Substances (PFAS) (QCLot: 54228)** | | | | | | | | | |
| fluorotelomer sulfonic acid, 6:2 [6:2 FTS] | 27619-97-2 | E745C | 0.01 | µg/L | 0.3 µg/L | 80.0 | 50.0 | 150 | ---- |
| fluorotelomer sulfonic acid, 8:2 [8:2 FTS] | 39108-34-4 | E745C | 0.01 | µg/L | 0.3 µg/L | 82.7 | 50.0 | 150 | ---- |
| perfluorobutane sulfonic acid [PFBS] | 375-73-5 | E745C | 0.01 | µg/L | 0.3 µg/L | 80.7 | 50.0 | 150 | ---- |
| perfluorobutanoic acid [PFBA] | 375-22-4 | E745C | 0.1 | µg/L | 1 µg/L | 145 | 50.0 | 150 | ---- |
| perfluoroheptanoic acid [PFHpA] | 375-85-9 | E745C | 0.01 | µg/L | 0.3 µg/L | 92.7 | 50.0 | 150 | ---- |
| perfluorohexane sulfonic acid [PFHxS] | 355-46-4 | E745C | 0.01 | µg/L | 0.3 µg/L | 82.7 | 50.0 | 150 | ---- |
| perfluorohexanoic acid [PFHxA] | 307-24-4 | E745C | 0.01 | µg/L | 0.3 µg/L | 92.0 | 50.0 | 150 | ---- |
| perfluorononanoic acid [PFNA] | 375-95-1 | E745C | 0.01 | µg/L | 0.3 µg/L | 100 | 50.0 | 150 | ---- |
| perfluorooctane sulfonic acid [PFOS] | 1763-23-1 | E745C | 0.01 | µg/L | 0.3 µg/L | 84.0 | 50.0 | 150 | ---- |
| perfluorooctanoic acid [PFOA] | 335-67-1 | E745C | 0.01 | µg/L | 0.3 µg/L | 96.0 | 50.0 | 150 | ---- |
| perfluoropentanoic acid [PFPeA] | 2706-90-3 | E745C | 0.01 | µg/L | 0.3 µg/L | 92.0 | 50.0 | 150 | ---- |

## *Matrix Spike (MS) Report*

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias.

Sub-Matrix: **Water**

| | | | | | *Matrix Spike (MS) Report* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Spike* | *Recovery (%)* | *Recovery Limits (%)* | | |
| *Laboratory sample ID* | *Client sample ID* | *Analyte* | *CAS Number* | *Method* | *Concentration* | *MS* | *Low* | *High* | *Qualifier* |
| **Dissolved Metals (QCLot: 51963)** | | | | | | | | | |
| VA20A8250-003 | Anonymous | aluminum, dissolved | 7429-90-5 | E421 | 0.2 mg/L | 96.6 | 70.0 | 130 | ---- |
| | | antimony, dissolved | 7440-36-0 | E421 | 0.02 mg/L | 98.9 | 70.0 | 130 | ---- |
| | | cadmium, dissolved | 7440-43-9 | E421 | 0.004 mg/L | 97.8 | 70.0 | 130 | ---- |
| | | chromium, dissolved | 7440-47-3 | E421 | 0.04 mg/L | 92.0 | 70.0 | 130 | ---- |
| | | cobalt, dissolved | 7440-48-4 | E421 | 0.02 mg/L | 93.2 | 70.0 | 130 | ---- |
| | | lead, dissolved | 7439-92-1 | E421 | 0.02 mg/L | 91.0 | 70.0 | 130 | ---- |
| | | titanium, dissolved | 7440-32-6 | E421 | 0.04 mg/L | 90.2 | 70.0 | 130 | ---- |
| | | zinc, dissolved | 7440-66-6 | E421 | 0.4 mg/L | 97.1 | 70.0 | 130 | ---- |
| **Volatile Organic Compounds (QCLot: 51876)** | | | | | | | | | |
| VA20A8760-001 | 02934-01 | benzene | 71-43-2 | E611H | 100 µg/L | 92.4 | 60.0 | 140 | ---- |
| | | dibromoethane, 1,2- | 106-93-4 | E611H | 100 µg/L | 99.6 | 60.0 | 140 | ---- |
| | | ethylbenzene | 100-41-4 | E611H | 100 µg/L | 94.6 | 60.0 | 140 | ---- |
| | | methyl-tert-butyl ether [MTBE] | 1634-04-4 | E611H | 200 µg/L | 97.9 | 60.0 | 140 | ---- |
| | | nonane, n- | 111-84-2 | E611H | 100 µg/L | 111 | 60.0 | 140 | ---- |
| | | styrene | 100-42-5 | E611H | 100 µg/L | 80.4 | 60.0 | 140 | ---- |
| | | toluene | 108-88-3 | E611H | 100 µg/L | 92.4 | 60.0 | 140 | ---- |
| | | trimethylbenzene, 1,2,4- | 95-63-6 | E611H | 100 µg/L | 101 | 60.0 | 140 | ---- |
| | | xylene, m+p- | 179601-23-1 | E611H | 200 µg/L | 96.6 | 60.0 | 140 | ---- |
| | | xylene, o- | 95-47-6 | E611H | 100 µg/L | 94.1 | 60.0 | 140 | ---- |
| **Hydrocarbons (QCLot: 51875)** | | | | | | | | | |
| VA20A8250-003 | Anonymous | VHw (C6-C10) | ---- | E581.VH+F1 | 6310 µg/L | 84.0 | 60.0 | 140 | ---- |
| **Perfluoroalkyl Substances (PFAS) (QCLot: 54228)** | | | | | | | | | |
| VA20A8760-007 | 02934-07 | fluorotelomer sulfonic acid, 6:2 [6:2 FTS] | 27619-97-2 | E745C | 0.3 µg/L | 79.3 | 50.0 | 150 | ---- |
| | | fluorotelomer sulfonic acid, 8:2 [8:2 FTS] | 39108-34-4 | E745C | 0.3 µg/L | 83.3 | 50.0 | 150 | ---- |
| | | perfluorobutane sulfonic acid [PFBS] | 375-73-5 | E745C | 0.3 µg/L | 76.0 | 50.0 | 150 | ---- |
| | | perfluorobutanoic acid [PFBA] | 375-22-4 | E745C | 1 µg/L | 124 | 50.0 | 150 | ---- |
| | | perfluoroheptanoic acid [PFHpA] | 375-85-9 | E745C | 0.3 µg/L | 90.7 | 50.0 | 150 | ---- |
| | | perfluorohexane sulfonic acid [PFHxS] | 355-46-4 | E745C | 0.3 µg/L | 80.0 | 50.0 | 150 | ---- |
| | | perfluorohexanoic acid [PFHxA] | 307-24-4 | E745C | 0.3 µg/L | 89.3 | 50.0 | 150 | ---- |
| | | perfluorononanoic acid [PFNA] | 375-95-1 | E745C | 0.3 µg/L | 91.3 | 50.0 | 150 | ---- |
| | | perfluorooctane sulfonic acid [PFOS] | 1763-23-1 | E745C | 0.3 µg/L | 86.0 | 50.0 | 150 | ---- |

Sub-Matrix: **Water**

| | | | | | Matrix Spike (MS) Report | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Recovery (%) | Recovery Limits (%) | | |
| *Laboratory sample ID* | *Client sample ID* | *Analyte* | *CAS Number* | *Method* | Concentration | MS | Low | High | Qualifier |
| **Perfluoroalkyl Substances (PFAS) (QCLot: 54228) - continued** | | | | | | | | | |
| VA20A8760-007 | 02934-07 | perfluorooctanoic acid [PFOA] | 335-67-1 | E745C | 0.3 µg/L | 93.3 | 50.0 | 150 | ---- |
| | | perfluoropentanoic acid [PFPeA] | 2706-90-3 | E745C | 0.3 µg/L | 90.0 | 50.0 | 150 | ---- |

# QUALITY CONTROL INTERPRETIVE REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **VA20A8760** | Page | : 1 of 11 |
| Client | : **Golder Associates Ltd.** | Laboratory | : Vancouver - Environmental |
| Contact | : Alison Verde | Account Manager | : Amber Springer |
| Address | : 200-2920 Virtual Way<br>Vancouver BC Canada V5M 0C4 | Address | : 8081 Lougheed Highway<br>Burnaby, British Columbia Canada V5A 1W9 |
| Telephone | : 604 297 2036 | Telephone | : +1 604 253 4188 |
| Project | : 20145856/1000 | Date Samples Received | : 19-Jun-2020 19:19 |
| PO | : ---- | Issue Date | : 26-Jun-2020 13:07 |
| C-O-C number | : 02934 | | |
| Sampler | : ---- | | |
| Site | : ---- | | |
| Quote number | : Q80351 | | |
| No. of samples received | : 7 | | |
| No. of samples analysed | : 7 | | |

**This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.**

**Key**

**Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.**
**CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.**
**DQO: Data Quality Objective.**
**LOR: Limit of Reporting (detection limit).**
**RPD: Relative Percent Difference.**

## *Summary of Outliers*

### *Outliers : Quality Control Samples*

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

### *Outliers: Reference Material (RM) Samples*

- No Reference Material (RM) Sample outliers occur.

### *Outliers : Analysis Holding Time Compliance (Breaches)*

- No Analysis Holding Time Outliers exist.

### *Outliers : Frequency of Quality Control Samples*

- No Quality Control Sample Frequency Outliers occur.

## Outliers : Quality Control Samples

### Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

| Analyte Group | Laboratory sample ID | Client/Ref Sample ID | Analyte | CAS Number | Method | Result | Limits | Comment |
|---|---|---|---|---|---|---|---|---|
| **Method Blank (MB) Values** | | | | | | | | |
| Perfluoroalkyl Substances (PFAS) | QC-54228-001 | ---- | perfluorobutanoic acid [PFBA] | 375-22-4 | E745C | 0.22 µg/L MB-LOR | 0.1 µg/L | Blank result exceeds permitted value |

## Result Qualifiers

| Qualifier | Description |
|---|---|
| *MB-LOR* | *Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.* |

## *Analysis Holding Time Compliance*

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-01 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-02 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-03 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-04 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-05 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-06 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |
| **Dissolved Metals : Dissolved Metals in Water by CRC ICPMS** | | | | | | | | | | |
| **HDPE dissolved (nitric acid)**<br>02934-07 | E421 | 19-Jun-2020 | 20-Jun-2020 | 180 days | 0 days | ✓ | 20-Jun-2020 | 179 days | 0 days | ✓ |

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group*<br>Container / Client Sample ID(s) | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-01 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-02 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-03 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-04 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-05 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-06 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : BC PHC - EPH by GC-FID** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-07 | E601A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 22-Jun-2020 | 40 days | 2 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-01 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-02 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-03 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-04 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-05 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-06 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Hydrocarbons : VH and F1 by Headspace GC-FID** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-07 | E581.VH+F1 | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-01 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-02 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-03 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-04 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-05 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-06 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |
| **Perfluoroalkyl Substances (PFAS) : PFAS in Water by LC-MS-MS** | | | | | | | | | | |
| **HDPE (teflon free)**<br>02934-07 | E745C | 19-Jun-2020 | 26-Jun-2020 | 14 days | 6 days | ✓ | 26-Jun-2020 | 7 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-01 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-02 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-03 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-04 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-05 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-06 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

| *Analyte Group* | *Method* | *Sampling Date* | *Extraction / Preparation* | | | | *Analysis* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container / Client Sample ID(s)** | | | *Preparation Date* | *Holding Times* | | *Eval* | *Analysis Date* | *Holding Times* | | *Eval* |
| | | | | *Rec* | *Actual* | | | *Rec* | *Actual* | |
| **Polycyclic Aromatic Hydrocarbons : PAHs by LVI GC-MS** | | | | | | | | | | |
| **Amber glass/Teflon lined cap (sodium bisulfate)**<br>02934-07 | E641A | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 40 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-01 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-02 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-03 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-04 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-05 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-06 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |
| **Volatile Organic Compounds : VOCs (BC Special List) by Headspace GC-MS** | | | | | | | | | | |
| **Glass vial (sodium bisulfate)**<br>02934-07 | E611H | 19-Jun-2020 | 19-Jun-2020 | 14 days | 0 days | ✓ | 20-Jun-2020 | 13 days | 0 days | ✓ |

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).

## *Quality Control Parameter Frequency Compliance*

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

| Quality Control Sample Type | | | Count | | Frequency (%) | | |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC Lot #* | *QC* | *Regular* | *Actual* | *Expected* | *Evaluation* |
| Laboratory Duplicates (DUP) | | | | | | | |
| Dissolved Metals in Water by CRC ICPMS | E421 | 51963 | 1 | 10 | 10.0 | 5.0 | ✓ |
| PFAS in Water by LC-MS-MS | E745C | 54228 | 1 | 8 | 12.5 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 51875 | 1 | 9 | 11.1 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 51876 | 1 | 7 | 14.2 | 5.0 | ✓ |
| Laboratory Control Samples (LCS) | | | | | | | |
| BC PHC - EPH by GC-FID | E601A | 51823 | 1 | 7 | 14.2 | 5.0 | ✓ |
| Dissolved Metals in Water by CRC ICPMS | E421 | 51963 | 1 | 10 | 10.0 | 5.0 | ✓ |
| PAHs by LVI GC-MS | E641A | 51824 | 1 | 7 | 14.2 | 5.0 | ✓ |
| PFAS in Water by LC-MS-MS | E745C | 54228 | 1 | 8 | 12.5 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 51875 | 1 | 9 | 11.1 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 51876 | 1 | 7 | 14.2 | 5.0 | ✓ |
| Method Blanks (MB) | | | | | | | |
| BC PHC - EPH by GC-FID | E601A | 51823 | 1 | 7 | 14.2 | 5.0 | ✓ |
| Dissolved Metals in Water by CRC ICPMS | E421 | 51963 | 1 | 10 | 10.0 | 5.0 | ✓ |
| PAHs by LVI GC-MS | E641A | 51824 | 1 | 7 | 14.2 | 5.0 | ✓ |
| PFAS in Water by LC-MS-MS | E745C | 54228 | 1 | 8 | 12.5 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 51875 | 1 | 9 | 11.1 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 51876 | 1 | 7 | 14.2 | 5.0 | ✓ |
| Matrix Spikes (MS) | | | | | | | |
| Dissolved Metals in Water by CRC ICPMS | E421 | 51963 | 1 | 10 | 10.0 | 5.0 | ✓ |
| PFAS in Water by LC-MS-MS | E745C | 54228 | 1 | 8 | 12.5 | 5.0 | ✓ |
| VH and F1 by Headspace GC-FID | E581.VH+F1 | 51875 | 1 | 9 | 11.1 | 5.0 | ✓ |
| VOCs (BC Special List) by Headspace GC-MS | E611H | 51876 | 1 | 7 | 14.2 | 5.0 | ✓ |

## *Methodology References and Summaries*

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

| *Analytical Methods* | *Method / Lab* | *Matrix* | *Method Reference* | *Method Descriptions* |
|---|---|---|---|---|
| Dissolved Metals in Water by CRC ICPMS | E421<br>Vancouver - Environmental | Water | APHA 3030B/EPA 6020B (mod) | Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS.<br>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method. |
| VH and F1 by Headspace GC-FID | E581.VH+F1<br>Vancouver - Environmental | Water | BC MOE Lab Manual / CCME PHC in Soil - Tier 1 (mod) | Volatile Hydrocarbons (VH and F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry’s law. |
| BC PHC - EPH by GC-FID | E601A<br>Vancouver - Environmental | Water | BC MOE Lab Manual | Extractable Petroleum Hydrocarbons (EPH) are analyzed by GC-FID. |
| VOCs (BC Special List) by Headspace GC-MS | E611H<br>Vancouver - Environmental | Water | EPA 8260D (mod) | Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry’s law. |
| PAHs by LVI GC-MS | E641A<br>Vancouver - Environmental | Water | EPA 8270E (mod) | Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS. |
| PFAS in Water by LC-MS-MS | E745C<br>Waterloo - Environmental | Water | MOECC E3533 | An aliquot of water is analyzed for PFAs by direct injection LC/MS/MS |
| VPH: VH-BTEX-Styrene | EC580A<br>Vancouver - Environmental | Water | BC MOE Lab Manual (VPH in Water and Solids) (mod) | Volatile Petroleum Hydrocarbons (VPH) is calculated as follows: VPHw = Volatile Hydrocarbons (VH6-10) minus benzene, toluene, ethylbenzene, xylenes (BTEX) and styrene. |
| LEPH and HEPH: EPH-PAH | EC600A<br>Vancouver - Environmental | Water | BC MOE Lab Manual (LEPH and HEPH) (mod) | Light Extractable Petroleum Hydrocarbons (LEPH) and Heavy Extractable Petroleum Hydrocarbons (HEPH) are calculated as follows: LEPH = Extractable Petroleum Hydrocarbons (EPH10-19) minus Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene; HEPH = Extractable Petroleum Hydrocarbons (EPH19-32) minus Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene. |

| *Preparation Methods* | *Method / Lab* | *Matrix* | *Method Reference* | *Method Descriptions* |
|---|---|---|---|---|
| Dissolved Metals Water Filtration | EP421<br>Vancouver - Environmental | Water | APHA 3030B | Water samples are filtered (0.45 um), and preserved with HNO3. |

| *Preparation Methods* | *Method / Lab* | *Matrix* | *Method Reference* | *Method Descriptions* |
|---|---|---|---|---|
| VOCs Preparation for Headspace Analysis | EP581<br>Vancouver - Environmental | Water | EPA 5021A (mod) | Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system. |
| PHCs and PAHs Hexane Extraction | EP601<br>Vancouver - Environmental | Water | EPA 3511 (mod) | Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction. |
| Preparation of PFAS in Water by Direct Injection | EP745C<br>Waterloo - Environmental | Water | MOECC E3533 | An aliquot of water is analyzed for PFAs by direct injection LC/MS/MS |

**Golder Associates**

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

# CHAIN OF CUSTODY RECORD/ANALYSIS REQUEST

No. 02934 page 1 of 1

Project Number: 20145856/1000
Short Title: CFB Comox SNOWBIRD Enviro Cleanup
Golder Contact: Alison Verde
Golder E-mail Address 1: averde @golder.com
Golder E-mail Address 2: alanna-umphrey @golder.com
Laboratory Name: ALS Environmental
Address: 8081 LOUGHEED HWY Burnaby
Telephone/Fax: 778 3703259
Contact: Amber SPRINGER

Office Name: Vancouver, VIRTUAL WAY
EQuIS Facility Code: 217832270
EQuIS upload: ☐

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

Note: Final Reports to be issued by e-mail
Quote No.: Q 80351

Analyses Required

| 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 | LEPH | PAH | BTEX | Aluminum, antimony, lead, titanium, cadmium, chromium, cobalt, zinc | 1,2,4 trimethylbenzene | PFOS, PFOA | VH /EPH10-19 | n-nonane | 1,2 dibromomethane | RUSH (Select TAT above) | Remarks (over) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2934 - 01 | MW20-04 | | | WG | 19/06/20 | 10:55 | | | | 6 | X | X | X | X | X | X | X | X | X | | |
| - 02 | MW20-03 | | | WG | | 11:55 | | | | 6 | X | X | X | X | X | X | X | X | X | | |
| - 03 | MW20-01 | | | WG | | 12:35 | | | | 6 | X | X | X | X | X | X | X | X | X | | |
| - 04 | MW20-02 | | | WG | | 13:20 | | FD | 2934-05 | 6 | X | X | X | X | X | X | X | X | X | X | 24 hr TAT |
| - 05 | MW20-02 | | | WG | | 13:20 | | FDA | 2934-04 | 6 | X | X | X | X | X | X | X | X | X | X | 24 h TAT |
| - 06 | Equipment Blank | | | WG | | 13:50 | | EB | | 6 | X | X | X | X | X | X | X | X | X | | |
| - 07 | Trip Blank. | | | WG | | 19:00 | | TB. | | 6 | X | X | X | X | X | X | X | X | X | | |
| - 08 | | | | | | | | | | | | | | | | | | | | | |
| - 09 | | | | | | | | | | | | | | | | | | | | | |
| - 10 | | | | | | | | | | | | | | | | | | | | | |
| - 11 | | | | | | | | | | | | | | | | | | | | | |
| - 12 | | | | | | | | | | | | | | | | | | | | | |

Environmental Division
Vancouver
Work Order Reference
VA20A8760
Telephone : +1 604 253 4188

Sampler's Signature:
Relinquished … ER
Date June 19 2020
Time 19:00
Received by: Signature
Company
Comments: Samples on ice detection limit must meet CCME
Method of Sh… o.:
Received for Lab by:
Date June 19
Time 7:19 h
Shipped by:
Shipment Condition:
Seal Intact:
Temp (°C) 12,2
Cooler opened by:
Date
Time

WHITE: Golder Copy YELLOW: Lab Copy

Ice cubes

ESED

# APPENDIX G

# Geotechnical Investigation Technical Memorandum

GOLDER

# TECHNICAL MEMORANDUM

**DATE** 13 July 2020

**Project No.** 20145856-007-TM-Rev0

**TO** Dave Osguthorpe
Public Services and Procurement Canada

**FROM** Nikki Manche, Shawn Lange

**EMAIL nicola_manche@golder.com, shawn_lange@golder.com**

## PRELIMINARY GEOTECHNICAL INVESTIGATION – FACTUAL RESULTS
## CFB COMOX SNOWBIRD ENVIRONMENTAL CLEANUP, 2425 GLENVIEW AVENUE, KAMLOOPS, BC

Golder Associates Ltd. (Golder) was retained by Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND) to conduct a Stage 2 Preliminary Site Investigation (Stage 2 PSI) at the location of the Royal Canadian Air Force (RCAF) aircraft crash site (the Site) in Kamloops, BC. As part of this investigation, Golder undertook geotechnical review, in-situ testing, and laboratory testing at one location on site to obtain information for the geotechnical aspects of the environmental cleanup as per our proposed scope of work in the amendment letter (our reference 20145856-002-L-Rev0), dated 8 June 2020.

This technical memorandum summarises the factual results of the geotechnical review, in-situ testing and laboratory testing.

This report was prepared in accordance with terms and conditions of the Public Works and Government Services Canada (PWGSC) Contaminated Sites Characterization Contract (reference EZ897-191444/002/Van) dated 25 October 2019 and Golder's workplan dated 20 May 2020 and subsequent amendment titled "*Request for Amendment (#2) to Task Authorization 700514134 to Undertake Additional Soil Sampling to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project*" dated 8 June 2020.

## 1.0 BACKGROUND

Golder undertook a field investigation program between 10 and 12 June 2020 for the Stage 2 PSI which included hydro-excavation with auger drilling at five of these locations. Further details are provided in Golder's Draft Remediation Plan Report (our reference 20145856-005-R-RevB) dated 10 July 2020.

## 2.0 GEOTECHNICAL INVESTIGATION

Golder undertook a geotechnical Site visit during the Stage 2 PSI on 11 June 2020. During the Site visit, Nikki Manche from Golder’s geotechnical group observed the hydro-excavated holes which had been undertaken the previous day, inspected the solid stem auger drilling and Dynamic Cone Penetration Test (DCPT) carried out at monitoring well MW20-01, and provided recommendations for geotechnical laboratory testing of the collected samples. The hydro-vacuum excavation work was carried out by Lynx Creek Industrial & Hydrovac Ltd. (Lynx Creek) from Kamloops and the auger drilling was carried out using a truck-mounted auger drilling rig owned and operated by On The Mark Locates Ltd. (On the Mark) from Kelowna.

The location of MW20-01 was adjacent to the north-west corner of the house at 2425 Glenview Avenue and is shown on the attached site plan, in Figure 1. A summary of the observations and test results are summarised in the following sections.

### 2.1 Subsurface Conditions

The soils observed within the auger drilling at MW20-01 consisted of alluvial firm silts and compact sands in the upper 3.3 metres below ground surface, overlying loose to compact sand becoming coarser and dense from approximately 5.2 metres below ground surface to the auger hole termination depth of approximately 6.3 metres below ground surface. Based on a review of samples retrieved from other auger holes across the site and the hydro-excavated holes across the site, the ground conditions described above were similar across the Site, but some variability was observed. Detailed descriptions of the soils encountered in MW20-01 are attached as Attachment 1.

Groundwater was observed in MW20-01 from approximately 5 metres below ground surface in the open auger hole at the time of drilling. During groundwater sampling, one week post groundwater well installation, groundwater was observed to be approximately 4.8 metres below ground surface. It is expected that groundwater elevation will fluctuate based on seasonal conditions.

Hydro-excavated hole sidewalls showed minimal sloughing in the upper 3 metres. The MW20-01 auger hole sidewall showed signs of sloughing below approximately 4.7 metres below ground surface and was unstable below the groundwater level.

### 2.2 Dynamic Cone Penetration Test Results

A DCPT was undertaken at the MW20-01 auger hole location in advance of putting down the auger hole. The DCPT measured the in-situ relative density of the soil that is approximately equivalent to Standard Penetration Test (SPT) results. The results of the DCPT probe are shown in Table 1 below as blow counts per 300 mm penetration.

**Table 1: DCPT Results at MW20-01**

| Depth Below Ground Surface | DCPT Blows/ 300 mm |
|---|---|
| 0 – 3 m | N/A – Hydro Vacuum |
| 3.0 – 3.3 m | 13 |
| 3.3 – 3.6 m | 14 |
| 3.6 – 3.9 m | 12 |
| 3.9 – 4.2 m | 8 |
| 4.2 – 4.5 m | 6 |
| 4.5 – 4.8 m | 8 |
| 4.8 – 5.1 m | 15 |
| 5.1 – 5.4 m | 31 |
| 5.4 – 5.7 m | 36 |
| 5.7 – 6.0 m | 47 |
| 6.0 – 6.3 m | 48 |

## 2.3 Geotechnical Laboratory Test Results

Geotechnical laboratory testing of four selected samples was undertaken including four moisture content tests and four particle size distribution analyses/sieve tests with results summarised in Table 2 below. Laboratory test certificates are provided in Attachment 2.

**Table 2: Geotechnical Laboratory Test Results at MW20-01**

| Approximate Sample Depth Below Ground Surface | Moisture Content (%) | Particle Size Distribution | | |
|---|---|---|---|---|
| | | GRAVEL (%) | SAND (%) | SILT & CLAY (%) |
| 0.9 – 1.2 m | 20 | 2 | 33 | 65 |
| 2.4 – 2.7 m | 21 | 1 | 37 | 62 |
| 4.0 – 4.3 m | 4 | 0 | 89 | 11 |
| 5.4 – 5.7 m | 16 | 3 | 91 | 6 |

## 3.0 ASSUMPTIONS

- The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.
- Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt and variability is expected between testholes.

## 4.0 NOTICE TO READERS

This report was prepared in accordance with terms and conditions of the Public Works and Government Services Canada (PWGSC) Contaminated Sites Characterization Contract (reference EZ897-191444/002/Van) dated 25 October 2019 and Golder’s workplan dated 20 May 2020 and amendment titled “Request for Amendment (#2) to Task Authorization 700514134 to Undertake Additional Soil Sampling to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project” dated 8 June 2020.

The inferences concerning Site conditions contained in this report are based on information obtained during the assessment conducted by Golder personnel, and are based solely on the condition of the properties at the time of the Site reconnaissance, supplemented by historical and interview information obtained by Golder, as described in this report.

This report was prepared, based in part, on information obtained from historic information sources. In evaluating the subject Site, Golder 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 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 and geotechnical 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.

## 5.0 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.

**Golder Associates Ltd.**

PROFESSIONAL
PROVINCE OF
S. LANGE
# 30149
BRITISH COLUMBIA
ENGINEER

July 13, 2020

Nikki Manche, BE
*Geotechnical Consultant*

Shawn Lange, PEng
*Associate, Senior Geotechnical Engineer*

NM/SL/lmk

Attachments: Figure 1 - Investigation Locations

Attachment 1 - Monitoring Well Log MW20-01 (with Geotechnical data included)
Attachment 2 - Laboratory Certificates of Analysis (Particle Size Distributions only)

https://golderassociates.sharepoint.com/sites/128990/project files/6 deliverables/issued to client_for wp/20145856-007-tm-rev0/20145856-007-tm-rev0-geotech inv_factual memo-13july_20.docx

**LEGEND**

| | |
|---|---|
| ——— | LOT BOUNDARY |
| ◕ | MONITORING WELL LOCATION |
| ⌖ | BOREHOLE LOCATION |
| ▼ | MONITORING WELL WITH EMBEDDED VAPOUR PROBE LOCATION |
| ▽ | VAPOUR PROBE LOCATION |

**REFERENCES**

BACKGROUND IMAGE (2017) SUPPLIED BY THE CITY OF KAMLOOPS

IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY

LOT BOUNDARIES OBTAINED FROM THE CITY OF KAMLOOPS ON 2020-05-28

DATUM: NAD83, PROJECTION: UTM ZONE 10

CLIENT

PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT

CFB COMOX SNOWBIRDS ENVIRONMENTAL CLEANUP,
KAMLOOPS

TITLE

**INVESTIGATION LOCATIONS**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-07-09 |
| DESIGNED | AV |
| PREPARED | RTJ |
| REVIEWED | NM |
| APPROVED | SL |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 20145856 | 1000 | 0 | 1 |

Last Edited By: rjames Date: 2020-06-29 Time:4:59:37 PM | Printed By: RYJames Date: 2020-07-09 Time:4:58:07 PM | File Name: 20145856_1000_00 - Geotech Memo.dwg
Path: \\golder.gds\gal\Kelowna\CAD-GIS\Client\PWGSC\CFB Snowbirds Kamloops\99_PROJECTS\20145856\1000\No Task\Enviro\02_PRODUCTION\DWG\Geotech\

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

25 mm

0

## ATTACHMENT 1

# Monitoring Well Log MW20-01 (with Geotechnical data included)

PROJECT No.: 20145856 / 1000 / 2

# RECORD OF MONITORING WELL: MW20-01

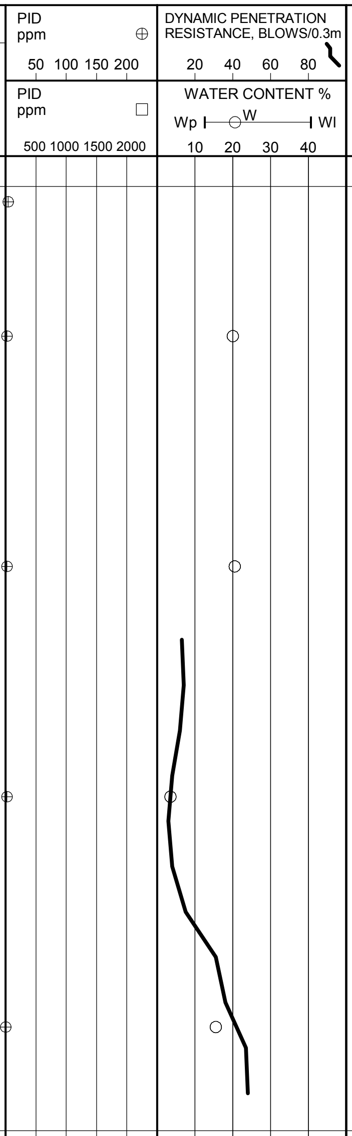
SHEET 1 OF 1

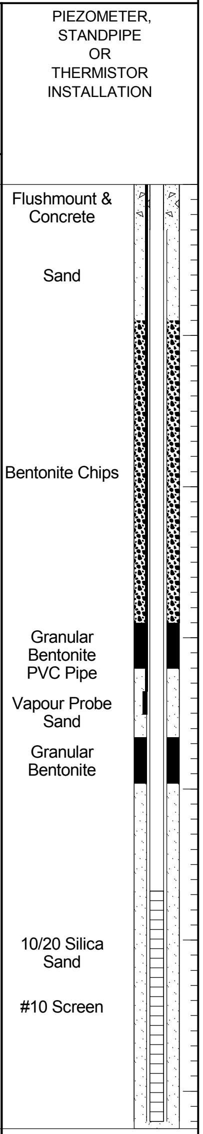
DATUM: Ground Surface

CLIENT: Public Services and Procurement Canada
PROJECT: CFB Comox Snowbird Environmental Cleanup
LOCATION: Kamloops, BC
N: 5619948.42 E: 682392.26

DRILLING DATE: 06/11&12/2020
DRILLING CONTRACTOR: Lynx Creek/On the Mark

| DEPTH SCALE METRES | DRILLING RIG | DRILLING METHOD | SOIL PROFILE DESCRIPTION | ELEV. DEPTH (m) | GEOTECH SAMPLES NUMBER | TYPE | BLOWS/0.3m | CORE No. | CORE RECOVERY % | CHEMISTRY SAMPLES NUMBER | SCN | ANALYSED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ground Surface | 345.47 | | | | | | | | |
| 0 | | Hydrovac | **(ML-SM)** SILT and SAND;brown, trace organics, no staining; moist, firm. | 0.00 | 1 | HV | | | | 1 | 02926-04/05 | |
| | | | - grades to no organics at 0.6m depth | | | | | | | | | |
| 1 | | | | | 2 | HV | | | | 2 | 02926-06 | |
| | | | | | | | | | 100 | | | |
| 2 | | | | | | | | | | | | |
| | | | | | 3 | HV | | | | 3 | 02926-07 | |
| | | | | 342.72 | | | | | | | | |
| | | | **(SP)** SAND, fine; light brown, no staining; moist, loose. | 342.57<br>2.90 | | | | | | | | |
| 3 | Track Mounted Auger Drill | Hollow Stem Auger (Casing:6 in. Casing: ) | **(SM)** SILTY SAND, fine; brown, no staining; moist, firm. | 342.11<br>3.35 | | | | | | | | |
| | | | **(SW)** SAND, fine to medium; grey, no staining; moist, loose to compact. | | | | | 1 | | | | |
| 4 | | | | | 4 | AS | | | | 4 | 02927-03 | |
| 5 | | | - wet at 5 m depth | | | | | 2 | | | | |
| | | | | | 5 | AS | | | | 5 | 02927-04 | |
| 6 | | | - grades to fine to coarse at 5.2m depth, becoming dense | 339.22<br>6.25 | | | | | | | | |
| | | | End of Monitoring Well. | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |





DEPTH SCALE
1 : 50

GOLDER

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: RM
CHECKED: EvK

## ATTACHMENT 2

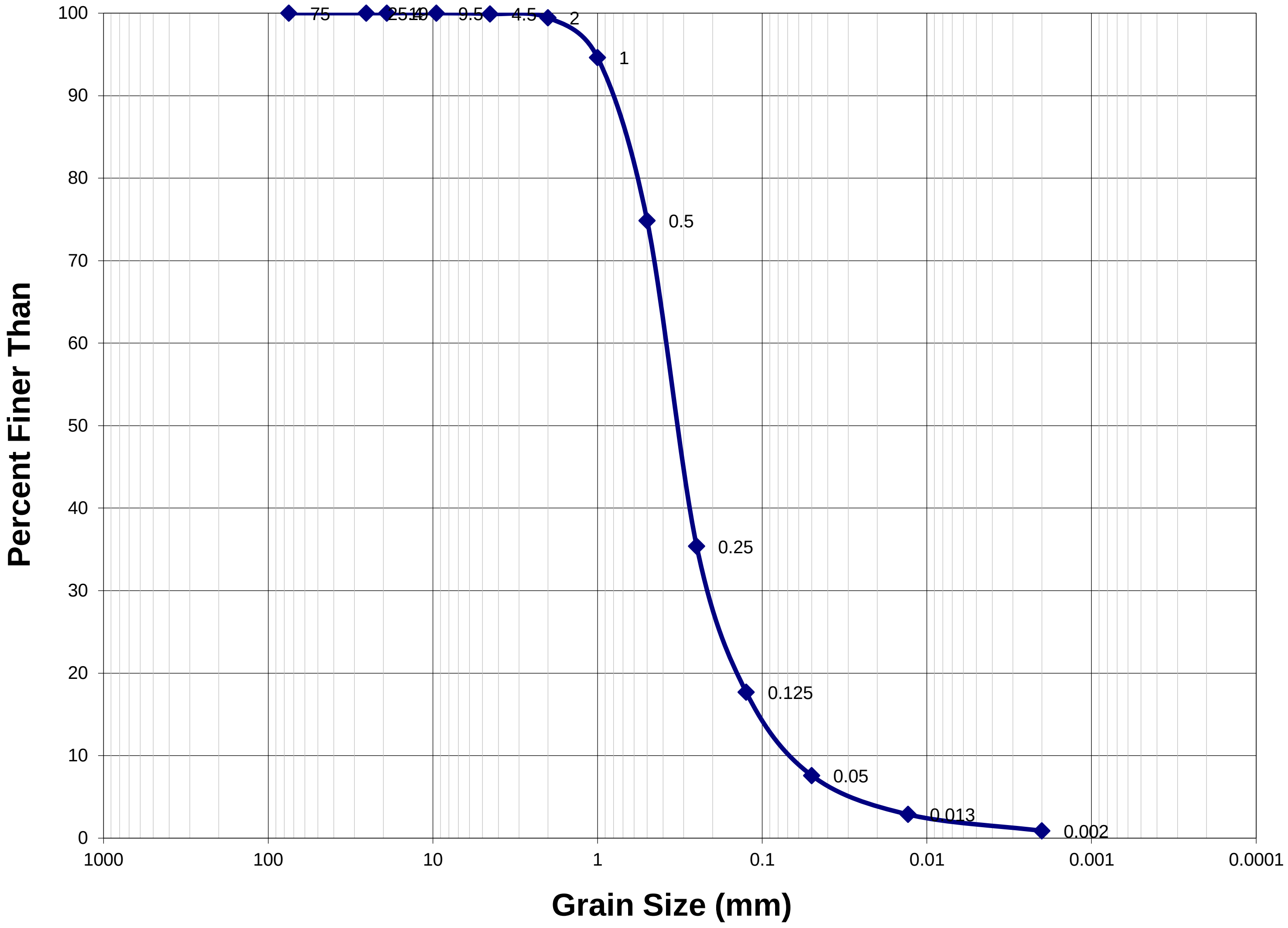
# Laboratory Certificates of Analysis

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

819-58th Street, Saskatoon, SK  S7K 6X5

**Client Name:** GOLDER ASSOCIATES LTD. ~VAN
**Project:**
**Sample ID:** 02927-03
**Lab ID:** L2460211-15

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 0 |
| Coarse Sand | 2.0mm - 4.75mm | 0 |
| Medium Sand | 0.425mm - 2.0mm | 25 |
| Fine Sand | 0.075mm - 0.425mm | 64 |
| Fines | < 0.075mm | 11 |

**Canadian Soil Survey Committee (CSSC)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 1 |
| Sand | 0.05mm - 2mm | 92 |
| Silt | 0.002mm - 0.05mm | 7 |
| Clay | < 0.002mm | 1 |

Texture  Sample contains material greater than 4.75mm.  T

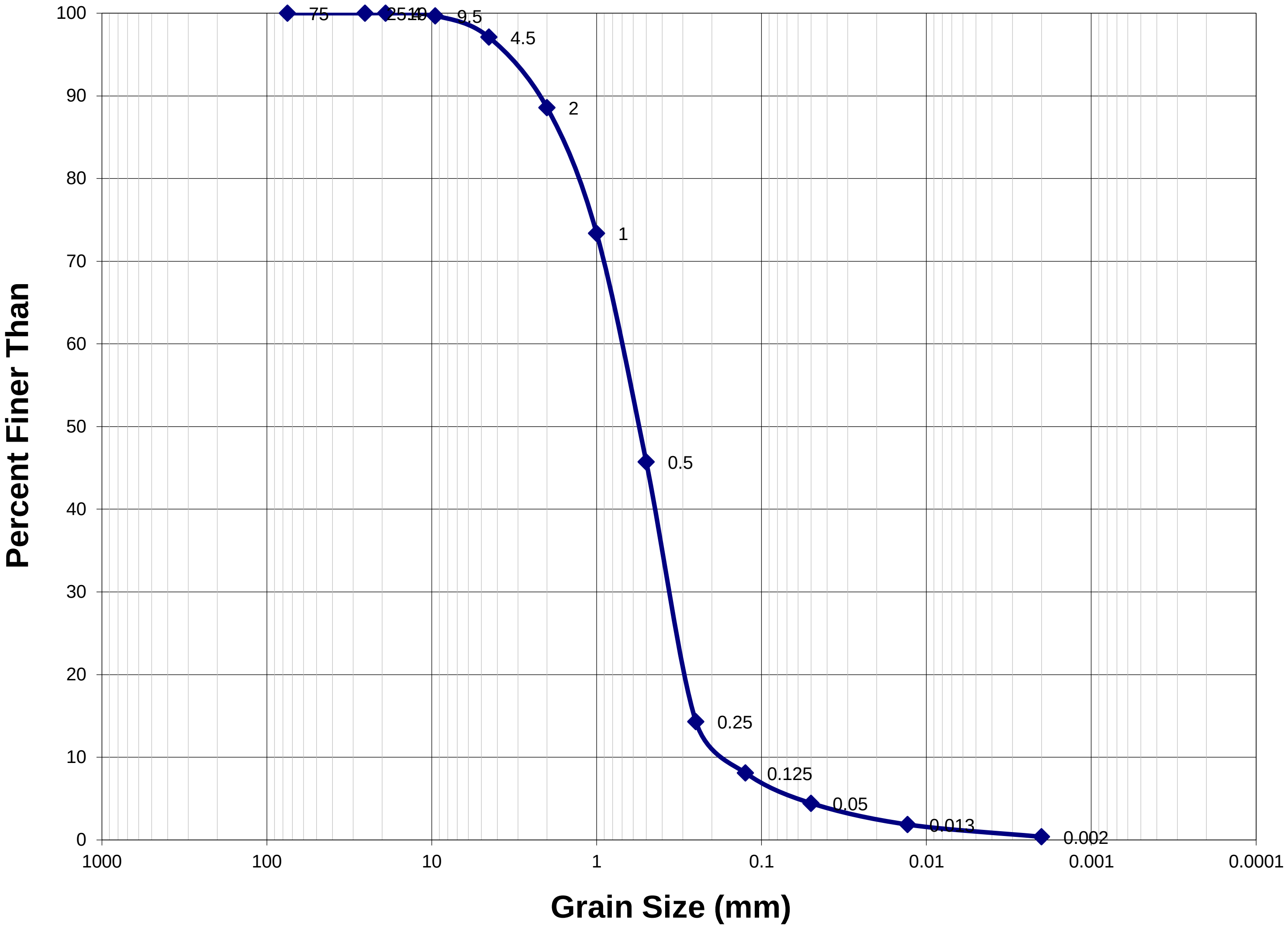
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

**819-58th Street, Saskatoon, SK  S7K 6X5**

**Client Name:** **GOLDER ASSOCIATES LTD. ~VAN**
**Project:**
**Sample ID:** **02927-04**
**Lab ID:** **L2460211-16**

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| **Size Class** | **Size Range** | **Wt. (%)** |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 3 |
| Coarse Sand | 2.0mm - 4.75mm | 9 |
| Medium Sand | 0.425mm - 2.0mm | 43 |
| Fine Sand | 0.075mm - 0.425mm | 40 |
| Fines | < 0.075mm | 6 |

**Canadian Soil Survey Committee (CSSC)**

| **Size Class** | **Size Range** | **Wt. (%)** |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 11 |
| Sand | 0.05mm - 2mm | 84 |
| Silt | 0.002mm - 0.05mm | 4 |
| Clay | < 0.002mm | 0 |

Texture Sample contains material greater than 4.75mm. T

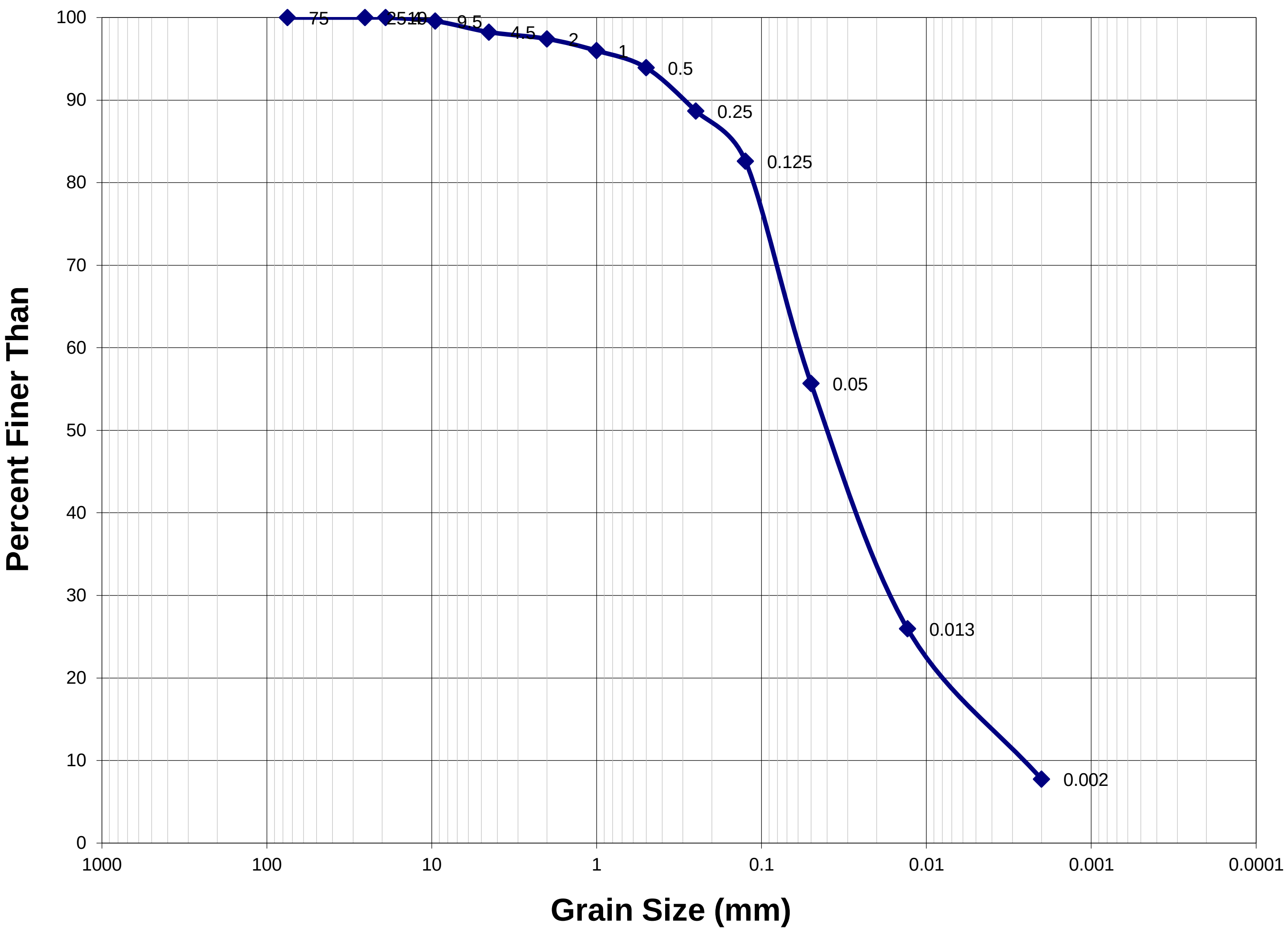
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

**819-58th Street, Saskatoon, SK  S7K 6X5**

**Client Name:** GOLDER ASSOCIATES LTD. ~VAN
**Project:**
**Sample ID:** 02926-06
**Lab ID:** L2460211-6

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 2 |
| Coarse Sand | 2.0mm - 4.75mm | 1 |
| Medium Sand | 0.425mm - 2.0mm | 3 |
| Fine Sand | 0.075mm - 0.425mm | 29 |
| Fines | < 0.075mm | 65 |

**Canadian Soil Survey Committee (CSSC)**

| Size Class | Size Range | Wt. (%) |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 3 |
| Sand | 0.05mm - 2mm | 42 |
| Silt | 0.002mm - 0.05mm | 48 |
| Clay | < 0.002mm | 8 |

Texture  Sample contains material greater than 4.75mm.  T

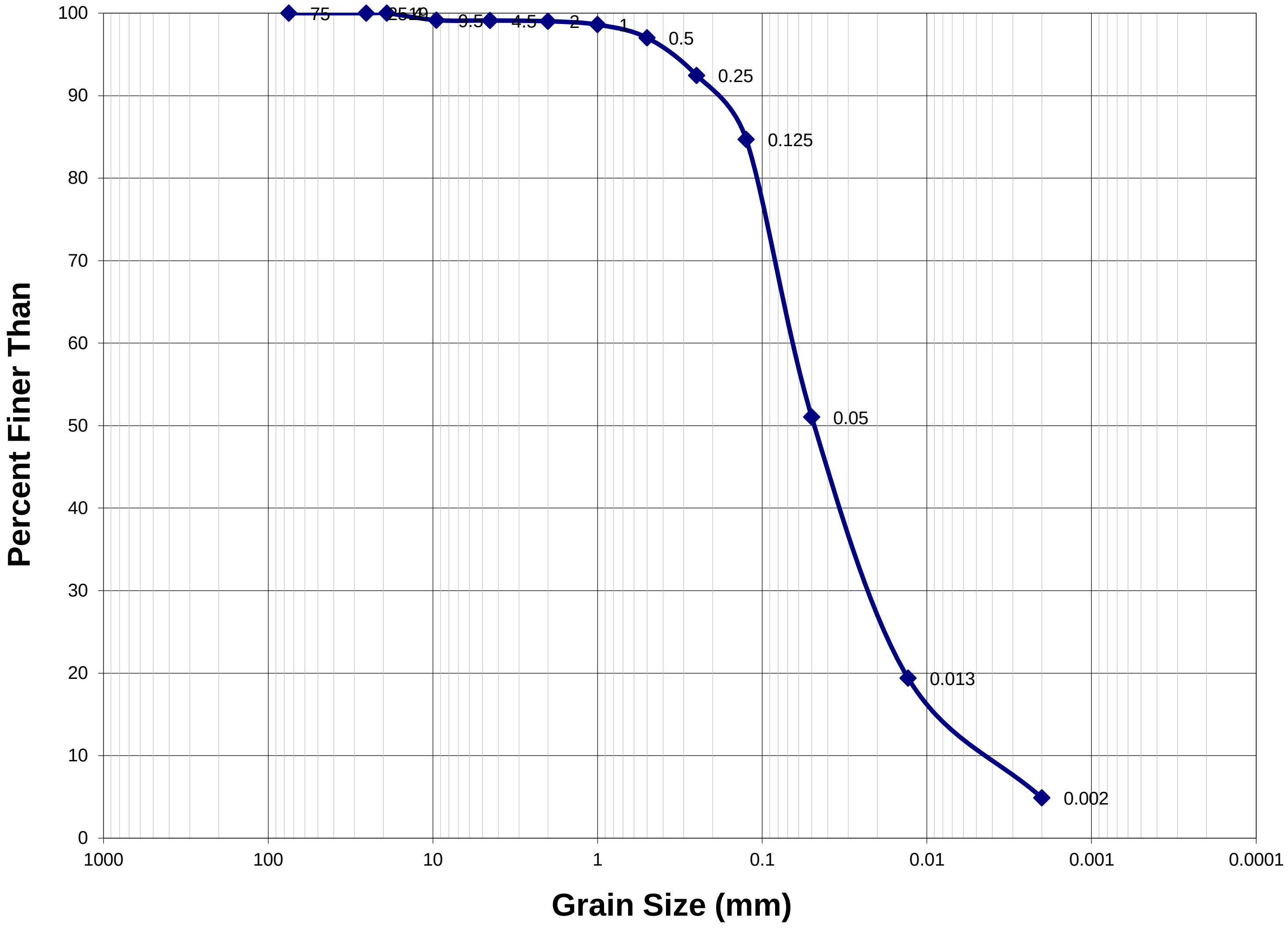
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

**ALS Laboratory Group**
ANALYTICAL CHEMISTRY & TESTING SERVICES
**Environmental Division**

**819-58th Street, Saskatoon, SK  S7K 6X5**

**Client Name:** GOLDER ASSOCIATES LTD. ~VAN
**Project:**
**Sample ID:** 02926-07
**Lab ID:** L2460211-7

# Particle Size Distribution Curve



## Summary of Results

**Unified Soil Classification System (USCS)**

| **Size Class** | **Size Range** | **Wt. (%)** |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 4.75mm - 3" | 1 |
| Coarse Sand | 2.0mm - 4.75mm | 0 |
| Medium Sand | 0.425mm - 2.0mm | 2 |
| Fine Sand | 0.075mm - 0.425mm | 35 |
| Fines | < 0.075mm | 62 |

**Canadian Soil Survey Committee (CSSC)**

| **Size Class** | **Size Range** | **Wt. (%)** |
|---|---|---|
| Cobbles | > 3" | 0 |
| Gravel | 2mm - 3" | 1 |
| Sand | 0.05mm - 2mm | 48 |
| Silt | 0.002mm - 0.05mm | 46 |
| Clay | < 0.002mm | 5 |

Texture Sample contains material greater than 4.75mm.  T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

GOLDER

golder.com

# ANNEX C

## Structural Information

GOLDER

15 July 2020

Reference No. 20145856-012-L-Rev1

**Dave Osguthorpe**
Public Services and Procurement Canada
401-1230 Government Street
Victoria, BC  V8W 3X4

**PRE-REMEDIATION STRUCTURAL ASSESSMENT OF DAMAGED BASEMENT CONCRETE WALL FOR THE RESIDENCE AT 2425 GLENVIEW AVENUE, KAMLOOPS, BC – SNOWBIRD ENVIRONMENTAL CLEANUP PROJECT**

Dear Mr. Osguthorpe:

Golder Associates Ltd. (Golder) subcontracted Watson Engineering Ltd (Watson) of Kamloops, BC to undertake a pre-remediation structural assessment of the basement foundation and walls of the home located at 2425 Glenview Avenue. Please find attached a pre-remediation structural assessment memorandum report prepared by Watson in support of the Snowbird Environmental Cleanup Project.

The work was completed in accordance with the terms and conditions of Public Works and Government Services Canada (PWGSC) Contaminated Sites Characterization Contract (reference EZ897-191444/002/VAN) dated 25 October 2019, **Golder's workplan dated 20 May 2020**, and the amendment titled, "*Request for Amendment (#2) to Task Authorization 700514134 to Undertake Additional Soil Sampling to Support the Department of National Defence Snowbird Kamloops Environmental Clean-up Project*" **dated 8 June 2020.**

We trust the attached meets with your requirements. Should there be any questions, please contact the undersigned.

Yours very truly,

**Golder Associates Ltd.**

Alison Verde, PEng
*Environmental Engineer*

Erik von Krogh, RPBio, PMP
*Associate, Project Director*

AV/EvK/lmk

Attachment: Watson Engineering Ltd. Memorandum:  Structural Assessment of Damaged Concrete Basement Wall

https://golderassociates.sharepoint.com/sites/128990/project files/6 deliverables/issued to client_for wp/20145856-012-l-rev1/20145856-012-l-rev1-foundation assessment-15jul_20.docx

**Watson Engineering Ltd.**
760 Seymour Street, Kamloops, BC V2C 2H4 Voice: (250) 374-2244 E-mail: watson@direct.ca

# Memorandum

---

**To:** Golder Associates Ltd. E-mail: Alanna_Umphrey@golder.com
**Attn**: Alanna Umphrey, AScT Title: Environmental Technician

**From:** Andrew Watson, P. Eng., Struct. Eng. Date: 2020 July 13

**Project Number:** 2067

**Project Name:** 2425 Glenview Avenue Residence Aircraft Accident Damage
**Subject:** Structural Assessment Of Damaged Concrete Basement Wall

**Number Of Pages Including This Sheet:** 11

**CC:** Erik Von Krogh Erik_VonKrogh@golder.com

---

## Message

Further to your request, we have completed an assessment of the Concrete Basement Wall at 2425 Glenview Avenue in Kamloops BC. We note that an initial site visit for this assessment was completed by Andrew Watson P.Eng. Struct. Eng. and Stephan Anderson AScT on 2020 June 26 with an additional follow-up site visit by Stephan Anderson AScT on 2020 June 30.

We understand that the Concrete Basement Wall was damaged as a result of an Aircraft Accident - specifically catastrophic loss of a Canadair CT-114 Tutor on 2020 May 17 resulting in impact immediately north of the Residence (as shown in Photo 1 and Photo 2) – and that the main purpose of our assessment is to consider the condition of the Concrete Basement Wall and the feasibility of safely excavating soil adjacent to (and perhaps under) the Concrete Basement Wall down to an elevation of approximately 4.3m below existing surface grade to permit removal/remediation of soil materials contaminated with jet fuel.

We note that the exact age of the Residence is unknown; however, its construction is typical of Residential Structures constructed in the area in the 1960s and 1970s. It is comprised of a single storey Timber Superstructure consisting of Pre-Fabricated Timber Trusses on Timber Stud Walls above ground on a Concrete Basement partly buried below ground. It was noted that the Concrete Basement Walls appeared to be constructed after installation of Floor Joists for the Main Floor as the Floor Joists were partly embedded in concrete.

We note that the Timber Superstructure on the west end of the Residence suffered significant damage due to fire after the initial impact including damage to the Roofing, extensive damage to the Roof Trusses caused by fire within the attic space and subsequent suppression of the fire (as shown in Photo 4), and damage to the Timber Stud Wall along the north side of the Residence. Significant damage also occurred to the Concrete Basement Wall due to indirect impact and significant transient soil pressures arising from the substantial impact of the Aircraft on soils immediately adjacent to the Concrete Basement Wall (as shown in Photos 5 through 8).

We note that the impact from the Aircraft resulted in contamination of soil materials immediately adjacent to the Concrete Basement Wall with jet fuel requiring remediation/removal of soil materials - and that subsequent soils investigation has revealed soil materials contaminated by hydrocarbons to a depth of at least 4.3m below grade immediately adjacent to the Concrete Basement Wall. We further note that the area of impact and anticipated excavation lies over or in close proximity to building utility services including buried water, sewer and gas lines (as shown in Photo 2 & Dwg. 1) - as well as overhead electrical utilities destroyed during the accident and/or fire.

Photo 1: Front View Of 2425 Glenview Ave. From The North Side.
Note Approximate Area Of Aircraft Impact And Anticipated Excavation
For Remediation/Removal Of Contaminated Soils.

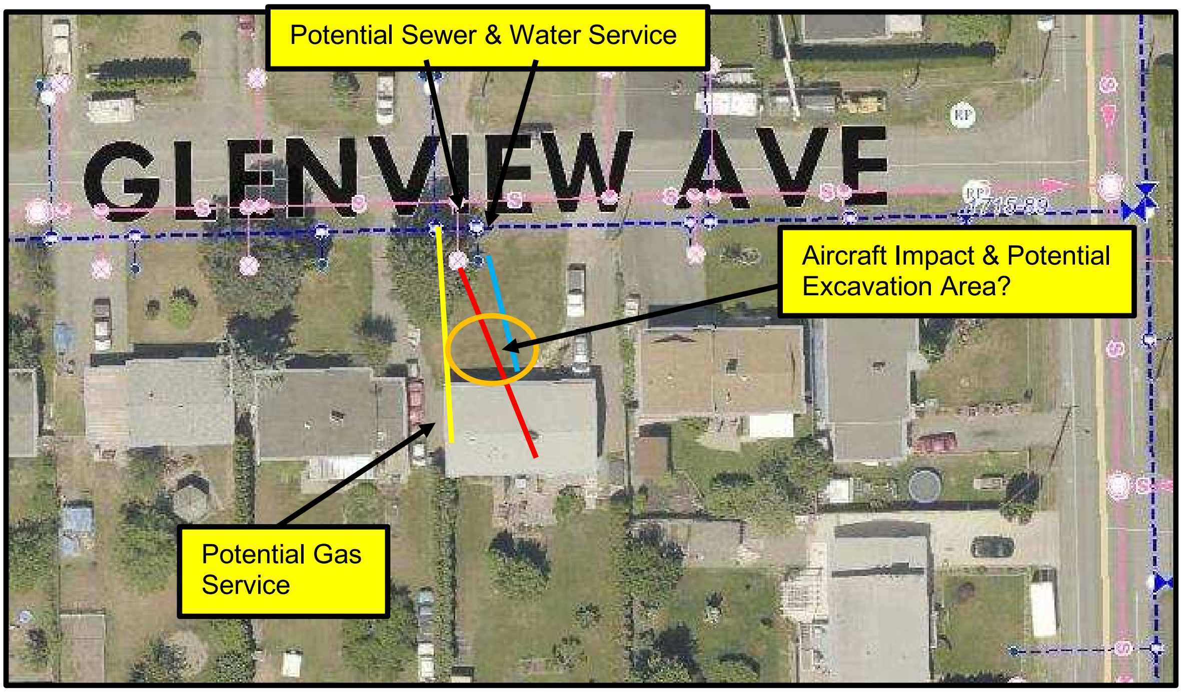


Photo 2: Kamloops GIS Location Map of 2425 Glenview Drive.
Note Estimated Locations For Building Services Below Grade.

Photo 3: Damage At North West Corner Of Residence Including Damage To Eaves/Soffit, Superficial Fire Damage To North Face Of Timber Stud Wall And Crack In Concrete Basement Wall Due To Exterior Soil Pressure.

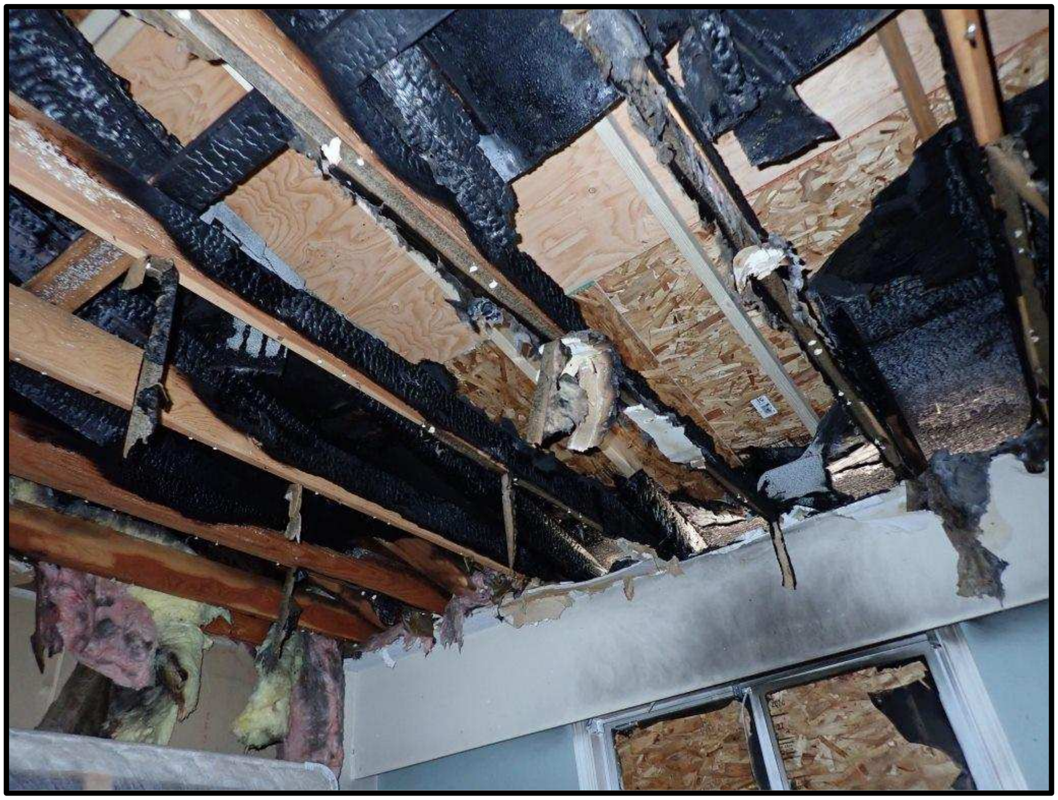


Photo 4: Fire Damage To Roof Trusses And Ceiling At Main Floor Bedroom Inside Residence Immediately Adjacent Aircraft Impact Location.

Photo 5: Close Up Of Crack In Concrete Basement Wall At North West Corner
Due To Exterior Soil Pressure

As noted previously, the Basement is partly buried and is constructed of concrete. The perimeter Concrete Basement Wall is approximately 2.3m (7' 6") tall and 200mm (8") thick and appears to be constructed without reinforcing steel. The Floor Slab is approximately 100mm (4") thick concrete based upon one hole cored through the Floor Slab as part of the Geotechnical/Environmental Investigation. It is unclear whether the Floor Slab is reinforced or not. No reinforcing steel was visible at the core hole; however, only one hairline crack was visible suggesting that the Floor Slab may have some reinforcement.

The Concrete Basement Walls appear to have been formed with plywood inside and out with steel snap ties connecting the formed surfaces. The exterior concrete above grade appears textured due to removal of stucco (as shown in Photo 5) – probably using a hammer-drill/chisel. The wall itself has areas of poor consolidation of concrete, minor cold joints, and a few hairline cracks typical of older residential construction (as shown in Photo 7); however, there is no evidence of water seepage through the concrete and the Concrete Basement Wall appears to have been generally sound prior to impact.

The 19' long Concrete Basement Wall along the north side of the Storage Room at the west end of the Residence appears to have been displaced approximately 50mm into the room (as shown in Photos 6 & 8) by substantial soil pressures during impact from the Aircraft forming a convex shape with a vertical crack near the west corner of the basement window and diagonal cracks from about midheight arching towards the Floor Slab on either side (as shown on Dwg. 1). There is an additional large arched crack on the east side of the north Concrete Basement Wall extending to the Floor Slab (as shown on Photo 6). All these cracks appear to be fresh cracks with well-defined sharp edges. The exterior crack in the west upper corner of the Concrete Basement Wall (shown in Photos 3 & 5) does not appear on the interior surface which is consistent with inward deflection of the wall under soil pressure. Though damaged by fire, the Timber Superstructure immediately above the Concrete Basement Wall does not appear to have been displaced relative to the Concrete Basement Wall below.

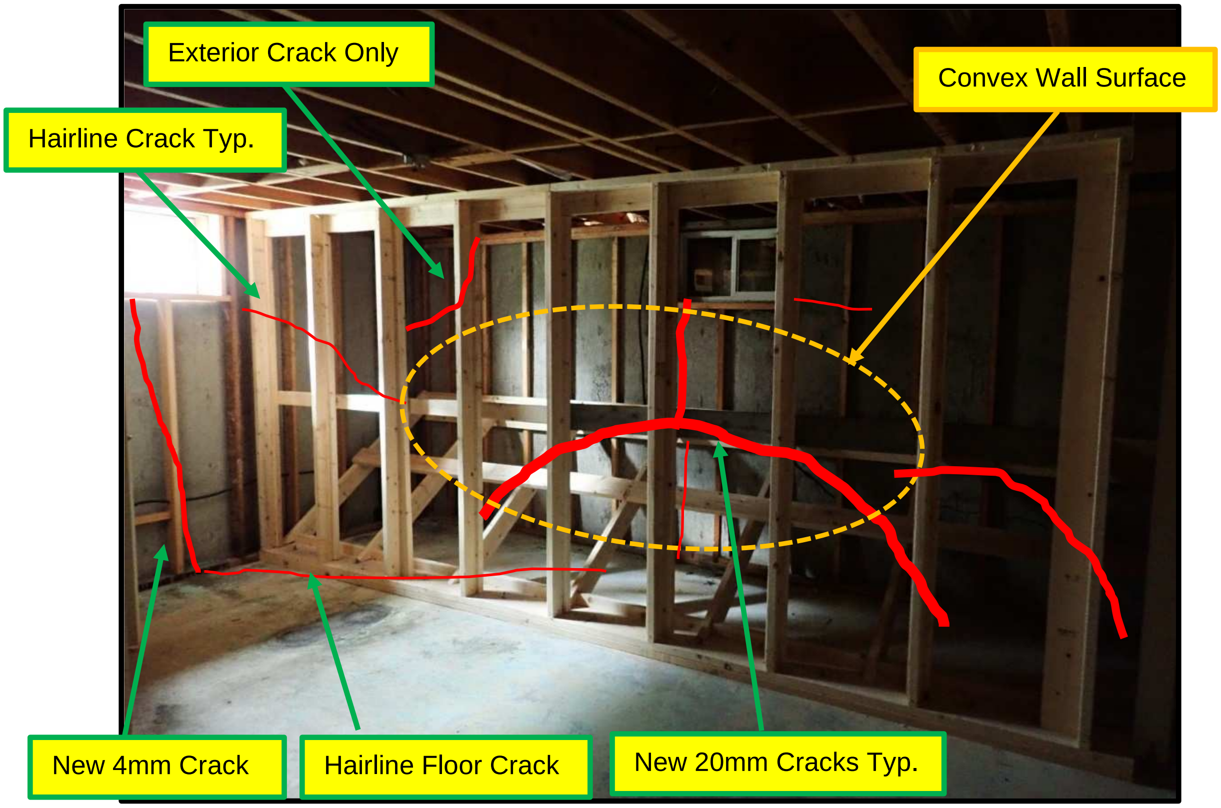


Photo 6: Outline Of Damage At North And West Concrete Basement Walls
With Temporary Stud Wall Support In Foreground

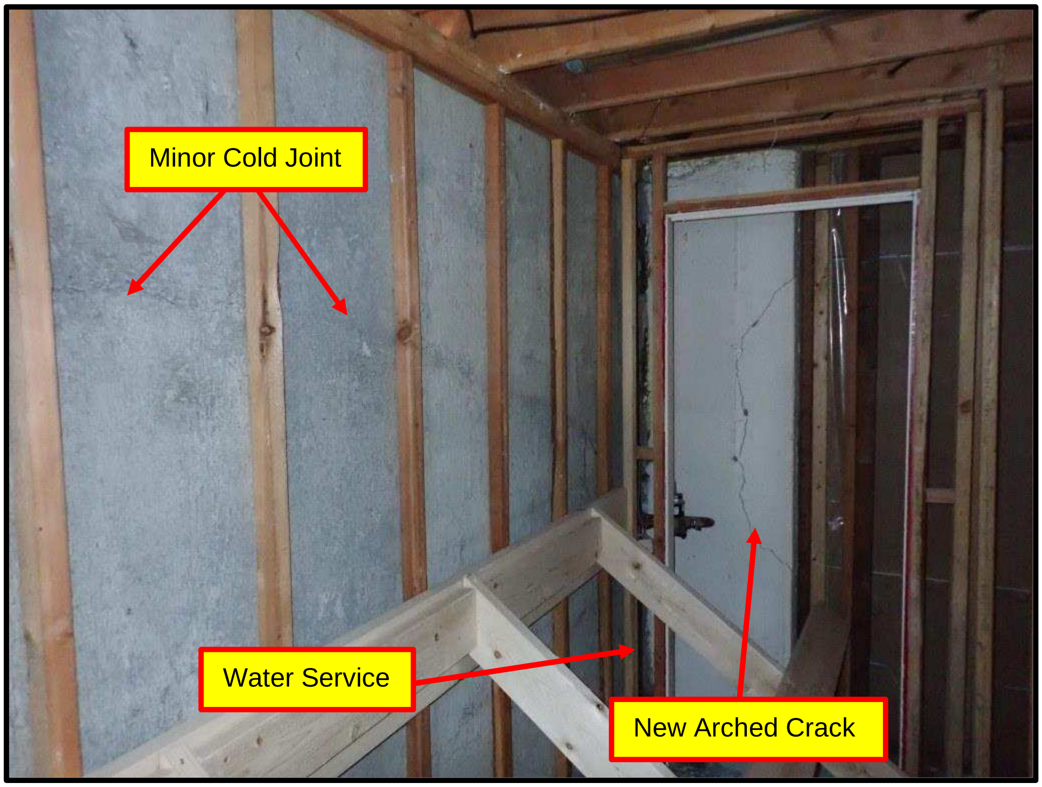


Photo 7: Close Up Of East Part of North Concrete Basement Wall In Storage Room
Showing Cold Joint, Additional Arched Crack In Return Wall And Water Service.

Photo 8: View Along North Concrete Basement Wall In Storage Room Showing Convex Inward Deflection of Wall And Also Temporary Stud Wall Support.

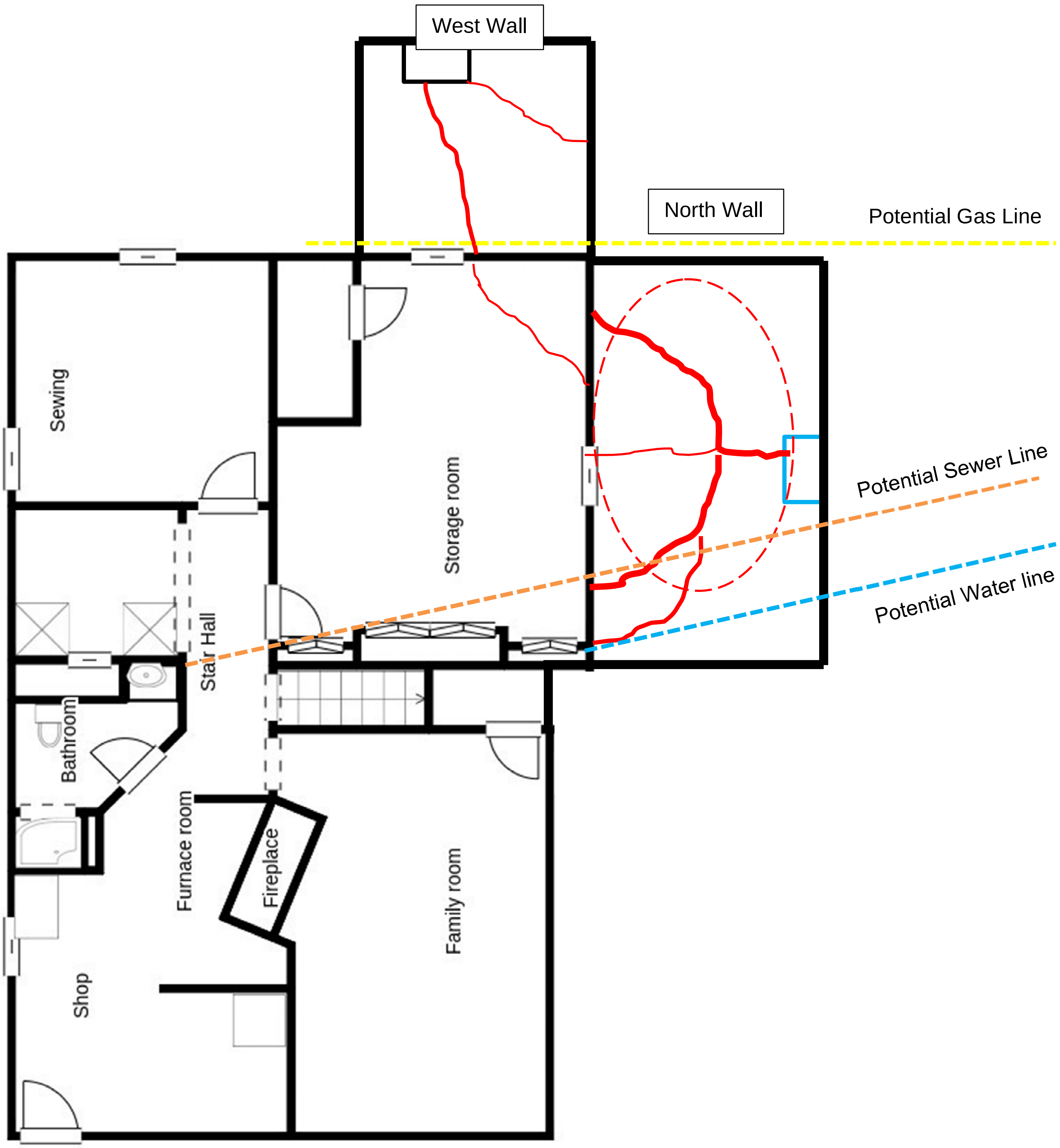
There is an Arched Crack near the east end of the Concrete Basement Wall in the Storage Room where the Concrete Basement Wall returns turns 90º south for approximately 2’ and then 90˚ eastwards again into the Family Room (as shown in Photo 7). This crack also appears new. The Concrete Basement Wall in the Family Room is covered with Gypsum Board so it is unclear whether there are any additional cracks in the Concrete Basement Wall in this area; however, there does not appear to be any damage to the painted Gypsum Board in the Family Room and/or Closet suggesting minimal – if any – displacement of the Concrete Basement Wall.

The 11’ long Concrete Basement Wall along the west side of the Storage Room at the west end of the Residence is exposed with another new crack approximately 4mm wide running vertically from near centre of another basement window to the Floor Slab (as shown in Photo 6 and Dwg. 1).

As noted previously, the Floor Slab is in good condition with a hairline crack running diagonally from the vertical crack at the window in the west Concrete Basement Wall towards the north Concrete Basement Wall (as shown on Dwg. 1).

We note that a Temporary Stud Wall has been installed in the Storage Room between the Floor Slab and Main Floor (as shown in Photo 6 & 8) and that similar diagonal Timber Bracing has been installed to provide lateral support to the deflected Concrete Basement Wall (as shown in Photos 6 & 8); however, no additional support has been provided above between the Main Floor and Roof Trusses.

As noted previously, buried utilities enter through the Basement (as shown in Photo 2). The Water Service enters the Residence through the Floor Slab at the east end of the Storage Room (as shown in Photo 7) and is inferred to run to the City Water Main near the west end of the property. The Sewer Service is presumed to run parallel to the Water Service from the west corner of the property under the Floor Slab towards the Kitchen on the Main Floor and Basement Bathroom at the rear of the Residence. The Gas Service is presumed to run along the west side of the property and enter the Residence partway along the west wall.



Drawing 1
2425 Glenview Ave. Basement Plan View
Note: North and West Walls Folded Out to Show New Cracks
(Base Sketch Provided By PSPC 2020 June 17 – Not To Scale)

As noted previously, we understand that the intent is to excavate soil materials down to about 4.3m below grade for removal/remediation of soil materials contaminated with jet fuel. We understand that this will require excavation 'near vertical' in close proximity to the Concrete Basement Wall along the north side of the Residence (as shown in Figure 1 and Figure 2) and similar 'near vertical' excavation in proximity to the property line along the west side of the property (as shown in Figure 1 and Figure 3).

Figure 1
OrthoPhoto From Golder of Residence With Reference Sections A & B

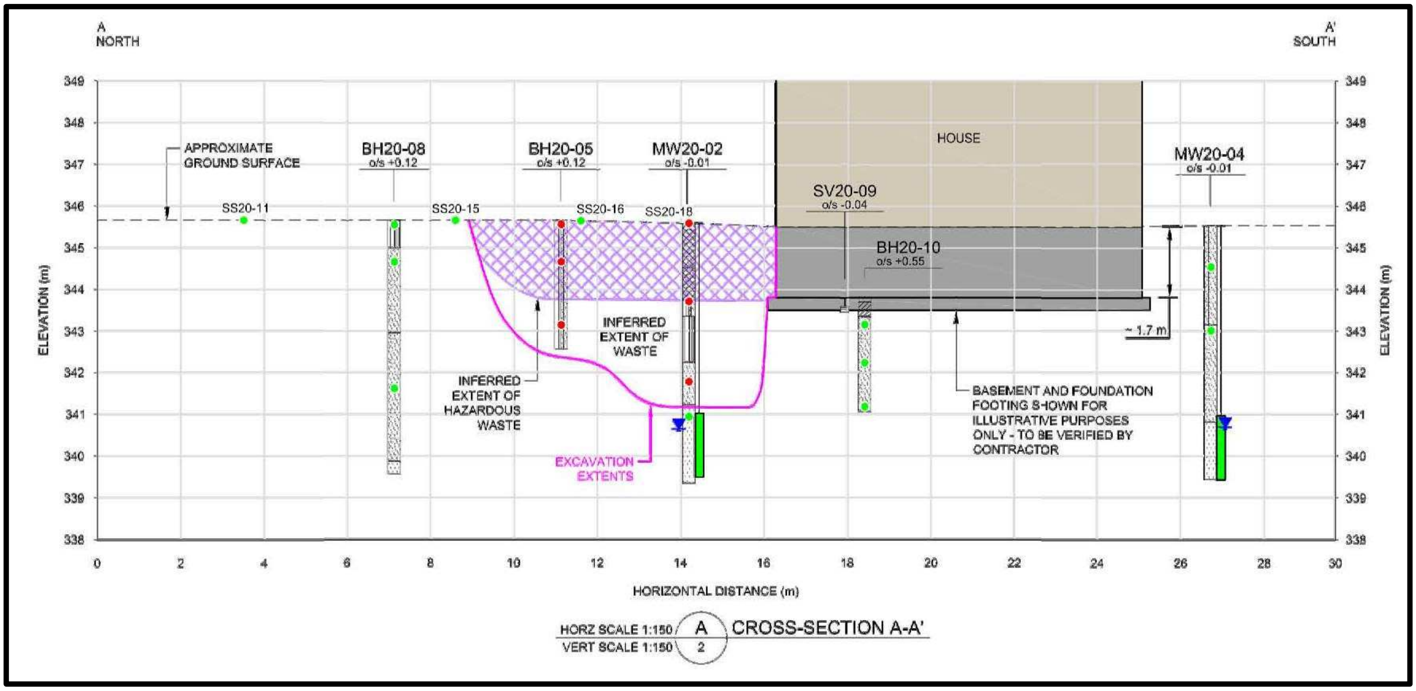


Figure 2
Section A From Golder In North-South Direction Showing Excavation In Proximity To Residence.

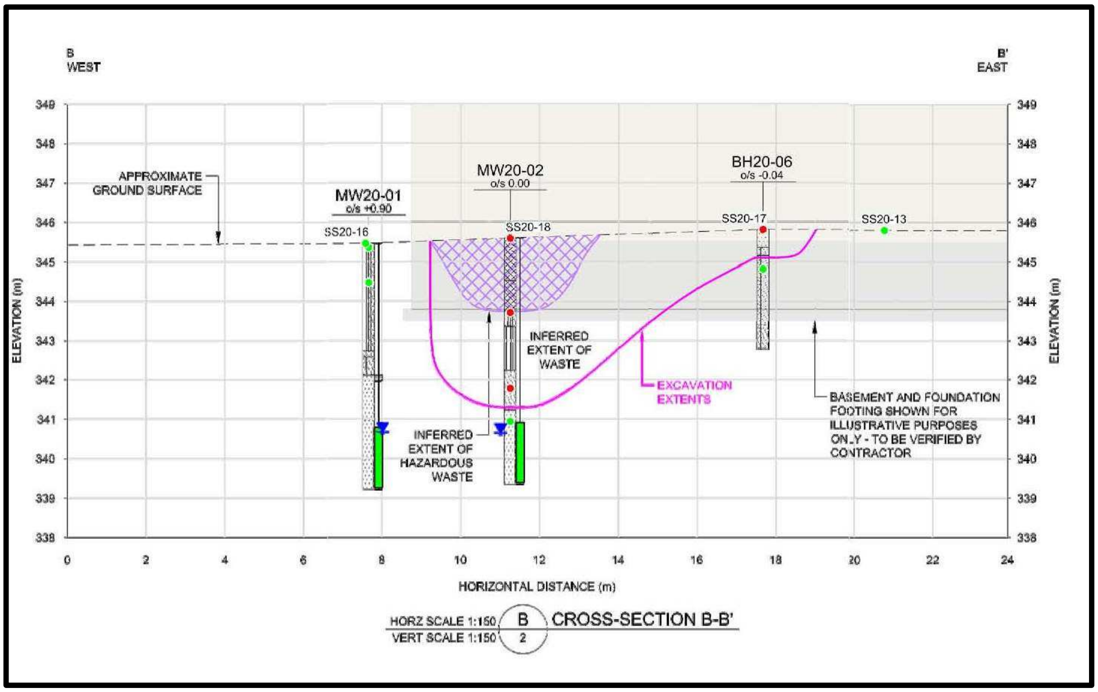


Figure 3
Section B From Golder In East-West Direction Showing Anticipated Excavation In Proximity To Property Line.

Based upon our own observations, the internal height of the Concrete Basement Wall is approximately 2.3m (7’ 6”) and the top of the Concrete Basement Wall is about 0.61m (2’) above grade. This suggests that the top of the Floor Slab is about 1.7m (5’ 6”) below grade and that the proposed excavation to 4.3m below existing grade will be about 2.6m below Floor Slab. No specific information is available on the depth/details of the Footing for the Concrete Basement Wall.

We note that the Concrete Basement Wall is severely cracked. It appears to be plain unreinforced concrete and has limited capacity to support retained soils or even itself as a grade beam. We further note that the top of the Concrete Basement Wall has only nominal lateral support from the Main Floor as there is no positive anchorage and attachment between the Timber Floor Joists partly cast into the top of the Concrete Basement Wall – and that the capacity of the damaged Roof Trusses above are also significantly compromised.

We anticipate that excavation of soil materials outside of the Concrete Basement Walls might be completed safely down to Footing Elevation of the Concrete Basement Walls if the excavation is completed carefully to avoid displacement of the damaged Concrete Basement Walls and that continuous monitoring of the Concrete Basement Walls is provided to minimize displacement. If significant displacement is observed, measures should be taken immediately to stabilize the damaged Concrete Basement Walls.

We anticipate that any ‘near vertical’ excavation below footing elevation outside of the north Concrete Basement Wall would result in a reduction of foundation capacity for the Concrete Basement Wall. Any significant ‘near vertical‘ excavation below Footing Elevation may result in some degree of physical undermining of the Concrete Basement Walls. We further note that physical undermining of the Concrete Basement Walls may be required intentionally for removal/remediation of contaminated soils if such contamination has spread under the Residence. We note that significant undermining of the damaged Concrete Basement Wall (without first adequately supporting the Concrete Basement Wall) may result in damaged portions of the Concrete Basement Wall falling into the excavation and/or collapse of the full height of the Concrete Basement Wall likely resulting in further damage to Main Floor and Roof of the Residence in the vicinity of the excavation.

We anticipate that if any significant physical undermining occurs (or is required to occur) beneath the Floor Slab, it would result in loss of foundation capacity for the Floor Slab and could compromise the Temporary Stud Wall and Bracing currently installed to stabilize the Concrete Basement Walls. Given the depth of excavation anticipated outside of the Concrete Basement Walls, we anticipate that (without adequately supporting the Concrete basement Walls, Footing and Floor Slab) such loss of support might extend significantly within the Basement.

We note that even if excavation to 4.3m below grade is completed without further compromising the integrity of the Concrete basement Wall and/or its supporting foundation soils, that there will likely challenges in backfilling the excavation to the underside of the Concrete Basement Wall and/or Floor Slab to restore support.

We note also that we anticipate that all of the above concerns will be exacerbated if surface water enters the excavation, if water from damaged utilities is encountered in the excavation and/or if ground water is encountered in the excavation.

Based upon the above, we conclude that:

1. The structure of the Residence is damaged as a result of the Aircraft Accident and that the capacity of the Concrete Basement Wall in particular is compromised.

2. Excavation of soil materials outside of the Concrete Basement Walls for removal/remediation of contaminated soil materials can likely be completed safely to the underside of the Concrete Basement Wall provided that excavation is completed carefully to avoid displacing damaged concrete.

3. Significant ‘Near Vertical’ Excavation of soil materials outside of the Concrete Basement Wall for removal/remediation of contaminated soil materials may be difficult to complete safely below the underside of the Concrete Basement Wall without providing some vertical support to the Concrete Basement Wall and ensuring that the Concrete Basement Wall is supported laterally at the elevation of the Main Floor to prevent toppling. As the Concrete Basement Wall is unreinforced and is all ready cracked, we anticipate that it has very limited capacity to span freely.

4. Excavation of soil materials for removal/remediation of contaminated soil materials below the Floor Slab may be difficult to complete safely providing some vertical support to the Floor Slab – and potentially also the existing Temporary Stud Walls and Bracing.

5. Excavation must accommodate backfill to reinstate or replace excavated soil materials and restore vertical soil support to the Concrete Basement Wall and/or Floor Slab.

Based upon the above, we recommend that:

1. All excavation be completed in accordance with Worksafe BC Requirements and under the direction of a qualified Geotechnical Engineer to ensure that safe backslopes are maintained, that structures supported at the edge of the excavation do not present a hazard to the excavation together with associated workers and equipment, and that structures supported at the edge of the excavation (including the Residence and adjacent Residence/Structures) do not suffer damage due to settlement, loss of support and/or undermining.

2. Excavation of soil materials be completed carefully down to the underside of footing elevation of the Concrete Basement Wall taking care to not to displace damaged concrete and monitoring the Concrete Basement Wall continuously for displacement and - if any such displacement is observed - that measures are immediately taken to stabilize the damaged Concrete Basement Wall. We anticipate that portions of the Concrete Basement Wall which are cracked and free to move independently will require restraint and that it would be desirable to provide some additional lateral restraint at the top of the Concrete Basement Wall to prevent toppling.

3. Excavation of soil materials adjacent to north of Concrete Basement Wall should:
    - Maintain vertical soil support for the Concrete Basement Wall; or
    - Provide independent vertical structural support for the Concrete Basement Wall; or
    - Accommodate temporary removal/reconstruction of the Concrete Basement Wall

   And:
    - Restrain or remove any portions of the Concrete Basement Wall that are free to move independently; and
    - Provide effective lateral support at the top of the Concrete Basement Wall to prevent toppling.

4. Excavation of soil materials below the underside of the Floor Slab should:
    - Maintain vertical soil support for the Floor Slab (and also for any Temporary Stud Walls and Bracing supported on the Floor Slab); or.
    - Provide independent vertical support for the Floor Slab (and also for any Temporary Stud Walls and Bracing supported on the Floor Slab); or
    - Remove the Floor Slab.

5. Backfill of excavation below the footing elevation of the Concrete Basement Wall be completed to reinstate full vertical soil support of the Concrete Basement Wall and Floor Slab without further damage to the Residence.

6. Backfill of excavation above the footing elevation of the Concrete Basement Wall, if contemplated, be completed with compaction suitable to restore exterior grades with minimal settlement but without imposing larger lateral soil pressures which may damage the existing (damaged) unreinforced Concrete Basement Walls.

7. Further to the above, we recommend Pre-Excavation and Post-Backfill Inspection of the Residence in question and any adjacent Structures which may be impacted by the Work in conjunction with the Excavation Contractor to ensure that the condition of these Residences/Structures are well documented and unnecessary claims from damage due to the Work are avoided.

Should you have any questions or require further information, please contact the undersigned directly:

Stephan Anderson, AScT.

A. D. WATSON
#21098

Andrew Watson, P. Eng., Struct. Eng.
2020/07/13.

**From:** Dan Sorge <dan@tvr.ca>
**Sent:** June 25, 2020 12:22 PM
**To:** Ryan G. Stade, P.Eng.
**Cc:** Julie Van Dusen
**Subject:** RE: EXT:RE: EXT:RE: EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection

Hello Ryan & Julie,
The additional studs and ribbon brace requested this morning will be completed shortly (ie.. for the temporary floor joist support wall).
I have the carpenter returning and he should be on site any minute.
Cheers.

---

**From:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Sent:** Thursday, June 25, 2020 9:31 AM
**To:** Dan Sorge <dan@tvr.ca>
**Cc:** 'Julie Van Dusen' <julie.vandusen@scm.ca>
**Subject:** EXT:RE: EXT:RE: EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection

**MacRae – 2425 Glenview Avenue, Kamloops**
**Attention: Dan Sorge – TVR**

**Re: Temporary Bracing for Access to Drill Inspection Holes**

Further to our meeting at the site this morning, I have the following comments:

1. Bracing to stabilize foundation wall is in place and in conformance with the details provided dated June 17th.
2. Drilling beside foundation wall can be completed with assurance the wall will not collapse on workers. (This does not provide any assurance with regard to possible combustion of flammable materials that may be in soil).

However, additional support wall to carry floor (in the event of wall collapse) is not yet completed. There is potential for the wall to collapse if enough material is removed from the exterior, but that is not planned at this point. We understand only narrow trenches may be excavated to examine soil at depth. This should allow keeping broken sections of concrete foundation in there current position.

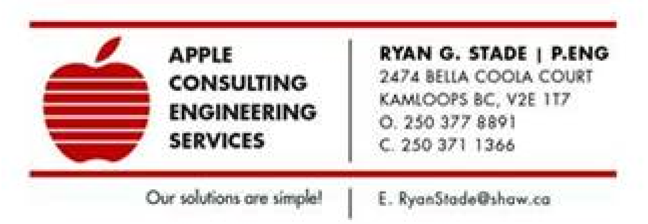
To complete the temporary supporting wall, install 2x6 (or 2x4) studs to each of the existing 2x4 studs (4 more required) for continuous support of 2x6 header. Then add a 2x4 'ribbon' lateral brace, at about mid-height of studs, over the length of stud frame wall.

Note: the proposed drilling of 'inspection holes' beside foundation wall can begin immediately.

Let me know if you require anything further.

Sincerely,

Ryan G. Stade, P.Eng.



APPLE
CONSULTING
ENGINEERING
SERVICES

Our solutions are simple!

RYAN G. STADE | P.ENG
2474 BELLA COOLA COURT
KAMLOOPS BC, V2E 1T7
O. 250 377 8891
C. 250 371 1366
E. RyanStade@shaw.ca

---

**From:** Dan Sorge <dan@tvr.ca>
**Sent:** June 24, 2020 8:23 AM
**To:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Subject:** RE: EXT:RE: EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection

Thanks Ryan,
The 2 guys that would do this are in Merrit right now, and would not be back on site till approx 230pm, so it will not get done before late in the day today.
Thursday first thing may be best, if your schedule permits that.

---

**From:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Sent:** Wednesday, June 24, 2020 8:10 AM
**To:** Dan Sorge <dan@tvr.ca>
**Subject:** EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection

Dan:

It appears you did exactly what I requested, but I assumed you would have installed double top plate.
So this is good for the exterior wall bracing, but should have addition capacity for the floor load.
I will suggest 2x6 on edge, nailed to existing studs, with 2x4 cripple to make “T” posts at 24 in. on centre.

Ryan

---

**From:** Dan Sorge <dan@tvr.ca>
**Sent:** June 24, 2020 8:03 AM
**To:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Cc:** julie.vandusen@scm.ca; Cathy Tucker <cathy@tvr.ca>
**Subject:** TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection
**Importance:** High

Good Morning Ryan,
The Bracing in the basement storage room has been completed, and is ready for your inspection.
We would be grateful if you could return to site asap and conduct a site inspection.
(Julie will need a report from you that you are satisified with the work completed) (or if any additional work is required?).
Let me know when you are able to attend, as I would like to meet you there.

(See photo attached).
Have a great day

Best Regards,
Dan Sorge
Project Manager

940 Mc Master Way, Kamloops BC  V2C 6K2
Cell: 250-682-0182
Phone:  250-372-1335   Fax:  250-372-5603
Website:  www.tvr.ca [tvr.ca]

---

**From:** Dan Sorge <dan@tvr.ca>
**Sent:** June 25, 2020 12:41 PM
**To:** Julie Van Dusen
**Cc:** Cathy Tucker
**Subject:** TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Better Photo
**Attachments:** IMG_4582.jpg

Hi Julie,
Further to the 2 photos Ryan emailed you this am, please find the attached.
This photo shows the entire bracing and temp wall assemblies - at the affected exterior wall.

Best Regards,
Dan Sorge
Project Manager

Thompson Valley DKI

940 Mc Master Way, Kamloops BC  V2C 6K2
Cell: 250-682-0182
Phone:  250-372-1335   Fax:  250-372-5603
Website:  www.tvr.ca [tvr.ca]

| | |
|---|---|
| **From:** | Ryan G. Stade, P.Eng. |
| **To:** | "Dan Sorge" |
| **Cc:** | Julie Van Dusen |
| **Subject:** | RE: EXT:RE: EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection |
| **Date:** | June 25, 2020 9:31:01 AM |
| **Attachments:** | image001.png<br>image003.jpg<br>20Jun25 (2).JPG<br>20Jun25 (3).JPG |

---

**MacRae – 2425 Glenview Avenue, Kamloops**
**Attention: Dan Sorge – TVR**

**Re: Temporary Bracing for Access to Drill Inspection Holes**

Further to our meeting at the site this morning, I have the following comments:

1. Bracing to stabilize foundation wall is in place and in conformance with the details provided dated June 17th.
2. Drilling beside foundation wall can be completed with assurance the wall will not collapse on workers.

(This does not provide any assurance with regard to possible combustion of flammable materials that may be in soil).

However, additional support wall to carry floor (in the event of wall collapse) is not yet completed. There is potential for the wall to collapse if enough material is removed from the exterior, but that is not planned at this point. We understand only narrow trenches may be excavated to examine soil at depth. This should allow keeping broken sections of concrete foundation in there current position.

To complete the temporary supporting wall, install 2x6 (or 2x4) studs to each of the existing 2x4 studs (4 more required) for continuous support of 2x6 header. Then add a 2x4 ‘ribbon’ lateral brace, at about mid-height of studs, over the length of stud frame wall.

Note: the proposed drilling of ‘inspection holes’ beside foundation wall can begin immediately.

Let me know if you require anything further.

Sincerely,

Ryan G. Stade, P.Eng.

APPLE
CONSULTING
ENGINEERING
SERVICES
Our solutions are simple!

RYAN G. STADE | P.ENG
2474 BELLA COOLA COURT
KAMLOOPS BC, V2E 1T7
O. 250 377 8891
C. 250 371 1366
E. RyanStade@shaw.ca

---

**From:** Dan Sorge <dan@tvr.ca>
**Sent:** June 24, 2020 8:23 AM
**To:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Subject:** RE: EXT:RE: EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection

Thanks Ryan,
The 2 guys that would do this are in Merrit right now, and would not be back on site till approx 230pm, so it will not get done before late in the day today.
Thursday first thing may be best, if your schedule permits that.

---

**From:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Sent:** Wednesday, June 24, 2020 8:10 AM
**To:** Dan Sorge <dan@tvr.ca>
**Subject:** EXT:RE: TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection

Dan:

It appears you did exactly what I requested, but I assumed you would have installed double top plate.
So this is good for the exterior wall bracing, but should have addition capacity for the floor load.
I will suggest 2x6 on edge, nailed to existing studs, with 2x4 cripple to make "T" posts at 24 in. on centre.

Ryan

---

**From:** Dan Sorge <dan@tvr.ca>
**Sent:** June 24, 2020 8:03 AM
**To:** Ryan G. Stade, P.Eng. <ryanstade@shaw.ca>
**Cc:** julie.vandusen@scm.ca; Cathy Tucker <cathy@tvr.ca>
**Subject:** TVR JOB#20239-A MACRAE, Bud 2425 Glenview Ave Kamloops - BRACING COMPLETED - Ready for P.Eng Inspection
**Importance:** High

Good Morning Ryan,
The Bracing in the basement storage room has been completed, and is ready for your inspection.
We would be grateful if you could return to site asap and conduct a site inspection.
(Julie will need a report from you that you are satisified with the work completed) (or if any additional work is required?).
Let me know when you are able to attend, as I would like to meet you there.

(See photo attached).

Have a great day

Best Regards,
Dan Sorge
Project Manager

Thompson Valley
DKI

940 Mc Master Way, Kamloops BC  V2C 6K2
Cell: 250-682-0182
Phone:  250-372-1335   Fax:  250-372-5603
Website:  www.tvr.ca [tvr.ca]