Foreshore Passive Treatment System Construction Report

Parkland Refinery, Burnaby, British Columbia

Parkland Refining (B.C.) Ltd.

Project number: 60542455

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Quality information

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1. Executive Summary

On behalf of the Parkland Refining (B.C.) Ltd. (Parkland) Burnaby Refinery AECOM Canada Ltd. (AECOM) has prepared this report to summarize the construction of the Foreshore Passive Treatment System (FPTS) executed by the prime contractor, Tervita Corporation (Tervita) and to meet various conditions in Permit 16-180 issued by the Vancouver Fraser Port Authority (VFPA). The FPTS was designed and constructed to be the final remedial action to address free-phase and dissolved phase hydrocarbon and sheens along the foreshore of Burrard Inlet, down slope from the Eastern Impounding Basin (EIB), Area 2 of the Parkland (formerly Chevron) Burnaby Refinery (Figure 1) (hereafter referred to as "the Site"). The FPTS was constructed to be a permanent feature on the Site. Construction of the FPTS was performed from July 10 through October 30, 2017.

The FPTS construction objectives were to excavate and dispose of the sand-organoclay and other materials from the existing 44 metre (m) Eastern and the 10 m Western Interim Remedial Action (IRA) Barriers and replace the Eastern IRA Barrier with the newly designed FPTS. The FPTS construction followed the British Columbia Ministry of Environment and Climate Change Strategies (ENV) supported Foreshore Remedial Action Plan (AECOM 2016b) and in accordance with the Construction Environmental Management Plan (AECOM 2017a). Based on field observations and sampling results, an FPTS was also installed at the former location of the Western IRA Barrier. The newly installed FPTS was designed to address the non-aqueous phase liquid (NAPL) seeps and associated potential contaminants of concern (PCOCs) in porewater and surface water, at the Site.

The Preliminary Site Investigation and Detailed Site Investigation were performed in June 2010 and April 2011, respectively (URS 2011a) to assess the nature and extent of petroleum hydrocarbon impacts across the Site. Findings of these Investigations along with various Human Health and Ecological Risk Assessments (SLR 2014 and 2016) identified the following contaminants of concern (COCs): benzene, toluene, ethylbenzene, and xylenes (BTEX), volatile petroleum hydrocarbons (VPH), light/heavy extractable petroleum hydrocarbons (LEPH/HEPH), polycyclic aromatic hydrocarbons (PAHs), and copper in sediment.

Applicable Standards

Sediment samples were screened against the ENV Consolidated Stage 11 Housekeeping Amendment to the Contaminated Sites Regulation (CSR), Schedule 3.4: Generic Numerical Sediment Standards for Sensitive and Typical sediments in marine and estuarine environments. Sensitive marine sediment applies to the upper 1 m of sediment collected below the high water mark in aquatic receiving environments that are not maintained watercourses. Typical marine sediment applies below the top 1 m of sediment collected below the high water mark in aquatic receiving environments. In the event that standards for a COC were not included in Schedule 3.4, sediment samples were compared to the most stringent of the following soil standards: Schedule 3.1 Part 1: Matrix Numerical Park Land (PL) Soil Standards, Schedule 3.1 Part 2: Generic Numerical PL Soil Standards to Protect Human Health; or Schedule 3.1 Part 3: Generic Numerical PL Soil Standards to Protect Ecological Health.

Field Program Methodologies

With a few exceptions, all above and below ground components of the FPTS were installed consistent with the issued for construction (IFC) drawings, completed in association with the Remedial Action Plan (AECOM 2016b). In summary, the components installed include:

- A subsurface treatment cell with Aquagate+Organoclay,
- An adjacent, down slope subsurface treatment cell with Aquagate+Powdered Activated Carbon,
- Baffles in the treatment cells,
- A French drain system in the treatment cells,
- Monitoring wells,
- A polyethylene liner to direct groundwater into the treatment cells,
- An Oleophilic Bio-Barrier, and
- Cobbles and a boulder embankment to protect the wells and other components.

The IFC drawings were modified slightly to account for a change in design and construction of the FPTS based on field observations and sampling results from the Western IRA Barrier. Minor design variations that deviated from the original IFC drawings are discussed in Section 11.2 and shown in Appendix G.

During construction, all work was completed within the conditions included in Vancouver Fraser Port Authority (Port of Vancouver) Project Permit No: 16-180.

Field Observations

Notable observations are as follows:

- No hydrocarbon sheens were observed in Burrard Inlet during construction activities;
- During the removal of the Eastern and Western IRA Barriers, the majority of the excavated sand-organoclay contained staining and/or hydrocarbon odours, indicating the effectiveness of the IRA Barriers in trapping petroleum hydrocarbons;
- During the installation of monitoring well PW17-14, an oily film was observed in water seeping out of the upper surface of the sediment at approximately 0.3 m below ground surface;
- NAPL was not observed during the IRA demolition, limit sampling or FPTS construction; and,
- During construction, surface water inside and outside of the construction zone was monitored for pH, temperature, conductivity and turbidity as per Permit No: 16-180. Occasionally, elevated turbidity, temperature, and pH readings above the BC Approved Water Quality Guidelines (WQG) were recorded both inside and outside of the construction zone. Generally, elevated turbidity measurements were the result of anthropogenic sources outside the footprint of the FPTS construction zone (i.e. large waves from passing watercrafts). Temperature and pH measurements outside the desired ranges were likely attributed to natural variations associated with the tide.

Analytical Discussion

A total of 106 sediment samples (including sidewall and base limit samples, samples of sand-organoclay mixture from within the Eastern and Western IRA Barriers, backfill material and samples from up gradient of the Eastern Barrier and duplicates) were collected during the construction of the FPTS. Sediment samples were analyzed for BTEX/VPH, LEPH/HEPH, extractable petroleum hydrocarbons (EPH(C10-C19)/EPH(C19-C32)), PAHs, methyl tertiary-butyl ether (MTBE), and metals. Two sediment samples were also analyzed for EPH(C10-C19)/EPH(C19-C32) with silica gel cleanup.

Of the 106 samples collected:

- 36 were limit sediment samples associated with the Eastern IRA Barrier;
- 31 were sand-organoclay samples from within the Eastern IRA Barrier;
- 17 were limit sediment samples associated with the Western IRA Barrier;
- 3 were sand-organoclay samples from within the Western IRA Barrier;
- 14 were samples of backfill material; and
- 5 sediment samples were collected from up gradient of the Eastern Barrier.

Of the 36 limit sediment samples associated with the Eastern IRA Barrier, five samples (ESA-9, ESA-13, ESA-23, ESA-29 and ESA-30) marginally exceeded applicable standards for 2-methylnaphthalene and/or naphthalene. The five samples containing 2-methylnaphthalene, and the one of these containing naphthalene, had concentrations slightly above the applicable standards, and within the same order of magnitude as the standards. As a result of the introduction of the Stage 11 Amendment to the CSR, 2-methylnaphthalene is considered a PCOC in sediment at the Site. However, it should be noted that 2-methylnaphthalene is not considered a PCOC in porewater or surface water at the Site, as there is no applicable CSR standard for porewater nor a Working or Approved BC Water Quality Guideline for surface water for this constituent.

Of the 17 limit sediment samples associated with the Western IRA Barrier, two samples (WSA-2 and WSA-3) exceeded applicable standards for EPH(C10-C19) and LEPH.

Due to the close proximity of the southern sidewall samples to the Canadian Pacific Railway (CPR) Zone of Potential Training Loading (ZPTL), over excavation to achieve clean limits was not feasible due to safety and slope stability concerns. Any migration of these impacts is anticipated to be trapped by the FPTS. Generally, when signs of hydrocarbon impacts were observed on the base and/or other sidewalls (north, east or west) of either of the IRA Barriers, the excavator operator was instructed to scrape away additional materials to achieve a clean limit. Of the seven limit sediment samples with exceedances, three were collected from the southern up slope sidewall of the excavation for the Eastern IRA Barrier, two were collected from the southern up slope sidewall of the excavation for the Western IRA Barrier, and two were collected from the base of the Eastern IRA Barrier. Any migration of these impacts is anticipated to be intercepted by the FPTS since the impacts are up gradient or below the treatment cells.

Six of 31 sand-organoclay samples (EIRA-6, EIRA-15, EIRA-16, EIRA-25, DUP-5, and EIRA-26) collected from within the Eastern IRA Barrier contained concentrations of PHCs and/or PAHs above the applicable standards. The three sand-organoclay samples collected from within the Western IRA Barrier did not contain concentrations of PHCs and/or PAHs above the applicable standards. Elevated concentrations from samples collected within the Eastern IRA Barrier are not unexpected as the barrier was designed to trap NAPL within the sand-organoclay. All materials represented by these samples were removed from Site and disposed of in accordance with applicable regulatory requirements.
All samples of backfill materials were below applicable standards.

Offsite Disposal

All excavated soil, pumped water, and demolition refuse generated during construction was contained and disposed of offsite at Tervita's Richmond Bioremediation facility. Total quantities of materials disposed of offsite are as follows:

- Soil - 103 tonnes (above commercial land use);
- Soil - 367 tonnes (above residential land use);
- Demolition refuse - 16 tonnes; and
- Groundwater – 170,000 litres.

FPTS Post-Construction Monitoring &Maintenance Plan

A FPTS Post-Construction Monitoring & Maintenance Plan (MMP) contained in Appendix K presents protocols and procedures to maintain and assess the performance of the recently installed FPTS. The MMP includes the monitoring and sampling of 33 newly installed monitoring wells, the collection of surface water samples, and maintaining the integrity of the FPTS by checking and replacing the protective rip-rap, cobbles and monitoring wells, and managing vegetation as required.

Summary

In summary, the FPTS was successfully installed between July and October 2017. Limit sediment samples were generally below applicable standards indicating that the bulk of the petroleum impacted soil and other materials were removed from the previous Eastern and Western IRA Barriers prior to the installation of the FPTS. Post construction monitoring will be performed according to the MMP and will include an evaluation of the performance of the FPTS.

REPORT ACRONYMS

AG+OC	Aquagate and Organoclay
AG+PAC	Aquagate and Powdered Activated Carbon
ALS	ALS Laboratories
BC	British Columbia
BCELM	BC Environmental Laboratory Manual
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CEMP	Construction Environmental Monitoring Plan
CEPA	Canadian Environmental Protection Act
CCME	Canadian Council of Ministers of the Environment
COC	Contaminants of concern
CPR	Canadian Pacific Railway
CSR	Contaminated Sites Regulation
DFO	Department of Fisheries and Oceans
DQO	Data quality objective
DSI	Detailed Site Investigation
EAZ	Ecologically Active Zone
EC	Environment Canada
EIB	Eastern Impoundment Basin
ESA	Eastern Seep Area
EMA	Environmental Management Act
ENV	Ministry of Environment and Climate Change Strategy
FPTS	Foreshore Passive Treatment System
HASP	Health and Safety Plan
HDPE	High density polyethylene
HWR	Hazardous Waste Regulation
IBA	In-between area

IFC	Issued for construction
IRA	Interim Remedial Action
LCS	Lab control sample
LEPH/HEPH	Light/Heavy Extractable Petroleum Hydrocarbons
LEPHw	Light Extractable Petroleum Hydrocarbons in water
m	meter
mm	millimeter
MTBE	methyl tertiary-butyl ether
NAPL	Non-aqueous phase liquid
OBB	Oleophilic Biobarrier
OMM	Operations, Monitoring, and Maintenance
OMOE	Ontario Ministry of Environment
ORP	Oxidation Reduction Potential
PAHs	Polycyclic Aromatic Hydrocarbons
PHC	Petroleum hydrocarbons
PCOC	Potential Contaminants of Concern
PL	Urban Park standards
PLv	Urban Park vapor standards
PMV	Port Metro Vancouver
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RBMT	Risk based management target
RCM	Reactive Core Mat
RDL	Reported Detection Limit
RFP	Request for proposal
ROW	right-of-way
RPD	Relative Percent Difference

SLR	SLR Consulting Canada Ltd.
SedSSS	Sediment Standards, Sensitive Sediments
SedSTS	Sediment Standards, Typical Sediments
VFPA	Vancouver Fraser Port Authority
VPH	Volatile Petroleum Hydrocarbons
WQG	Water Quality Guidelines
WSA	Western Seep Area
ZPTL	Zone of Potential Train Loading

2. Introduction

On behalf of the Parkland Refining (B.C.) Ltd. (Parkland) Burnaby Refinery, AECOM Canada Ltd. (AECOM) has prepared this remediation report to summarize the construction of the Foreshore Passive Treatment System (FPTS) executed by the prime contractor, Tervita Corporation (Tervita), and to meet various conditions in Permit 16-180 issued by the Vancouver Fraser Port Authority (VFPA). The FPTS was designed and constructed to be the final remedial action to address free-phase and dissolved phase hydrocarbon and sheens along the foreshore of Burrard Inlet, down slope from the Eastern Impounding Basin (EIB), Area 2 of the Parkland (formerly Chevron) Burnaby Refinery (Figure 1) (hereafter referred to as “the Site”). The FPTS was constructed to be a permanent feature on the Site. Construction of the FPTS was performed from July through October 2017.

The FPTS construction objectives were to excavate and dispose of the sand-organoclay and other materials from the existing 44 metre (m) Eastern and the 10 m Western Interim Remedial Action (IRA) Barriers and replace the Eastern IRA Barrier with the newly designed FPTS. The FPTS construction followed the British Columbia Ministry of Environment and Climate Change Strategies (ENV) supported Foreshore Remedial Action Plan (AECOM 2016b) and in accordance with the Construction Environmental Management Plan (AECOM 2017a). Based on field observations and sampling results, the FPTS was also installed at the former location of the Western IRA Barrier. The newly installed FPTS was designed to address the non-aqueous phase liquid (NAPL) seeps and associated potential contaminants of concern (PCOCs) in porewater and surface water, at the Site.

The scope of work was developed by Dr. Ram Kannappan, CA PE., Mr. Robert Horwath, CA PG, Ms. Leslie Southern, M.Sc., P.Ag., of AECOM and Mr. Michael Gill, P.Eng., CSAP, formerly of AECOM. Environmental monitoring was completed by Mr. Kenneth Gauthier, P.Ag., and Mr. Edward Preece, E.I.T., of AECOM. Additional field assistance was provided by Mr. Albert Wang, P.Eng., Mr. Brian McGill, B.Sc., Mr. Keith Bell, R.P.Bio., Mr. Justin Becker, E.I.T., Mr. Mark Hoculik, B.Sc., and Mr. Carny Wong, A.Ag. This report was prepared by Mr. Ken Gauthier and Ms. Leslie Southern and reviewed by Mr. Robert Horwath, Dr. Ram Kannappan, Mrs. Christine Patterson, P.Eng. and Ms. Lesley Reid, M.Eng., P.Eng., CSAP of AECOM.

3. Background

Chevron Canada Limited (CCL) first observed NAPL seeps on the north, downward slope of the Parkland (formerly Chevron) Burnaby Refinery (Refinery) towards Burrard Inlet during an inspection on April 21, 2010. The seeps were immediately reported by CCL to the Provincial Emergency Program (now Emergency Management BC [EMBC]) and addressed using soaker pads and booms. The source of the NAPL is unknown but believed to be associated with historical Refinery operations and the north process sewer (decommissioned in June 2011).

A Preliminary Site Investigation (PSI) and a Detailed Site Investigation (DSI) were performed at the Site in June 2010 and April 2011, respectively (URS 2011a). The PSI and DSI determined that the NAPL seeps emanated from the sediment near the contact between the overlaying beach sand and underlying colluvium, near the high tide line at the base of the Canadian Pacific Railway Right-of-Way (CPR ROW) slope. The DSI along with various Human Health and Ecological Risk Assessments (HHERA) (SLR 2014 and 2016) identified the following COCs: volatile petroleum hydrocarbons (VPH), light and heavy extractable petroleum hydrocarbons (LEPH/HEPH), polycyclic aromatic hydrocarbons (PAHs), and copper, in sediment.

Following the DSI, Interim Remedial Action (IRA) Barriers, comprised of a sand-organoclay mixture and a CETCO Reactive Core Mat (RCM) were constructed and installed in the Western Seep Area (WSA) and Eastern Seep Area (ESA) in February and March 2011 (URS 2011b). Confirmatory sediment “excavation limit” samples were collected from the base and sidewalls of the trench excavated at the Site during the DSI. Details of the IRA Barrier installation are included in URS’ Foreshore Interim Remedial Action report (URS 2011b). In November 2011, an assessment of petroleum hydrocarbon (PHC) concentrations and NAPL saturation was completed in and down slope of the IRA Barriers. Based on the results of this assessment, the Eastern IRA Barrier was refurbished in March and April 2012

by removing the sand in the down slope anchor trench and replacing it with sand-organoclay. Confirmatory sediment excavation limit samples were collected from the base and some of the sidewalls of the refurbishment trench. The Western IRA Barrier did not require refurbishment. The extents of the IRA Barriers are shown in Figure 2.

In February and March 2013, an investigation assessed the extent of PHC in sediment in the area between the ESA and the WSA, labelled as the In-Between Area (IBA). None of the sediment samples collected contained concentrations of COCs above the applicable standards. Details of the IBA investigation are included in URS' Foreshore 2013 First Semi-Annual Monitoring Report (January-June 2013) (URS 2014).

In March 2014, a second assessment of PHC concentrations and NAPL saturation was completed within and down slope of the IRA Barriers. Concentrations of PHCs were reported above the applicable standards in the sand-organoclay samples collected from within the Eastern and/or the Western IRA Barriers. Details of the investigation are included in AECOM's Foreshore 2014 Annual Monitoring Report (AECOM 2016a).

AECOM completed air, porewater and surface water monitoring and sampling in the ESA and WSA from 2011 to 2017. Details of the monitoring and sampling from 2011 to 2016 are included in eight reports completed by AECOM (URS 2011a, URS 2013b, URS 2013c, URS 2014, URS 2015, AECOM 2016a, AECOM 2016e, and AECOM 2017b). The monitoring and sampling from 2017 has not yet been formally reported.

Additional information on the background of the Site, including summaries of investigations, remedial activities and a list of monitoring reports, is presented within Appendix A.

3.1 FPTS Design Basis

The Remedial Action Plan (RAP) gives the basis of design for the FPTS (AECOM 2016b). The FPTS is designed with built-in redundancy, or "belt-and-suspenders", and contingency. The following factors provide redundancy or over-design:

- The samples of contaminated water, upon which the design testing and calculations were based, were taken from wells at the Refinery because elevated LEPHw concentrations were not able to be found at the Foreshore or even up gradient at the railroad;
- Based on a conservative estimate of the quantity of NAPL entering the FPTS and the ability of organoclay to absorb NAPL, the mass of Aquagate+Organoclay (AG+OC) exceeds the minimum mass required to absorb a 30 year flow of NAPL by a factor of seven;
- Based on a conservative estimate of the concentration of dissolved LEPHw entering the FPTS and the ability of activated carbon to absorb LEPHw, the mass of Aquagate+Powdered Activated Carbon (AG+PAC) exceeds the minimum mass required to absorb a 30 year flow of dissolved LEPHw by a factor of 4 to 46 times;
- NAPL has not been observed in the IRA Barriers since September 2011, and NAPL was not observed during the IRA demolition or FPTS construction;
- Surface water sheens observed within the boom have been rare and have not been observed since March 2015; and
- Up gradient remedial systems are precluding the movement of NAPL past the Refinery property.

As a contingency, a French drain system allows for nutrients or other components to be added to the FPTS. Given all these items, AECOM and Parkland believe the FPTS provides a reliable remedy to impacts at the Site resulting from the seeps. From an ecological benefit perspective, the additional boulders and cobbles provide habitat conditions consistent with the surrounding Foreshore.

4. Objectives

The purpose of the FPTS is to prevent migration of NAPL and associated COCs from reaching Burrard Inlet at the Site. The objectives of the construction were as follows:

- Excavation and removal of the existing Eastern and Western IRA Barriers as well as any additional impacted sediment identified during construction activities;
- Installation of a FPTS in the ESA;
- Evaluation of the WSA and, if found to be impacted, installation of a FPTS; and
- Completion of an effective and timely installation that can withstand extreme tidal fluctuations and winter storms.

As indicated in the Introduction, one of the objectives of this report is to meet several conditions in the VFPA Permit 16-180 (Appendix C). Portions of this comprehensive post-construction report meeting or contributing to various conditions are as follows:

- Condition 40, Record Drawings – Appendix G
- Condition 41, Photos and Survey Plan – Appendix D, Appendix G
- Condition 42, A comprehensive report that includes:
    - Information about Contamination onsite – Sections 9.1.1, 9.1.3, and 11.1, Tables 2 and 3, and Figures 3 and 4.
    - Summary of Environmental Monitoring – Section 7.3, Appendix F.
    - Copies of all manifests – Section 10, Appendix I.
    - A Post-Construction Monitoring Plan – Section 13, Appendix K.

5. Scope of Work

5.1 Original Scope of Work

AECOM's scope of work for the FPTS included the following:

- Development of a Construction Environmental Management Plan (CEMP) for the construction of the FPTS;
- Providing environmental monitoring and technical support to Tervita during decommissioning and removal of the previously installed IRA Barriers and the installation of the FPTS;
- Completion of three Site inspections prior to construction to identify potential bird nests, rare or endangered plants, and/or wildlife;
- Ensuring the FPTS were installed to the designed requirements as detailed in the issued for construction (IFC) drawings and that all requirements within the CEMP were met;
- Ensuring Tervita, was aware of and adhered to all conditions included in Vancouver Fraser Port Authority (VFPA) Project Permit No: 16-180;
- Monitoring for hydrocarbon vapours during installation using a flame-ionization detector (FID), and observe visually for NAPL and other physical evidence of contamination;
- Completing daily surface water field parameter monitoring throughout the day using a YSI multimeter and Hach turbidimeter to monitor for any impacts to the receiving environment during construction activities;
- Collecting excavation limits soil samples (including blind duplicates) from the base and sidewalls of the excavations and within the barrier system trenches and extremities to be analyzed for the following chemical

analysis: benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary-butyl ether (MTBE), volatile petroleum hydrocarbons (VPH), light/heavy extractable petroleum hydrocarbons (LEPH/HEPH), extractable petroleum hydrocarbons (EPH(C10-C19)/EPH(C19-C32)), polycyclic aromatic hydrocarbons (PAHs), and metals;

- Comparing excavation limit sample analytical results to the most stringent of the applicable Contaminated Site Regulation (CSR) matrix and generic numerical soil standards for Urban Park (PL), and numerical sediment standards (typical and sensitive) for marine environments;
- Conducting visual inspections of the FPTS at regular intervals during construction to monitor the performance; and
- Preparing this report, summarizing work performed and discussing the results of the confirmatory analytical data collected during FPTS construction activities.

Key components of completed construction activities, field methods and observations, and laboratory analytical data are described in the following sections of this report.

5.2 Additional Tasks Added in the Scope of Work

Additional tasks added to AECOM's original scope of work included the following:

- Update IFC Drawings to include a FPTS in the WSA.

6. Site Description

The Site is located on the southern shore of Burrard Inlet, north of Area 2 of the Refinery (Figure 1). The former NAPL seeps at the Site were located at the base of a north facing benched slope. NAPL has not been observed in monitoring wells at the Site since September, 2011. The upper portion of the slope (Upper Bench) is located within the Refinery fence and is the northern berm of the Eastern Impounding Basin (EIB). The topography north of the fence line drops sharply but flattens out at a Lower Bench which is located 10 metres (m) north of the Refinery fence line in the vicinity of the Refinery property line. The topography continues to drop past the Lower Bench to a pair of CPR railway tracks. There is a steep downward embankment north of the railway tracks onto the Site. The total drop in elevation from the Upper Bench to the high tide line of the Site is approximately 17 m. The intertidal zone at the Site then slopes more gently down into Burrard Inlet. The Site, established for the purposes of PSI, DSI, IRA installations and refurbishment, and subsequent Foreshore monitoring activities, is approximately 100 m wide from east to west.

6.1 Geology

According to the Geological Survey of Canada Map 1484A, Surficial Geology of New Westminster, BC, the Site is located in an area of raised marine, deltaic and fluvial deposits (Capilano Sediments) comprised of poorly sorted sand and gravel formed during the Pleistocene. The sand and gravel is underlain by glacial drift deposits (Vashon Drift and Capilano Sediments) comprised of lodgment and minor flow till, lenses and interbeds of sub-stratified drift (sedimentary materials deposited directly from the ice or melt water of a glacier) overlying the Tertiary bedrock.

The Site's southern boundary with the CPR ROW is located at the high tide line and is near the bottom of an approximately four metre high, steeply sloping embankment, covered with rip-rap. The rip-rap generally consists of boulders between 0.25 to 0.75 m in diameter, with scattered pieces up to 2 m in length. The surface of the Site is composed of fine to coarse sands with some silts and gravels. Visual estimates indicate about 15 to 20 percent of the surface of the Site is made up of 0.25 m or larger rock fragments; 5 percent of 0.25 to 0.1 m rock fragments; with the remaining being sands and silts. Beneath the rip-rap and beach sand, the underlying sediments are a mixture of weathered colluvium, underlain by colluvium, followed by till.

6.2 Tidal Effects

The local tide fluctuates from approximately 0.5 to 4.5 m above the local datum. During low tides of 0.5 m, approximately 25 m of foreshore at the Site is exposed between the NAPL seeps (toe of the rip-rap slope) and the tidal water line. During the FPTS construction, all work occurred during low to moderate tide levels.

7. Regulatory Context

7.1 Stage 11 Housekeeping Amendments

The British Columbia Ministry of Environment and Climate Change Strategy (ENV) approved the Stage 10 Amendment (Omnibus) to the Contaminated Sites Regulation (CSR) on October 27, 2016. The Omnibus amendment updated over 8,500 environmental quality standards and came into effect November 1, 2017. Since the introduction of the Omnibus, five Errata updates have been issued (Versions 1 - 5) with the most recent amendment being the Stage 11 (Housekeeping) Amendment, which came into force on November 1, 2017.

The Stage 11 Amendment included updates to all existing soil, water, vapour, and sediment standards to reflect contemporary science and have simplified the formatting and consolidation of the existing CSR schedules into four new schedules:

- Schedule 3.1 – Part 1, Matrix Numerical Soil Standards;
- Schedule 3.1 – Part 2, Generic Numerical Soil Standards to Protect Human Health;
- Schedule 3.1 – Part 3, Generic Numerical Soil Standards to Protect Ecological Health;
- Schedule 3.2, Generic Numerical Water;
- Schedule 3.3, Generic Numerical Vapour Standards; and
- Schedule 3.4, Generic Numerical Sediment Standards.

7.2 Applicable Screening Standards For Sediment

All particulate matter samples collected at the Site were considered to be sediments, as opposed to soil, because they are collected in an inter-tidal, marine environment. According to the ENV's Technical Guidance 15, Concentration Limits for the Protection of Aquatic Receiving Environments, sediments in the upper one meter of an aquatic receiving environment are separated into those for sensitive (SedSSS) and typical (SedSTS) sediments based on the level of protection needed to support the designated uses of the ecosystem and ministry sediment management objectives (ENV 2017). Based on the ENV's January 24, 2011 letter, sediment samples collected in the upper 1 m below ground surface (bgs) were compared to (former) CSR Schedule 9 sensitive sediment criteria to assess potential risk to marine aquatic receptors.

Sediment samples collected within the upper 1 m of sediment during construction of the FPTS were compared against Schedule 3.4: Generic Numerical Sediment Standards for SedSSS in marine and estuarine environments. As per ENV's Technical Guidance 15, sediment samples collected from below 1 m bgs were compared to SedSTS standards.

In the event that standards for a COC were not included in Schedule 3.4, sediment samples were compared to the most stringent of the following soil standards: Schedule 3.1 Part 1: Matrix Numerical Park Land (PL) Soil Standards, Schedule 3.1 Part 2: Generic Numerical PL Soil Standards to Protect Human Health; or Schedule 3.1 Part 3: Generic Numerical PL Soil Standards to Protect Ecological Health.

One of the new standards introduced as part of the Stage 11 Amendment to the CSR, is for 2-methylnaphthalene, a polycyclic aromatic hydrocarbon, in Schedule 3.1 (soil) and Schedule 3.4 (sediment).

Although the construction of the FPTS altered the surface elevation through the addition of rip rap, the rip rap installed is between 0.25 and 0.75 m in diameter. This creates a very porous media which does not inhibit contact of sediments with the aquatic biota. Thus it is appropriate that the sediment samples taken prior to FPTS construction be compared to the SedSSS.

Further information on the regulatory context of the Site is presented in Appendix B.

8. Field Program Methodologies

8.1 Installation of Foreshore Passive Treatment System

The installation of the FPTS consisted of two key components:

1. Excavation and removal of the existing Eastern and Western IRA Barriers; and
2. Installation of the FPTS.

All work was completed at the toe of the CPR ROW rip-rap embankment located at the high tide line of the Site as shown in Figure 5 and in photos 1 and 13 in Appendix D. All construction activities at the Site occurred from July 10 to October 30, 2017. During construction, both Tervita and AECOM followed all conditions outlined in VFPA Permit No: 16-180. Due to unfavorable tidal windows, an amendment was made to VFPA Permit No: 16-180 to allow for night work, which occurred from October 2 through October 21, 2017. The VFPA permit, related email correspondence and night work amendment are provided as Appendix C.

Remedial construction activities were completed during low tides and consisted of the following sequence of events. A photo log showing the IRA Barrier's decommissioning and installation of the FPTS is provided as Appendix D. Equipment and materials used during construction are listed in Appendix L.

8.1.1 Site Preparation

- Prior to excavation activities, three baseline survey data points were collected on the up gradient CPR ROW. Surveying was completed by Peter Smith of PS Surveys to ensure excavation activities adjacent to the CPR ROW embankment did not compromise the integrity of the CPR railway. Surveying continued throughout the program any time excavation activities occurred. Yadav Pathak, P.Eng., of AECOM was onsite for slope stability monitoring and technical support;
- To allow safer access and egress, vegetation was trimmed throughout the footprint of the FPTS along the toe of the CPR ROW embankment. All efforts were made to keep a healthy strip of continuous vegetation above the work area and below the CPR tracks. Trimming was performed by hand and with the use of power tools, and all trimmings were taken offsite for disposal;
- A safe work area was established in the FPTS area by clearing rip-rap within the tidal zone to provide safe access for heavy duty equipment; and
- Following vegetation clearing all rip-rap was removed from the surface of the Eastern and Western IRA Barriers.

8.1.2 Sediment Sampling and Field Observations

During excavation activities, all sediment samples were collected with the use of a decontaminated Teflon spoon, placed on ice and submitted to ALS Laboratories (ALS) for analysis of:

BTEX/VPH, LEPH/HEPH, EPH(C10-C19)/EPH(C19-C32), PAHs, MTBE and metals.

Sediment samples were collected in the following manner:

- Collection of confirmatory sediment limit samples (along the base and side walls) approximately every 5 m horizontally and every 1 m vertically to ensure all contamination was removed; and

AECOM visually assessed the excavation limits for staining and collected samples based on staining, headspace vapours and/or odours. If contamination was suspected, the excavation was extended to achieve clean limits except along the southern sidewalls to preserve the integrity of the CPR ROW. Each day, all excavated material was placed in supersacs (1 m3 soil bags) by Tervita and brought onto the barge for later offsite disposal.

8.1.3 Subsurface Components

Refer to Record Drawings presented in Appendix G and photos in Appendix D.

- The Eastern and Western IRA Barriers were each excavated in 5 to 10 m segments at a time with the following general trench dimensions - down slope treatment cell of 1.4 m in width by 1.2 m in depth and up slope treatment cell of 1.4m in width by 1.0 m in depth;
- Following sediment sampling, each 5 to 10 m length of trench installation was completed in the following manner:
  - Plywood forms were laid across the eastern and western edges of the excavation and across the length of the centre of the excavation to separate and contain the up slope and down slope subsurface treatment cells to be backfilled (refer to photo 3 in Appendix D);
  - Subsurface components were then installed into the trench, consisting of French drains (4” Schedule 80 PVC both with and without 0.25 millimetre (mm) slot size) and performance monitoring wells (2” Schedule 40 PVC);
  - Prior to backfilling, three rows of high density polyethylene (HDPE) baffles were placed - one in the up slope, one in the down slope treatment cell, and one between the two cells. Plywood was used to reinforce the baffles during installation, but was removed from the baffles once the trenches were backfilled. The purpose of the baffles is to increase the length of the flow path for groundwater entering the FPTS, thereby using the absorbent materials more efficiently;
  - Both up slope and down slope treatment cells were backfilled with the appropriate materials. The up slope cells were composed of a mixture of 75% Lafarge washed sand and 25% AG+OC. The down slope cells were composed of 75% Lafarge washed sand and 25% AG+PAC. The treatment cells were compacted to a minimum of 90% modified proctor density, being careful not to damage the sub surface components during backfilling and compaction (refer to photo 4 in Appendix D) ;
  - If backfilling was unable to be completed on the same day, then supersacs of clean gravel were temporarily placed within the excavation. Polyethylene sheeting was placed on the surface of the excavation at the end of each day to minimize tidal erosion;
  - As a portion of the treatment cell was completed (backfilled and compacted), a plywood blind was placed at the end of the completed section within the trench to prevent sloughing of materials at the end of the work day. This blind was removed the following day at the start of the excavation to connect the treatment cell sections to one other;
  - Each end of the horizontally laid 4” drainage PVC piping was temporarily capped with filter fabric at the end of the work day. The filter fabric was removed prior to connecting the PVC piping to the next section as the excavation progressed;
  - Plywood forms were removed once an area was backfilled and compacted to the appropriate standards; and
  - At the ends of each trench, a 0.5m long layer of Aquablok was placed.

8.1.4 Above Ground up Slope Components

- As sections of the treatment cells were backfilled and compacted, the GSE HD Textured High Density Polyethylene Geomembrane (HDPE geomembrane) followed by the Nilex 4510 non-woven geotextile filter fabric (filter fabric) were placed on the surface with small holes cut through the materials to allow the French drains and Performance Wells to penetrate through;

- The overlapping geomembrane was sealed with an AECOM approved mouldable double-sided sealant tape (3M M50RC Black)[1]. Prior to using the double sided tape, the overlapping areas were cleaned of debris, and a heat gun was used to dry the area of application. All other layers (i.e. filter fabric, etc.) were overlapped by 500 millimeters (mm) to ensure no gaps existed in the materials;
- A 150 mm layer of gravel was spread on the surface of the filter fabric to enhance support for the concrete protector casings and anchoring of rip-rap;
- Prior to placing the concrete protectors, square concrete forms were created (using plywood as the forms) to provide a strong and flat base for the concrete risers to sit on (refer to photo 8 in Appendix D);
- Using the excavator, concrete protectors were then set into place (providing protection for all the 4" French drain and/or 2" Performance Wells) and rip-rap was then placed on the surface to anchor all the components;
- Due to the height of the rip-rap, the concrete protectors were extended to allow the rip-rap to be built up around the 4" French drain and 2" Performance Wells;
- CPR embankment components were completed independently of the above:
  - A mixture of 75 % Lafarge washed sand and 25 % AG/OC was initially spread over the existing rip-rap;
  - Followed by the sequential placement of Tendrain II Oleophilic Biobarrier (OBB), Nilex Bx1100 Biaxial Geogrid (geogrid), HDPE geomembrane, and filter fabric.

Prior to the final placement of gravel and rip-rap, the multiple layers (OBB, geogrid, HDPE geomembrane and filter fabric)were temporarily anchored to the CPR embankment by tying rope to tree branches on the upper portions of the CPR slope:

- A 150 mm layer of gravel was then placed on the surface of the filter fabric (both on top of the treatment cells and CPR embankment), followed by the gradual placement of rip-rap. This gravel layer was continuous, extending from the initial placement of gravel above the treatment cells;
- In order to drill the Up Gradient Wells, rip-rap was not placed in the areas surrounding the wells locations. Small pads consisting of gravel and cobbles were created as a temporary working platform for the drill rig; and
- Following completion of all above ground components (up slope and down slope), a small layer of granular activated carbon was then placed along the entire length of the FPTS below the upper seam where the HDPE geomembrane approaches the CPR embankment.

8.1.5 Above Ground Down Slope Components

8.1.5.1 Down Slope Rip-Rap Embankment

- Upon completion of the up slope components discussed above, the down slope rip-rap embankment was excavated to an approximate depth of 0.6 m bgs to allow anchoring of the OBB, geogrid and filter fabric for final placement of rip-rap. Typically 10 m sections were excavated at a time to ensure the following sequence of events could be completed in a single tide window;
- After the down slope rip-rap embankment was excavated to the desired depth, surface layers were placed on the ground surface in the following order: OBB, geogrid, and filter fabric; and
- After inserting the surface layers, rip-rap was then placed at a general 2:1 slope throughout the entire FPTS (both east and west) from the most up gradient extent of the CPR embankment (where surface layers were laid) to the down slope portion of the rip-rap embankment.

8.1.5.2 Downslope Cobble Matting

- The Site was then excavated out in 10 to 20 m length sections approximately 0.4 m deep, followed by the placement of OBB, geogrid, and filter fabric with cobbles placed above to anchor the materials in (refer to photo 9 in Appendix D); and
- Excavated beach sand from the down slope rip-rap and cobble surface preparation was spread over the cobble mat and rip-rap.

[1] The approved mouldable double sided sealant tape did not contain volatile organic compounds.

8.2 Drilling Activities and Monitoring Well Installations

A summary table of well installation details is provided in Table 1 and the borehole logs are provided as Appendix E. All 33 monitoring wells were installed using 50 millimeter (mm) diameter Schedule 40 PVC pipe casing with either PVC or stainless steel screens. The connections between the PVC and the stainless steel screens was completed with threaded joints and/or couplers connecting the PVC piping. Twenty (20) of 33 wells were installed using PVC 0.25 mm slot screen size and 20/40[2] filter sand. The remaining eight Performance Wells (within the treatment cells) and five of the nine down slope Compliance Wells were installed using stainless steel pre-packed screens pipe 0.25 mm screens prepacked with 20/40 filter sand. See borehole logs provided as Appendix E and Table 1.

The 16 - 4" French drains and eight Performance Wells in the treatment cells were installed during excavation activities, in which the eight Performance Wells were set into place prior to backfilling the cells with an excavator. All 25 remaining wells (8 Up Gradient, 8 Sentry, and 9 Compliance) were installed post trench construction using a Bobcat mounted with a 1 m length solid stem 8" diameter auger bit.

With the exception of the eight Performance Wells installed within the treatment cells (backfilled with sand and AG+OC or AG+PAC mixtures, refer to borehole logs provided as Appendix E), and the five Compliance Wells installed using stainless steel, the annulus of the remaining wells were backfilled in the following sequence:

- Silica sand filter pack placed approximately 0.5 – 0.15 m above and below the screened interval (the degree of sloughing reflected the amount of sand pack placed above and below the screen);
- A bentonite seal at least 0.3 m in thickness placed above the filter pack to hydraulically isolate the screened interval;
- When specified in IFCs, a 150 mm layer of gravel was placed on top of the bentonite seal to support the concrete protectors; and,
- Monitoring wells were completed with J-plugs and enclosed by a custom made concrete protector casing provided by Langley Concrete; eight concrete protectors and six original concrete protectors were extended (variance from the IFCs).

Generally, wells were screened between 0.45 and 1.2 m bgs with a 0.3 m length screened interval and in some instances a 0.36 m length screen (stainless steel prepacked screens). Details are as follows and presented in the MMP contained in Appendix K:

- The four Performance Wells (PW17-5, PW17-17, PW17-22, and PW17-27) located in the up slope treatment cell were installed at 1.0 m bgs and screened from 0.64 to 1.0 m bgs, whereas the four Performance Wells (PW17-6, PW17-18, PW17-23, and PW17-28) located in the down slope treatment cells were installed at 1.2 m bgs and screened from 0.84 to 1.2 m bgs; and
- Four Up Gradient Wells (PW17-4, PW17-16, PW17-21, and PW17-26) were installed following completion of the above ground up gradient components. These wells were installed to 0.8 m bgs and screened from 0.45 – 0.75 m bgs;

The remainder of the 21 Up Gradient, Sentry and Compliance Wells were installed after all the above ground components were completed. In order to properly anchor the concrete protectors in place (0.75 m height), a 0.4 m deep trench was excavated into the surface. Generally, these locations were drilled to 1.4 m bgs and screened from 0.85 – 1.15 m bgs.

All concrete protectors surrounding the monitoring wells were either filled in with concrete grout, gravel, and/or native beach sand.

8.3 Environmental Monitoring

Prior to vegetation trimming and construction, AECOM completed three Site inspections on May 3, June 30 and July 7, 2017 to identify potential bird nests, rare or endangered plants or wildlife, in proximity of the construction. Bird nests, rare endangered plants and wildlife were not identified during the three inspections.

[2] 20/40 Sand passes a #20 sieve but is captured on a #40 sieve. The sand has a nominal diameter between 0.42 and 0.84 mm.

During the course of the project, AECOM was responsible for enforcing all requirements of the CEMP and VFPA Project Permit No: 16-180. One of the key requirements of Project Permit No: 16-180, was the continuous monitoring of surface water field parameters (including temperature, pH, conductivity, and turbidity) both inside and outside the construction zone. At a minimum, AECOM measured these water quality parameters three times a day.

The weekly VFPA reports and environmental monitoring data are presented in Appendix F. Water quality parameters were generally stable throughout the course of the project with the occasional turbidity and temperature reading exceeding the applicable BC Approved Water Quality Guidelines (WQG). Any time a water quality parameter fell outside the desired range (i.e. turbidity), the crew was informed and mitigative measures were immediately implemented, when feasible. During construction, there were approximately 91 turbidity measurements, 33 temperature measurements, and five pH measurements, which were outside the desired ranges. Generally, elevated turbidity measurements were the result of anthropogenic sources outside the footprint of the FPTS construction zone (i.e. large waves from passing watercrafts). When this was the case, a follow up turbidity reading was collected to show that turbidity had decreased since the last measurement. Generally, mitigative measures consisted of minimizing unnecessary heavy duty equipment traffic, ensuring all equipment was operating as far away from the tide line as possible, and ensuring the barge was secured and not prone to shifting. Temperature and pH measurements outside the desired ranges were likely attributed to natural variations associated with the tide.

As the FPTS construction area is situated near a known archeological site (DhRr-0230) and per conditions 23 and 24 of VFPA Permit No: 16-180, a qualified archeologist and cultural monitor from Inlailawatash (a company of the Tsleil-Waututh Nation) were onsite during ground disturbance activities into native soils. During the course of the project, no cultural artifacts were identified.

AECOM submitted weekly update reports to the VFPA outlining all construction activities, volumes of soil and groundwater removed offsite, water quality data, environmental incidents, and any other notable activities. No environmental incidents occurred during the course of the project.

8.4 Field Changes Made To the Work Plan

Generally, the proposed work plan was carried out in the field as planned, with a few notable exceptions:

- Based on field observations and concentrations of LEPH detected in sediment samples (WSA-2 and WSA-3) collected from the south wall of the Western IRA Barrier excavation, a FPTS was constructed and installed in the WSA;
- Prior to receiving authorization to complete the FPTS in the WSA, the excavation was temporarily backfilled with native soil which was then disposed of once construction activities began;
- Due to the extended field program, an amendment was made to VFPA Permit No: 16-180 (provided as Appendix C) which authorized night work from Monday to Saturday, 12:00am – 7:00am. This working window was utilized to successfully complete the program; and
- Due to the sequence of excavation activities, there were circumstances when the excavation had to be temporarily infilled with supersacs of clean gravel.

9. Field Observations

Notable field observations recorded during construction are summarized below:

- During the removal of the Eastern and Western IRA Barriers, as expected, the majority of the excavated sand-organoclay contained staining and/or hydrocarbon odours to varying degrees (based on the location within the Barriers) indicating the effectiveness of the IRA Barriers in trapping petroleum hydrocarbons. If staining was observed at the limits of either of the two excavations, the excavator operator was instructed to scrape away additional materials to achieve clean limits except along the southern sidewalls to preserve the integrity of the CPR ROW;

- Hydrocarbon sheens were not observed in Burrard Inlet during construction activities;
- During the installation of monitoring well PW17-14, an oily film was observed in water seeping out of the upper surface at approximately 0.3 m bgs; and
- NAPL was not observed during the IRA demolition, limit sampling or FPTS construction.

10. Analytical Results

From July 4 to October 2, 2017, 106 sediment samples (including five duplicates) were collected during the construction of the FPTS. Sediment samples were analyzed for BTEX/VPH, LEPH/HEPH, EPH(C10-C19)/EPH(C19-C32), PAHs, MTBE, and metals. Two samples were also collected for EPH(C10-C19)/EPH(C19-C32) with silica gel cleanup. All sediment analytical results are provided in Tables 2 through 4 and limit sample locations are presented in Figures 3 and 4. Copies of the 2017 analytical laboratory reports are provided in Appendix H.

Results of the sediment analytical data are discussed below.

10.1 Sediment Analytical Results

10.1.1 Eastern IRA Barrier – Limit Samples

Concentrations of petroleum hydrocarbons (PHCs), PAHs, and metals in sediment limit samples collected from the Eastern IRA Barrier were either below the reported detection limits (RDL) or the applicable standard in 31 of 36 samples. The remaining five samples (ESA-9, ESA-13, ESA-23, ESA-29 and ESA-30) collected from the base or southern wall contained concentrations of 2-methylnaphthalene and/or naphthalene above their applicable standards. The five samples containing 2 methylnaphthalene had concentrations slightly above the applicable standards, and within the same order of magnitude as the standards. The one elevated naphthalene sample (ESA-9) was collected from 1 m below ground surface, and contained a concentration (0.377 µg/L) slightly above the SedSSS standard applicable to the EAZ, but below the SedSTS standard.

10.1.2 Eastern IRA Barrier – Disposal Samples

Concentrations of PHCs, PAHs, and metals in sediment samples collected during the removal of the Eastern IRA Barrier were either below the RDL or the applicable standard in 25 of 31 samples. The remaining six samples (EIRA-6, EIRA-15, EIRA-16, EIRA-25, DUP-5, and EIRA-26) contained concentrations of EPH(C10-C19)/EPH(C19-C32), LEPH/HEPH, VPH, benzene, ethylbenzene, toluene, xylenes and/or PAH constituents (fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and/or pyrene) above their applicable standards. All materials represented by these samples were removed from Site and disposed of in accordance with applicable regulatory requirements.

10.1.3 Western IRA Barrier – Limit Samples

Concentrations of PHCs, PAHs, and metals in sediment limit samples collected from the Western IRA Barrier were either below the RDL or the applicable standard in 15 of 17 samples. The remaining two samples (WSA-2 and WSA-3) collected from the southern wall contained concentrations of EPH(C10-C19) both with and without silica gel cleanup[3] and LEPH, above but within an order of magnitude of their applicable standards.

10.1.4 Western IRA Barrier – Disposal Samples

Concentrations of PHCs, PAHs, and metals in sediment samples collected during the removal of the Western IRA Barrier were either below the RDL or the applicable standard in all three samples collected. All materials represented

[3] The with and without silica gel cleanup $EPH_{(C10-C19)}$ concentrations were not significantly different in these two samples.

by these samples were removed from Site and disposed of in accordance in accordance with applicable regulatory requirements.

10.1.5 Up Gradient Sediment Samples

Concentrations of PHCs, PAHs, and metals in sediment samples collected during the installation of the four Up Gradient Wells (PW17-4, PW17-16, PW17-21 and PW17-26) were either below the RDL or the applicable standards in all five samples collected from the four locations.

10.1.6 Backfill Sediment Samples

Concentrations of PHCs, PAHs, and metals in samples of backfill material were either below the RDL or the applicable standards in all 14 samples collected.

11. Offsite Disposal of Materials

11.1 Sediment

During the FPTS construction, all sediment and demolition refuse were contained in Tervita provided supersacs and disposed of offsite at Tervita's Richmond Bioremediation facility. Sediment, once it is taken offsite for treatment and/or disposal is considered soil. Copies of the manifests are provided in Appendix I and Table A below summarizes quantities of materials disposed of offsite.

Table A - Materials Disposed Offsite

Material Type	Waste Class1	Weight (Tonnes)
Soil	CL+	103
Soil	RL+	367
Demolition Refuse	Not Applicable	16

CL+ - Exceeds CSR commercial land use standard
RL+ - Exceeds CSR residential land use standard
[1] None of the soil disposed offsite was characterized as below residential land use standards.

11.2 Groundwater

During the FPTS construction, all water pumped from the excavation was contained in large holding tanks and later disposed of at Tervita's Richmond Bioremediation facility. Copies of the bill of lading are provided in Appendix I. Table B below summarizes quantities of water disposed of offsite.

Table B – Water Disposed Offsite

Material Type	Waste Class	Quantity (L)
Groundwater	Groundwater with trace BTEX	170,000

12. Discussion

12.1 Distribution of Exceedances

An exceedance refers to concentrations of PHCs and/or PAHs that were greater than applicable standards. The following samples contained exceedances which are discussed below:

Two limit samples (WSA-2 and WSA-3) from the southern wall of the excavation of the Western IRA Barrier and five limit samples (ESA-9, ESA-13, ESA-23, ESA-29, and ESA-30) from the base and southern wall of the excavation of the Eastern IRA Barrier contained concentrations of PHCs or PAHs above the applicable standards. These samples were either located on the base or southern sidewalls of the excavations and due to their close proximity to the CPR Zone of Potential Training Loading (ZPTL), over excavation was not feasible due to safety and slope stability concerns. Any migration of these impacts is anticipated to be intercepted by the FPTS since the impacts are up gradient or below the treatment cells. The five samples containing 2 methylnaphthalene, and the one of these containing naphthalene, had concentrations slightly above the applicable standards, and within the same order of magnitude as the standards.

Six sediment disposal samples collected from within the Eastern IRA Barrier contained concentrations of PHCs and/or PAHs above the applicable standards. Elevated concentrations within the Eastern IRA Barrier are not unexpected as the barrier was designed to trap NAPL within the sand-organoclay.

All backfill samples were below applicable standards.

12.2 Variations from Issued-For-Construction Drawings

During the construction of the FPTS, there were construction variations to the project that had to deviate from the IFC drawings. The deviations were proposed by Tervita and approved by AECOM, prior to implementation in the field. These changes were generally the result of adapting to dynamic and challenging field conditions, and the use of alterative approved materials. The final record drawings including any red line markups (discussed below in Table C) were provided by Tervita which are included in Appendix G. The variations from the IFC drawings are summarized below in Table C.

Table C –Variations from IFC

Design Component	Comments
Alternative material - Oleophilic Biobarrier (OBB)	While constructing the down slope cobble mat, Tervita experienced a shortage of the Tendrain II Oleophilic Biobarrier material (GSE Tendrain 7.6mm Geocomposite). Because of the extended lead time required to order more of this material, an alternative similar material was sourced (Skaps Transnet HDPE Geocomposite with TN 330 Geonet) and used on portions of the down slope cobble matting in both the east and west systems. See Drawing G-C-102.
Cobble matting design change	Due to shortages of the alternative OBB material, the cobble matting did not extend as far out from both FPTS's on the eastern and western edges. Rather than curve with the shape of the rip-rap (as shown on the IFC drawings), dimensions of the cobble matting was more rectangular in shape. See Drawing G-C-101.
Infilling of monitoring wells	IFC drawings indicated that all of the monitoring wells were to be infilled with non-shrink grout. Due to the excessive time involved with mixing and pouring the grout (during limited tidal windows), many of the monitoring wells (Compliance, Sentry, Performance and Up gradient) had their concrete protectors infilled with gravel, native beach sand, and/or cobbles to supplement the non-shrink grout. See Drawing G-C-401.

Design Component	Comments
Alternative screens - Compliance wells	Due to the tidal windows not dropping low enough during the installation of several of the Compliance Wells, five of the down slope Compliance Wells (PW17-8, PW17-11, PW17-15, PW17-20, and PW17-30) were installed using stainless steel wrapped screens prepacked with 20/40 filter sand, rather than the standard 2" Sch 40 PVC - 10 slot screens. During drilling, these boreholes had sloughing and infilling with water; the use of prepacked screens ensured the screen would have a sand pack surrounding it.
Alternative design for concrete protectors	Several concrete protectors were fabricated at the wrong total height when considering the final elevation of the rip-rap slope. Because of the extended lead time required to manufacture new custom protectors (18 days) Tervita completed two alternate designs consisting of: 1) Encapsulating the existing casings in a concrete basin from Langley concrete with a diameter of at least 762mm (Detail E, Drawing G-C-402) or 2) an extended casing with a concrete saddle for support (Detail F, Drawing G-C-402). The high density polyethylene (HDPE) well casings (2" monitoring wells and 4" French drains) were then extended to the top of the new basin
Concrete protector lids	Due to the design changes of the concrete protectors, the larger diameter sewer type lids were retrofitted with rope handles to allow safe lifting of these lids. See Drawing G-C-402.
Alternative moldable sealant for geomembrane	The Splash Zone (specified in the IFC) cured into a hard material, while the geomembrane remained flexible. The difference in elasticity created the concern that the Splash Zone would separate from the geomembrane. As a result, the Splash Zone epoxy was substituted with Tapecoat Moldable Sealant - M50RC Black double sized tape. See Drawing G-C-301.
Height of rip-rap	The height of the rip-rap around the down slope Performance Well concrete protectors was changed from 1.4 m to 1.2 m to reflect variation between the elevations shown in the construction drawings and true field conditions. See Drawing G-C-301.
Gravel placement on top of the filter fabric on the sloped CPR embankment	In order to achieve the 150 mm gravel layer, additional AG/OC was applied to build up the slope and lower the slope angle. A "stepped" approach was also applied to hold the gravel in place better.
Alternative baffle design	Plywood was used to brace the HDPE baffles during installation, but was removed prior to completion of the trenches.
Monitoring wells depth installation.	Many of the monitoring wells were installed and screened at a slightly deeper depth than the IFC drawings. The IFC showed a concrete protector with a height of approximately 0.3 m whereas the actual size was 0.75 m. As a result, a small trench was dug prior to drilling to allow the concrete protector to be properly secured (resulting in a deeper installation to true grade). See Detail 6 on Drawing C-401.

12.3 Status of the Foreshore Passive Treatment System

Construction of the FPTS was completed on October 30, 2017 and the system has been in operation since this day. Since completion, NAPL has not been detected in any of the monitoring wells during well development and monitoring completed in November 2017. Post-construction monitoring will continue to assess the performance of the FPTS.

13. Quality Assurance/Quality Control

In order to assure the integrity and reliability of the data collected, rigorous quality assurance/quality control (QA/QC) protocols were observed. The results of the laboratory analyses were considered to be of good quality and

acceptable for the purposes of this investigation.QA/QC protocols used by AECOM in undertaking the staged investigation and remediation of the Site are presented in Appendix J.

13.1 Precision

Relative percent differences (RPD) are presented with duplicate samples for PHCs, PAHs, and metals in sediment samples in Tables 2, 3, and 4. For evaluating precision, RPDs were only calculated if the duplicate and parent samples had concentrations greater than five times the RDL for the conducted analyses. Throughout the FPTS construction, five samples were duplicated - resulting in 66 calculated RPDs.

The BC Environmental Lab Manual (BCELM) provides data quality objectives for recommended laboratory duplicate RPDs[4]. The ENV has provided guidance indicating that field RPDs within 1.5 times the laboratory RPDs as defined in the BCELM are acceptable[5]. Volatile organics (BTEX/VPH), EPH, and PAHs in sediment therefore have acceptable laboratory RPDs of 60%, 60% and 75%, respectively. Metals in sediment have acceptable RPDs of 60% for high variability metals and 45% for all other metals. Of the 66 RPDs, 65 were within the acceptable range for RPD values. The one RPD that fell outside the acceptable range came from ethylbenzene in sample EIRA-25 (and its corresponding duplicate, DUP-5) which was collected at 0.5 m bgs. This elevated RPD value was likely due to the "nugget" effect and aside from this one sample, sediment RPD ranges indicate good to moderate correlation.

The average, median, maximum and minimum RPDs of the field duplicates are presented in Table D:

Table D - Relative Percent Differences (%) of Duplicate Analyses

Sample Type	Average RPD (%)	Median RPD (%)	Maximum RPD (%)	Minimum RPD (%)
Sediment and Backfill Samples	13.7	8.8	63.5	0.4

As 98% of the RPDs were within the acceptable RPD range and given the low average and median RPD values, the analytical results are considered acceptable and do not add uncertainty to the findings of the field program. It is AECOM's opinion that the analytical results are valid with respect to precision.

13.2 Accuracy

Analytical accuracy was confirmed in a review of percent recoveries reported in the laboratory reports. Percent recoveries are obtained when the project laboratory analyzes samples with known concentrations and compares their analytical results to the known concentrations. The laboratory provided percent recoveries for the majority of the organic parameter analyses. The reported laboratory control spike (LCS) sample recoveries and matrix control spike (MS) sample recoveries for parameters with CSR standards were within laboratory QC limits.

It is AECOM's opinion that the analytical results are valid with respect to accuracy.

13.3 Completeness

No samples were invalidated by ALS. Completeness for all samples collected for this project was 100%.

13.4 QA/QC Mixing Assessment

Prior to backfilling the FPTS trenches with the premixed materials, a QA/QC sieve analysis (ASTM E-11 Standard – Sieve No.8) was implemented to verify that Tervita was appropriately mixing the materials consistent with the RAP and IFC drawings. The backfill materials in the up slope treatment cells were designed to consist of a mixture of 75%

[4] British Columbia Environmental Laboratory Manual (2015) https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/lab-manual/section-a.pdf

[5] Question #36 from the ENV Questions and Answers webpage accessed November 25, 2017. http://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/contaminated-sites/cs_q-a.pdf

Lafarge washed sand and 25% AG+OC. The backfill materials in the down slope treatment cells were designed to consist of a mixture of 75% Lafarge washed sand and 25% AG+PAC.

As the sand and AG/OC and AG/PAC mixtures were being placed in one cubic meter supersacs to store and transport the backfill materials to the Site, representative samples were collected from the top, middle, and bottom of the supersacs.

Prior to sieve analysis, materials were transferred to a bucket to determine the total weight. Once the sieve analysis was completed (fines and coarse materials separated), the percentage of fine materials were calculated. Overall, the average weight of fine materials (sand) was within the acceptable criteria for both types of premixed sand. The average fines weight (%) for the sand mixed with AG/OC was 68.% (acceptable criteria: 64 - 71 %), whereas the average fines weight (%) for the sand mixed with AG/PAC was 63.9% (acceptable criteria: 59 - 68.7 %). If the batches were outside the acceptable criteria, Tervita was then requested to mix in more or less sand to ensure the batches were within the acceptable criteria prior to using onsite. Results of the sieve analysis are summarized in further detail in Appendix J.

14. Post Construction Monitoring

As per condition #42 of VFPA Permit No: 16-180, a Post-Construction Monitoring and Maintenance Plan (MMP) has been prepared (Appendix K).

The objectives of the MMP are to:

- Collect samples from, and present the data for, the Compliance Wells;
- Assess the presence/absence of NAPL and the concentrations of dissolved phase contaminants of concern (COCs) in the water, at the Site;
- Assess the performance of the remedial treatment cells and OBB surface layer installed in 2017; and,
- Maintain the integrity of the FPTS by checking and, where needed, replacing the protective rip-rap, cobbles and monitoring wells, and by managing vegetation as required.

The complete MMP Plan is provided in Appendix K.

15. Summary

This 2017 FPTS Construction Report summarizes activities conducted July 10 through October 30, 2017 along the Foreshore. The objectives of the construction were as follows:

- Excavation and removal of the existing Eastern and Western IRA Barriers as well as any additional impacted sediment identified during construction activities;
- Installation of a FPTS in the ESA;
- Evaluation of the WSA and, if found to be impacted, installation of an FPTS; and
- Completion of an effective and timely installation that can withstand extreme tidal fluctuations and winter storms

As indicated in the Introduction, and Section 3, one of the objectives of this report is to meet several conditions in the VFPA Permit 16-180 (Appendix C). Portions of this comprehensive post-construction report meeting or contributing to various conditions are as follows:

- Condition 40, Record Drawings – Appendix G
- Condition 41, Photos and Survey Plan – Appendix D, Appendix G

- Condition 42, A comprehensive report that includes:
  - Information about Contamination onsite – Sections 9.1.1, 9.1.3, and 11.1, Tables 2 and 3, and Figures 3 and 4.
  - Summary of Environmental Monitoring – Section 7.3, Appendix F
  - Copies of all manifests – Section 10, Appendix I
  - A Post-Construction Monitoring Plan – Section 13, Appendix K.
-

The project was executed by prime contractor, Tervita, in which AECOM field personnel completed environmental monitoring and general field oversight. With a few exceptions, all components of the FPTS were installed consistent with the IFC drawings.

All requirements laid out in the CEMP were followed in addition to all field personnel being aware of and adhering to all conditions in VFPA Project Permit No: 16-180.

A total of 106 sediment samples (including limit, backfill and up gradient) were collected during the installation of the FPTS. Sediment samples were analyzed for BTEX/VPH, LEPH/HEPH, EPH(C10-C19)/EPH(C19-C32) and metals. Seven limit samples contained concentration of PHCs or PAHs greater than the applicable standards; however, due to their close proximity to the CPR ZPTL, over excavation to achieve clean limits was not feasible due to safety and slope stability concerns. Any migration of these impacts is anticipated to be intercepted by the FPTS.

As a result of the introduction of the Stage 11 Amendment to the CSR, 2-methylnaphthalene is considered a PCOC in sediment at the Site. However, it should be noted that 2-methylnaphthalene is not considered a PCOC in porewater or surface water at the Site, as there is no applicable CSR standard for porewater nor a Working or Approved BC Water Quality Guideline for surface water for this constituent.

All excavated soil, pumped water, and demolition refuse were contained and disposed of offsite at Tervita's Richmond Bioremediation facility. Total quantities of materials disposed of offsite are as follows:

- Soil - 103 tonnes of CL+;
- Soil - 367 tonnes of RL+;
- Demolition refuse - 17 tonnes; and
- Groundwater; 170,000 litres.

As per condition #42 of VFPA Permit No: 16-180, an MMP has been prepared which sets out follow up monthly, quarterly, and annual sampling events in addition to maintenance activities. See Appendix K. Since completion of the FPTS, the MMP has been and will continue to be implemented in the field.

16. Report Use and Limitations

The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area, and in accordance with AECOM's standard terms and conditions. No other warranty, expressed or implied, is made. This report is for the exclusive use of Parkland Refining (B.C.) Ltd., VFPA and ENV who may rely upon this report. This report has been prepared in accordance with ENV CSR (2017).

Testing conducted on the Site was in locations and for parameters consistent with the identified contamination for the subject property uses. Furthermore, the sampling was of sufficient quantity and location to provide adequate spatial coverage. However, as conditions between sampling locations may vary, a potential always remains for the presence of unknown, unidentified, or unforeseen surface and subsurface contamination. Further evidence against such

potential Site contamination would require additional surface and subsurface exploration and chemical analytical testing.

Conclusions and recommendations in this report are based on comparison of chemical analytical results to the ENV CSR (2017). In the event these standards are changed, new standards are introduced, or new information is developed in future Site work, AECOM should be contacted to re-evaluate the conclusions of this report, and to provide amendments as required.

AECOM's objective is to perform our work with care, exercising the customary thoroughness and competence of earth science, environmental, and engineering consulting professionals, in accordance with the standard for professional services at the time and location those services are rendered. It is important to recognize that even the most comprehensive scope of services may fail to detect environmental liability on a particular site. Therefore, AECOM cannot act as insurers and cannot "certify" or "underwrite" that a site is free of environmental contamination, and no expressed or implied representation or warranty is included or intended in our reports, except that our work was performed, within the limits prescribed by our client, with the customary thoroughness and competence of our profession.

17. Disclaimers

In the event that this report is provided in electronic format, AECOM is not responsible for uses of the data outside of or beyond the scope of our original agreement with our client. Our paper report represents our official work product. Also, because data stored on electronic media or transmitted by electronic means can deteriorate undetected or be modified without AECOM's knowledge, AECOM is not liable for the compatibility, completeness or correctness of the data.

18. Professional Statement

All information compiled for this document has been prepared in accordance with all requirements of the Environmental Management Act and its Regulations.

AECOM certifies that the persons signing this document have demonstrable experience in the assessment and remediation of industrial sites. The work has been performed by AECOM personnel under the guidance and supervision of the signatories below.

We trust this report meets your current requirements and clarifies the current status of the Site. If you have any questions or would like to discuss the project, please do not hesitate to call the undersigned at 604.444.6400 if you have any questions.

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client (Parkland Refining (B.C.) Ltd.) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and and the qualifications contained in the Report (the "Limitations");
- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been ind ependently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;

- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in th e Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Except (1) as agreed to in writing by AECOM and Client; (2) as required bylaw; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

AECOM accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information (“improper use of the Report”), except to the extent those parties have obtained the prior written consent of AECOM to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2015-04-13

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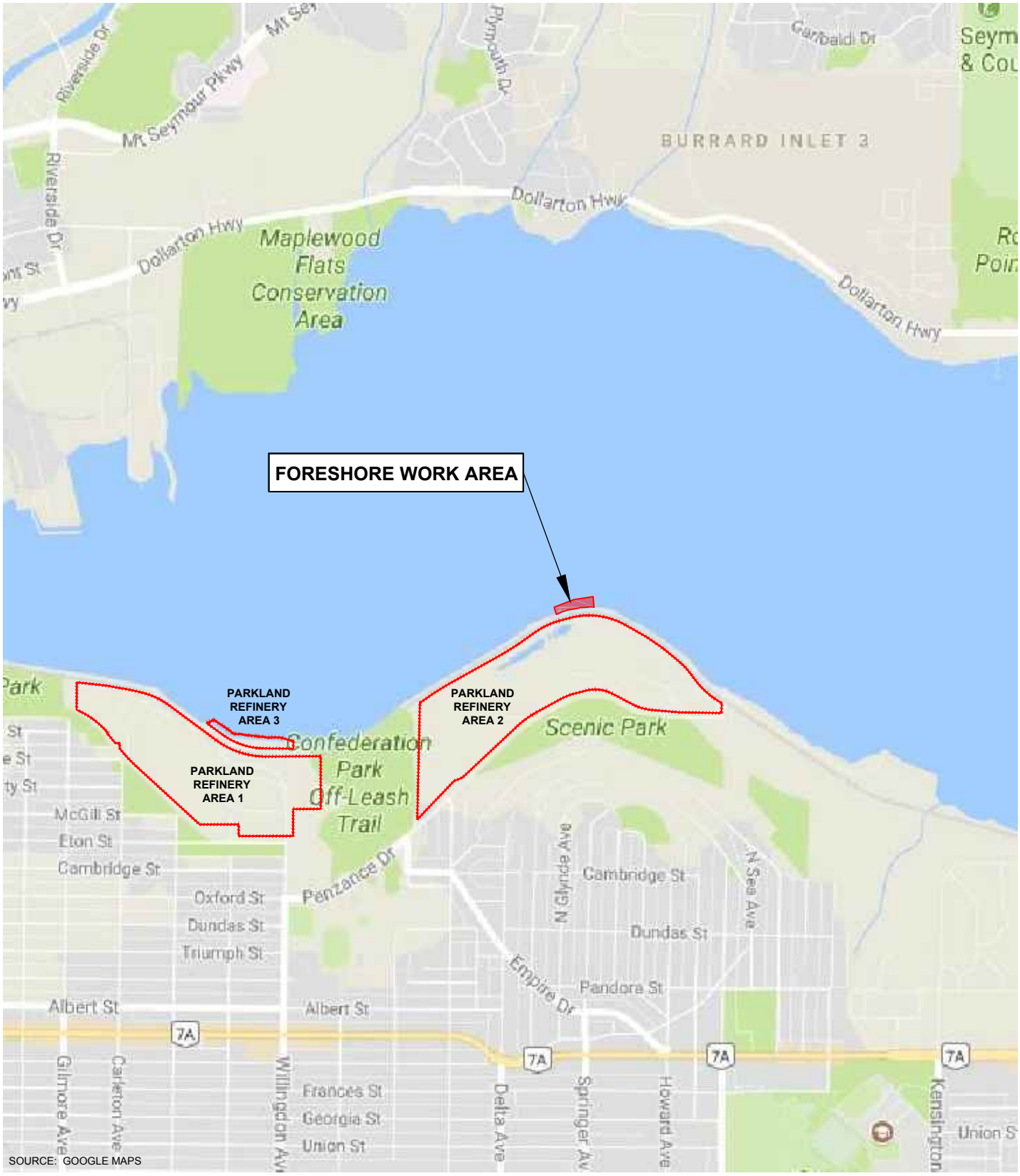
FIGURES



LEGEND:

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AECOM

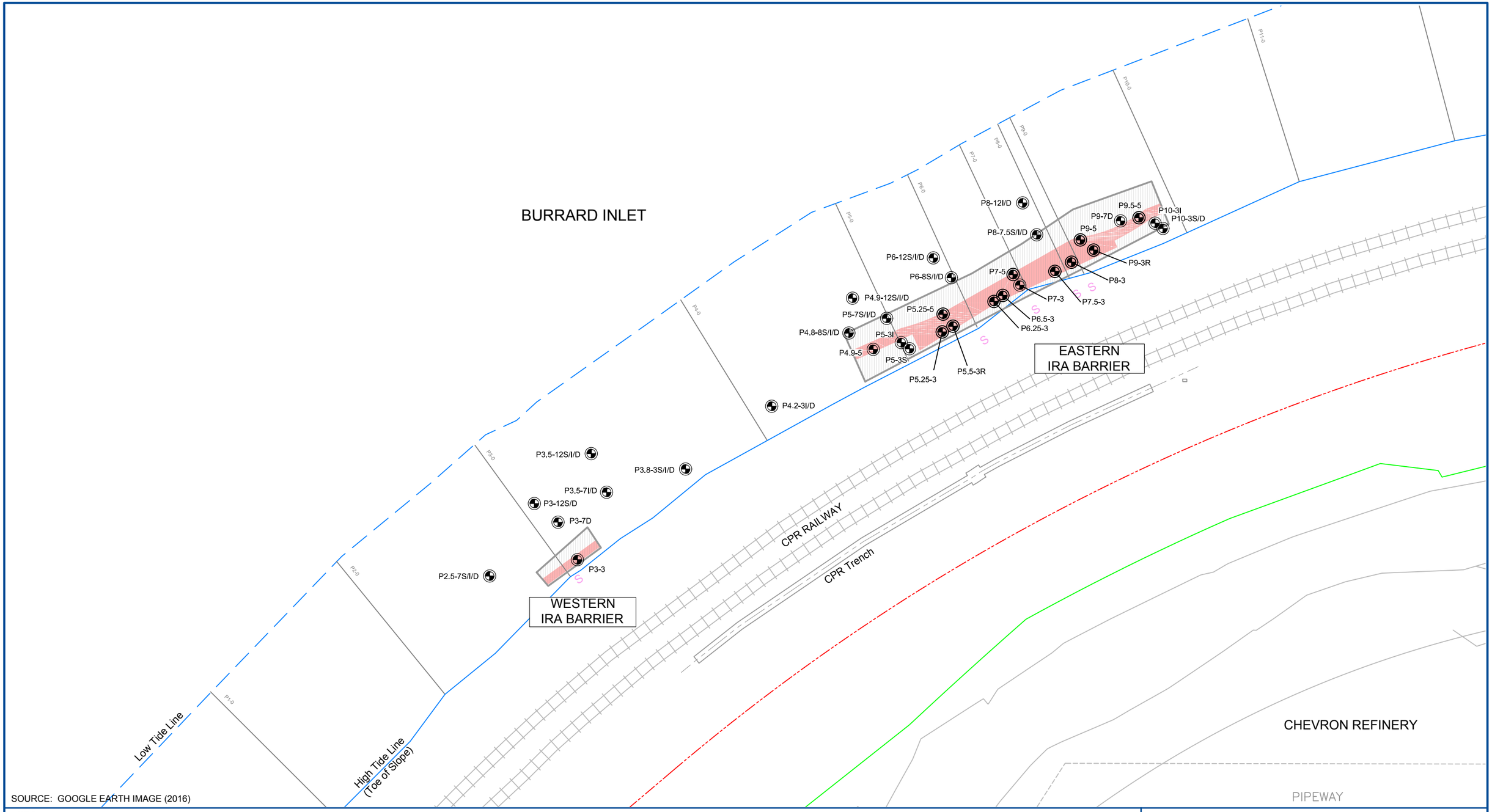
FORESHORE WORK AREA

Foreshore Passive Treatment System Construction Report
Foreshore Below Area 2 - Parkland Refinery, Burnaby, BC

PARKLAND REFINING (B.C.) LTD.

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
December 2017	60542455	TS	0	FIGURE 1

FILE NAME: H:\URS-CHEVRON\60542455.Final Remedy Installation\5. Deliverables\Remediation Report\Figures\Figure files\20171127 F01 Foreshore and Surrounding Area.dwg



SOURCE: GOOGLE EARTH IMAGE (2016)

LEGEND:

- Property Line
- Fence Line
- Foreshore Sampling Transect
- NAPL Seep
- Extent of Horizontal RCM
- Extent of IRA Barriers and RCM Sand-Organoclay Trench
- Historical Foreshore Monitoring Well

NOTE:
1. Well clusters shown with only one well symbol.

ABBREVIATIONS:

S	Shallow Well
I	Intermediate Well
D	Deep Well
NAPL	Non-Aqueous Phase Liquid
RCM	Reactive Core Mat
IRA	Interim Remedial Action
CPR	Canadian Pacific Railway
ROW	Right-of-Way
EIB	Eastern Impounding Basin

GRID NORTH

metres
0 10 20

SITE MAP - PRE-CONSTRUCTION

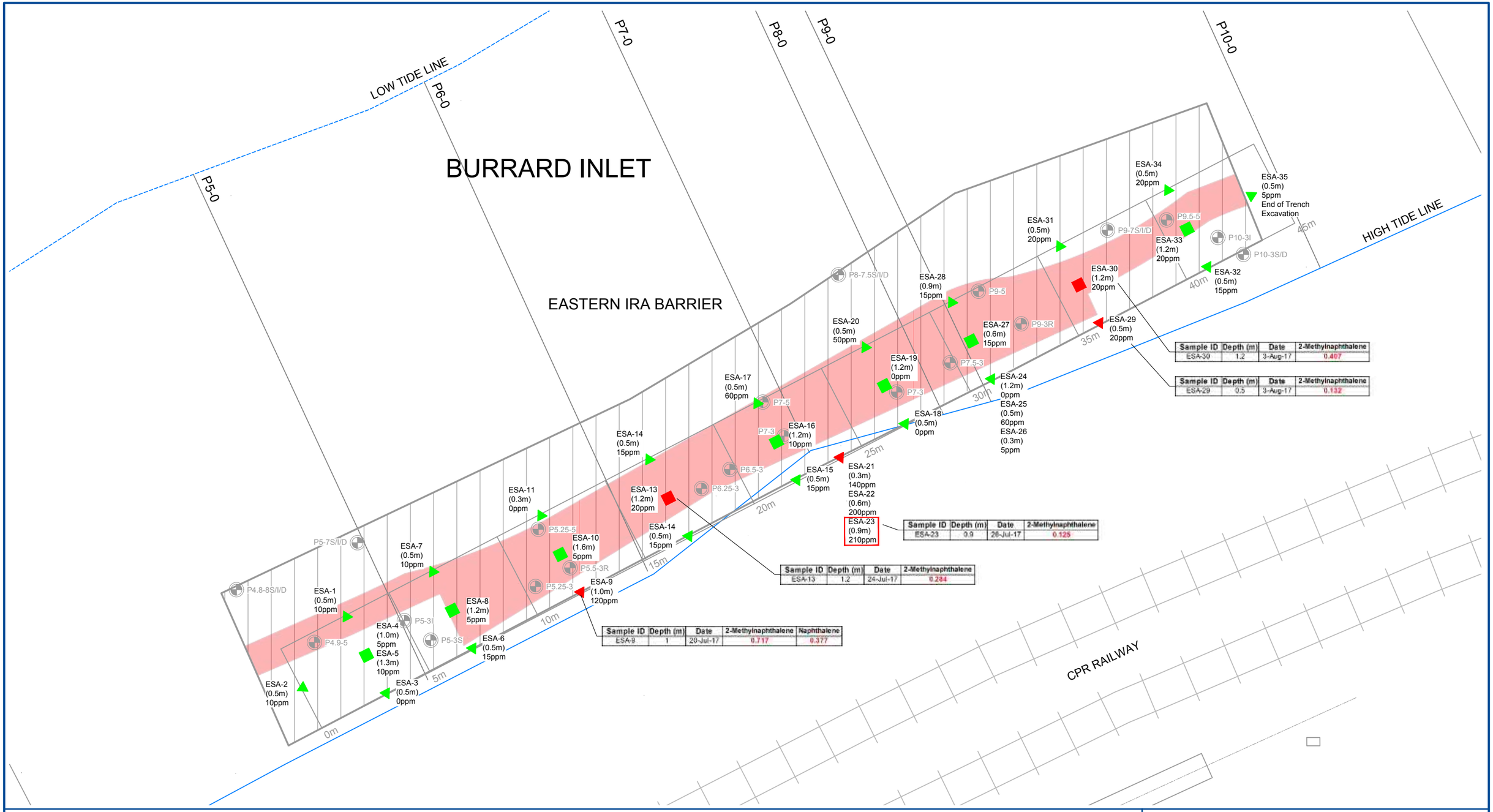
Foreshore Passive Treatment System Construction Report
Foreshore Below Area 2 - Parkland Refinery, Burnaby, BC

PARKLAND REFINING (B.C.) LTD.

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
December 2017	60542455	TS	0	FIGURE 2

AECOM

FILE NAME: H:\URS-CHEVRON\60542455.Final Remedy Installation\5. Deliverables\Remediation Report\Figures\Figure files\20171218 F02 MONITORING WELLS.dwg



LEGEND

- Historical Foreshore Monitoring Well
- Extent of Horizontal RCM
- Extent of IRA Barriers and RCM Sand-Organoclay Trench
- Foreshore Sampling Transect
- Wall Sample
- Base Sample
- Depth of Sample (metres) 1.2m
- Headspace (ppm) 120ppm
- Samples less than or equal to applicable standard for all parameters analysed
- Samples greater than applicable standard for at least one parameter analysed

Applicable Stage 11 (Housekeeping edmendment)	2-Methylnaphthalene	Naphthalene
Standard (Sediment EAZ)	0.12	0.24
Standard (Sediment)	0.24	0.47

Units: ug/L

ABBREVATIONS:
CPR Canadian Pacific Railway
ESA Eastern Seep Area
IRA Interim Remedial Action
m metres
ppm parts per million
RCM Reactive Core Material
ROW Right-of-way

NOTES:
Clean limit wall and base samples were collected during the excavation of the IRA Barrier system.

GRID NORTH
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metres
0 2 4 6

EASTERN IRA BARRIER EXCAVATION LIMIT SAMPLES

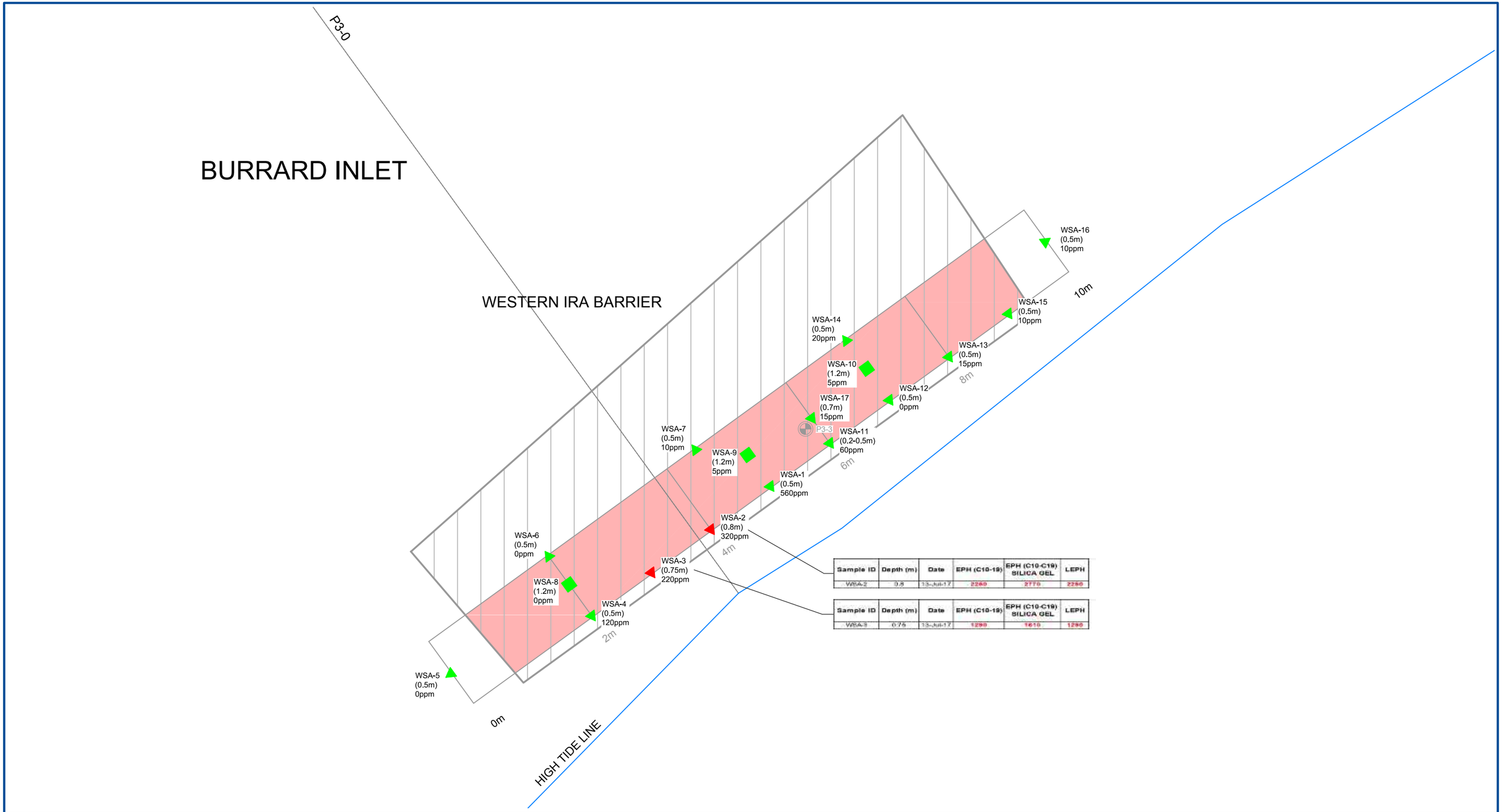
Foreshore Passive Treatment System Construction Report
Foreshore Below Area 2 - Parkland Refinery, Burnaby, BC

PARKLAND REFINING (B.C.) LTD.

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
December 2017	60542455	TS	0	FIGURE 3

AECOM

FILE NAME: H:\URS-CHEVRON\60542455.Final Remedy Installation\5. Deliverables\Remediation Report\Figures\Figure files\20171218 F03 F04 FFR EASTERN WESTERN BARRIER_metric.dwg



Sample ID	Depth (m)	Date	EPH (C10-19)	EPH (C10-C19) SILICA GEL	LEPH
WSA-2	0.8	13-Jul-17	2260	2770	2260

Sample ID	Depth (m)	Date	EPH (C10-19)	EPH (C10-C19) SILICA GEL	LEPH
WSA-3	0.75	13-Jul-17	1290	1610	1290

LEGEND

- Historical Foreshore Monitoring Well
- Extent of Horizontal RCM
- Extent of IRA Barriers and RCM Sand-Organoclay Trench
- Foreshore Sampling Transect
- Wall Sample
- Base Sample
- Depth of Sample (metres) 1.2m
- Headspace (ppm) 120ppm
- Samples less than or equal to applicable standard for all parameters analysed
- Samples greater than applicable standard for at least one parameter analysed

Applicable Stage 11 (Housekeeping Amendment)	EPH (C10-19)	EPH (C10-C19) SILICA GEL	LEPH
Standard	1000	1000	1000

Units: ug/L

ABBREVIATIONS:
IRA Interim Remedial Action
m metres
ppm parts per million
RCM Reactive Core Material
WSA Western Seep Area

NOTES:
Clean limit wall and base samples were collected during the excavation of the IRA Barrier system.

GRID NORTH
N
W E
S

metres
0 1 2

AECOM

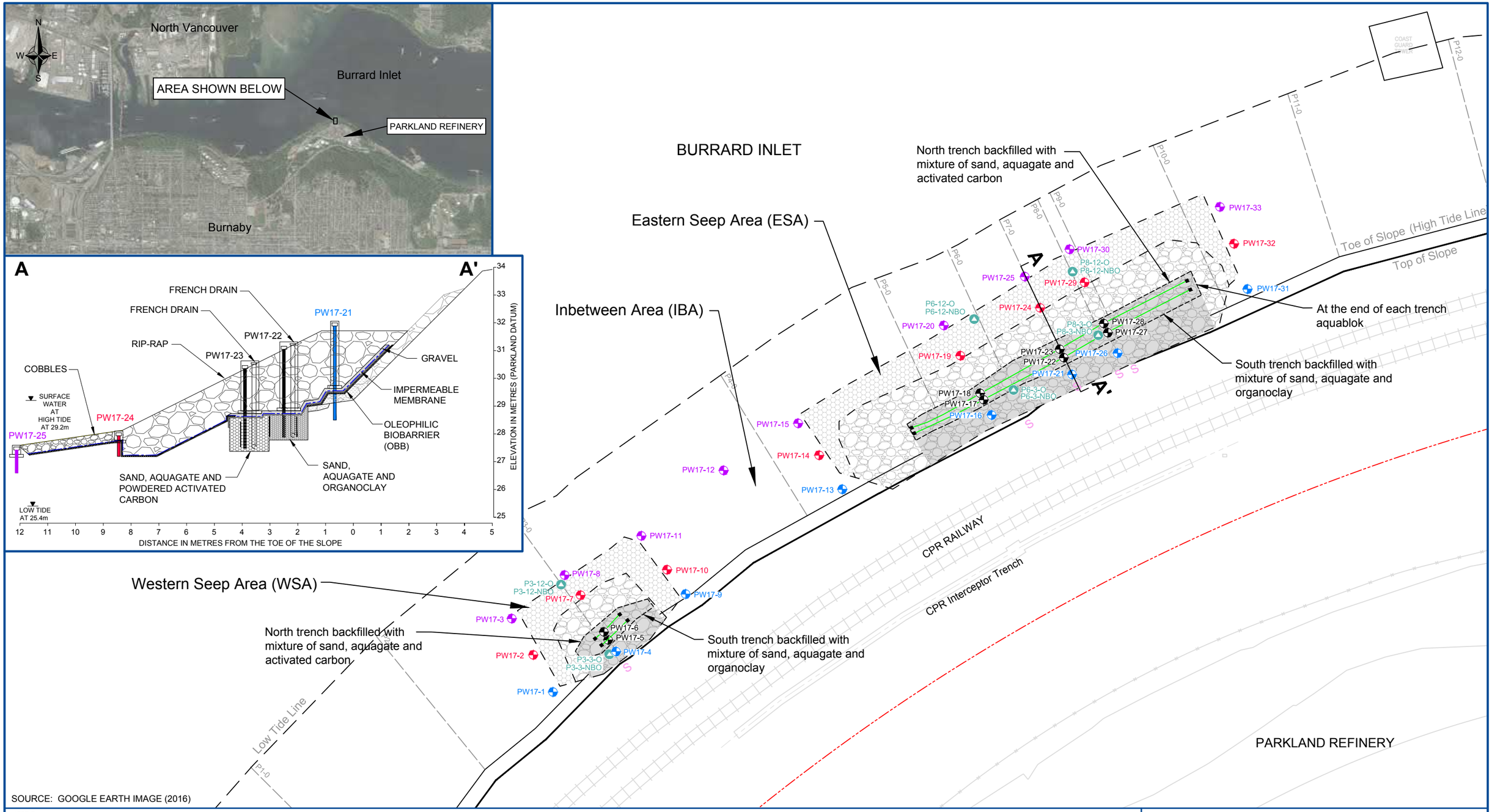
WESTERN IRA BARRIER EXCAVATION LIMIT SAMPLES

Foreshore Passive Treatment System Construction Report
Foreshore Below Area 2 - Parkland Refinery, Burnaby, BC

PARKLAND REFINING (B.C.) LTD.

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
December 2017	60542455	TS	0	FIGURE 4

FILE NAME: H:\URS-CHEVRON\60542455.Final Remedy Installation\5. Deliverables\Remediation Report\Figures\Figure files\20171218 F03 F04 FFR EASTERN WESTERN BARRIER_metric.dwg



SOURCE: GOOGLE EARTH IMAGE (2016)

LEGEND:

- Property Line
- Fence Line
- Foreshore Sampling Transect
- Impermeable Sheet
- Cobble Mat
- Rip Rap Embankment
- French Drain
- Drain Cleanout
- NAPL Seep Observed in 2010
- Surface Water Sample
- POREWATER SAMPLES
- Compliance Well
- Sentry Well
- Performance Well
- Up Gradient Well

ABBREVIATIONS:

O	Ocean - Near Top Surface Water
NBO	Ocean - Near Bottom Surface Water
NAPL	Non-Aqueous Phase Liquid
CPR	Canadian Pacific Railway

GRID NORTH

N W E S

metres 0 10 20

SITE MAP - POST CONSTRUCTION

Foreshore Passive Treatment System Construction Report
Foreshore Below Area 2 - Parkland Refinery, Burnaby, BC

PARKLAND REFINING (B.C.) LTD.

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
December 2017	60542455	TS	0	FIGURE 5

AECOM

FILE NAME: H:\URS-CHEVRON\60542455.Final Remedy Installation\5. Deliverables\Remediation Report\Figures\Figure files\20171218 05 POST CONSTRUCTION.dwg

TABLES

TABLE 1
WELL INSTALLATION DETAILS
FORESHORE
PARKLAND BURNABY REFINERY

Monitoring Well	Well Type	Total Depth (m bgs)	Top of Well Screen (m bgs)	Bottom of Well Screen (m bgs)	Screen type
PW17-1	Up gradient	1.20	0.85	1.15	PVC
PW17-2	Sentry	1.20	0.85	1.15	PVC
PW17-3	Compliance	1.20	0.85	1.15	PVC
PW17-4	Up gradient	0.80	0.45	0.75	PVC
PW17-5	Performance	1.10	0.64	1.00	SS
PW17-6	Performance	1.30	0.84	1.20	SS
PW17-7	Sentry	1.05	0.7	1.00	PVC
PW17-8	Compliance	1.30	0.84	1.20	SS
PW17-9	Up gradient	1.20	0.85	1.15	PVC
PW17-10	Sentry	1.25	0.85	1.15	PVC
PW17-11	Compliance	1.20	0.74	1.10	SS
PW17-12	Compliance	1.20	0.85	1.15	PVC
PW17-13	Up gradient	1.20	0.85	1.15	PVC
PW17-14	Sentry	1.20	0.85	1.15	PVC
PW17-15	Compliance	1.30	0.84	1.20	SS
PW17-16	Up gradient	0.80	0.45	0.75	PVC
PW17-17	Performance	1.10	0.64	1.00	SS
PW17-18	Performance	1.30	0.84	1.20	SS
PW17-19	Sentry	1.20	0.87	1.15	PVC
PW17-20	Compliance	1.10	0.64	1.00	SS
PW17-21	Up gradient	0.80	0.45	0.75	PVC
PW17-22	Performance	1.10	0.64	1.00	SS
PW17-23	Performance	1.30	0.84	1.20	SS
PW17-24	Sentry	1.20	0.85	1.15	PVC
PW17-25	Compliance	1.25	0.85	1.15	PVC [1]
PW17-26	Up gradient	0.80	0.45	0.75	PVC
PW17-27	Performance	1.10	0.64	1.00	SS
PW17-28	Performance	1.30	0.84	1.20	SS
PW17-29	Sentry	1.20	0.85	1.15	PVC
PW17-30	Compliance	1.30	0.84	1.20	SS
PW17-31	Up gradient	1.20	0.85	1.15	PVC
PW17-32	Sentry	1.20	0.85	1.15	PVC
PW17-33	Compliance	1.20	0.85	1.15	PVC

m bgs - metres below ground surface

SS - Stainless steel wrapped screen prepacked with 20/40 sand

PVC - Schedule 40 - 10 slot screen

1 - Screen consisted of a 3" - 10 slot screen surrounding a 2" - 10 slot screen prepacked with 20/40 filter sand (manufactured by Bluemax Drilling)

TABLE 2
CONCENTRATIONS OF PETROLEUM HYDROCARBON PARAMETERS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							$EPH_{ag}(C_{10}$-$C_{19})$ [2]	$EPH_{ag}(C_{10}$-$C_{19})$ (Silica gel) [2]	$EPHw(C^{19}$-$C^{32})$ [2]	$EPHw(C^{19}$-$C^{32})$ (Silica gel) [2]	LEPH	HEPH	VPH	VH	Benzene	Ethylbenzene	Styrene	Toluene	Xylenes	MTBE
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1]							1,000	1,000	1,000	1,000	1,000	1,000	200	NS	6.5	200	5	150	20	8,000
Source							Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	---	Mat. So.	Mat. So.	Gen. So.	Mat. So.	Mat. So.	Gen. So.
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Area Location**	**Sample Depth (m)**	**SampleDate**														
Eastern IRA Barrier Removal																				
EIRA-1	Sediment EAZ	P7-5	ATB	EB	0.4	14-Jul-17	<200	---	**810**	---	<200	**810**	<100	<100	**0.1**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-2	Sediment EAZ	P7-5	ATB	EB	0.8	14-Jul-17	<200	---	**730**	---	<200	**730**	<100	<100	**0.411**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-3	Sediment EAZ	P7-3	OB	EB	0.8	14-Jul-17	<200	---	**460**	---	<200	**460**	<100	<100	**0.327**	**0.049**	<0.050	**0.086**	**0.186**	<0.20
EIRA-4	Sediment EAZ	P7-3	OB	EB	0.4	14-Jul-17	<200	---	**540**	---	<200	**540**	<100	<100	**0.297**	**0.051**	<0.050	<0.050	<0.075	<0.20
EIRA-5	Sediment EAZ	P7-5	ATB	EB	0.4	14-Jul-17	<200	---	**700**	---	<200	**700**	<100	<100	**0.0155**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-6	Sediment EAZ	P7-5	ATB	EB	0.8	14-Jul-17	<200	---	**630**	---	<200	**630**	<100	<100	**0.0185**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-7	Sediment EAZ	P4.9-5	ATB	EB	0.2	17-Jul-17	<200	---	**550**	---	<200	**550**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
DUP-1 (EIRA-7)	Sediment EAZ	P4.9-5	ATB	EB	0.2	17-Jul-17	<200	---	**750**	---	<200	**750**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EIRA-8	Sediment EAZ	P5-3I	USAT	EB	0.5	19-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-9	Sediment EAZ	P5.5-3R	OB	EB	0	20-Jul-17	<200	---	**660**	---	<200	**660**	<100	<100	**0.0124**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-10	Sediment EAZ	P5.5-3R	OB	EB	0.4	20-Jul-17	<200	---	**790**	---	<200	**790**	<100	<100	**0.0101**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-11	Sediment EAZ	P5.5-3R	OB	EB	0.8	20-Jul-17	<200	---	**680**	---	<200	**680**	<100	<100	**0.0899**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-12	Sediment EAZ	P5.5-3R	OB	EB	0	20-Jul-17	<200	---	**680**	---	<200	**680**	<100	<100	**0.0083**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-13	Sediment EAZ	P5.5-3R	OB	EB	0.4	20-Jul-17	<200	---	**660**	---	<200	**660**	<100	<100	**0.0111**	<0.015	<0.050	<0.050	**0.178**	<0.20
EIRA-14	Sediment EAZ	P5.5-3R	OB	EB	0.8	20-Jul-17	<200	---	**740**	---	<200	**740**	<100	<100	**0.0779**	**0.046**	<0.050	<0.050	**0.402**	<0.20
EIRA-15	Sediment EAZ	P5.25-5	ATB	EB	0.3	21-Jul-17	<200	---	**670**	---	<200	**670**	<100	<100	**0.0303**	**0.101**	<0.050	<0.070	**0.534**	<0.20
EIRA-16	Sediment EAZ	P6.25-3	OB	EB	0.4	22-Jul-17	**32,400**	---	**22,900**	---	**32,200**	**22,900**	**86,000**	**97,000**	**217**	**1,570**	<2.0	**1,950**	**7,530**	<8.0
EIRA-17	Sediment EAZ	P7-5	ATB	EB	0.5	24-Jul-17	**210**	---	**790**	---	**210**	**790**	<100	<100	**2.44**	**0.056**	<0.050	**0.082**	<0.075	<0.20
EIRA-18	Sediment EAZ	P7.5-3	OB	EB	0.4	26-Jul-17	<200	---	**670**	---	<200	**670**	<100	<100	**0.0116**	<0.015	<0.050	<0.050	<0.075	<0.20
DUP-2 (EIRA-18)	Sediment EAZ	P7.5-3	OB	EB	0.4	26-Jul-17	<200	---	**710**	---	<200	**710**	<100	<100	**0.0132**	<0.015	<0.050	<0.050	<0.075	<0.20
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EIRA-19	Sediment EAZ	P9-3R	OB	EB	0	27-Jul-17	<200	---	**670**	---	<200	**670**	<100	<100	**0.0099**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-20	Sediment EAZ	P9-3R	OB	EB	0	27-Jul-17	<200	---	**720**	---	<200	**720**	<100	<100	**0.014**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-21	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	<200	---	**660**	---	<200	**660**	<100	<100	**0.0134**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-22	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	**210**	---	**770**	---	**210**	**770**	<100	<100	**0.039**	**0.034**	<0.050	<0.050	<0.075	<0.20
DUP-3 (EIRA-22)	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	<200	---	**720**	---	<200	**720**	<100	<100	**0.0278**	**0.046**	<0.050	<0.050	<0.075	<0.20
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	**34%**	---	---	---	---	---
EIRA-23	Sediment EAZ	P9-3R	OB	EB	0.8	27-Jul-17	**230**	---	**740**	---	**230**	**740**	<100	<100	**0.006**	<0.015	<0.050	<0.050	<0.075	<0.20
EIRA-24	Sediment EAZ	P9-3R	OB	EB	0.8	27-Jul-17	<200	---	**420**	---	<200	**420**	<100	<100	**0.0135**	**0.207**	<0.050	<0.050	<0.075	<0.20
EIRA-25	Sediment EAZ	P9-5	ATB	EB	0.5	1-Aug-17	**2,260**	---	**1,890**	---	**2,250**	**1,890**	**1,150**	**1,230**	**0.528**	**11.5**	<0.050	**0.588**	**61.6**	<0.20
DUP-5 (EIRA 25)	Sediment EAZ	P9-5	ATB	EB	0.5	1-Aug-17	**1,720**	---	**1,660**	---	**1,710**	**1,660**	**760**	**870**	**0.711**	**22.2**	<0.050	**0.911**	**85.7**	<0.20
QA/QC RPD						**Duplicates**	**27%**	---	**13%**	---	**27%**	**13%**	**41%**	**34%**	**30%**	**64%**	---	**43%**	**33%**	---
EIRA-26	Sediment EAZ	P9-7	DS	EB	0.5	2-Aug-17	**340**	---	**690**	---	**340**	**690**	<100	<100	<0.0070	**0.382**	<0.050	<0.050	**2.57**	<0.20
EIRA-27	Sediment EAZ	P9.5-5	ATB	EB	0.5	3-Aug-17	**200**	---	**640**	---	**200**	**640**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
Western IRA Barrier Removal																				
WIRA-1	Sediment	P3-3	OB	WB	0.5	13-Jul-17	**220**	---	**930**	---	**220**	**930**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WIRA-2	Sediment	P3-3	OB	WB	0.5	13-Jul-17	<200	---	**680**	---	<200	**680**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WIRA-3	Sediment	P3-3	OB	WB	0.5	16-Aug-17	**220**	---	<200	---	**220**	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
Eastern Final Barrier Installation - Limit Samples																				
ESA-1	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-2	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	<200	---	**210**	---	<200	**210**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-3	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-4	Sediment EAZ	P4.9-5	ATB	EB	1.0	17-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-5	Sediment	P4.9-5	ATB	EB	1.3	18-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-6	Sediment EAZ	P5-3S	USAT	EB	0.5	19-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-7	Sediment EAZ	P5-3I	USAT	EB	0.5	19-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-8	Sediment	P5-3I	USAT	EB	1.2	19-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0058**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-9	Sediment EAZ	P5.5-3R	OB	EB	1.0	20-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0071**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-10	Sediment	P5.5-3R	OB	EB	1.6	20-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0064**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-11	Sediment EAZ	P5.25-5	ATB	EB	0.3	20-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0208**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-12	Sediment EAZ	P6.5-3	OB	EB	0.5	24-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0189**	<0.015	<0.050	**0.099**	<0.075	<0.20
ESA-13	Sediment	P6.5-3	OB	EB	1.2	24-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.022**	**0.233**	<0.050	**0.059**	**1.11**	<0.20
ESA-14	Sediment EAZ	P6.5-3	OB	EB	0.5	24-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0167**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-15	Sediment EAZ	P7-3	OB	EB	0.5	25-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-16	Sediment	P7-3	OB	EB	1.2	25-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.030	**0.101**	<0.050	<0.050	**0.426**	<0.20

TABLE 2
CONCENTRATIONS OF PETROLEUM HYDROCARBON PARAMETERS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							$EPH_{ul}(C_{10}$-$C_{19})$ [2]	$EPH_{ul}(C_{10}$-$C_{19})$ (Silica gel) [2]	$EPHw(C^{19}$-$C^{32})$ [2]	$EPHw(C^{19}$-$C^{32})$ (Silica gel) [2]	LEPH	HEPH	VPH	VH	Benzene	Ethylbenzene	Styrene	Toluene	Xylenes	MTBE
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1]							1,000	1,000	1,000	1,000	1,000	1,000	200	NS	6.5	200	5	150	20	8,000
Source							Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	---	Mat. So.	Mat. So.	Gen. So.	Mat. So.	Mat. So.	Gen. So.
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Area Location**	**Sample Depth (m)**	**SampleDate**														
ESA-17	Sediment EAZ	P7-5	ATB	EB	0.5	25-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0112**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-18	Sediment EAZ	P7.5-3	OB	EB	0.5	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0221**	**0.04**	<0.050	<0.050	<0.075	<0.20
ESA-19	Sediment	P7.5-3	OB	EB	1.2	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.018	**0.087**	<0.050	<0.050	**0.534**	<0.20
ESA-20	Sediment EAZ	P7-5	ATB	EB	0.5	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0083**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-21	Sediment EAZ	P7-3	OB	EB	0.3	26-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-22	Sediment EAZ	P7-3	OB	EB	0.6	26-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0147**	<0.015	<0.050	**0.058**	<0.075	<0.20
ESA-23	Sediment EAZ	P7-3	OB	EB	0.9	26-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0104**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-24	Sediment EAZ	P9-3R	OB	EB	0.3	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-25	Sediment EAZ	P9-3R	OB	EB	0.6	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	**0.0066**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-26	Sediment EAZ	P9-3R	OB	EB	0.9	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
DUP-4 (ESA-26)	Sediment EAZ	P9-3R	OB	EB	0.9	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
QA/QC RPD						**Duplicates**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	---
ESA-27	Sediment	P9-5	ATB	EB	1.2	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-28	Sediment EAZ	P9-5	ATB	EB	0.5	27-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-29	Sediment EAZ	P9-3R	OB	EB	0.5	3-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-30	Sediment	P9-7	DS	EB	1.2	3-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0090	**0.111**	<0.050	<0.050	**0.694**	<0.20
ESA-31	Sediment EAZ	P9-7	DS	EB	0.5	3-Aug-17	<200	---	<200	---	<200	<200	<100	<100	**0.0053**	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-32	Sediment EAZ	P10-3S	USAT	EB	0.5	3-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-33	Sediment	P9.5-5	ATB	EB	1.2	3-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-34	Sediment EAZ	P9.5-5	ATB	EB	0.5	3-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
ESA-35	Sediment EAZ	P10-3I	USAT	EB	0.5	4-Aug-17	<200	---	<200	---	<200	<200	<10	<10	<0.0050	<0.015	<0.050	<0.050	---	---
Western Final Barrier Installation - Limit Samples																				
WSA-1	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	**390**	---	<200	---	**390**	<200	**130**	**130**	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-2	Sediment EAZ	P3-3	OB	WB	0.8	13-Jul-17	**2,250**	**2,770**	**420**	**490**	**2,250**	**420**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-3	Sediment EAZ	P3-3	OB	WB	0.75	13-Jul-17	**1,290**	**1,610**	**200**	**260**	**1,290**	**200**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-4	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<200	---	**490**	---	<200	**490**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-5	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<200	---	**590**	---	<200	**590**	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-6	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-7	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-8	Sediment	P3-3	OB	WB	1.2	13-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-9	Sediment	P3-3	OB	WB	1.2	13-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-10	Sediment	P3-3	OB	WB	1.2	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-11	Sediment EAZ	P3-3	OB	WB	0.2-0.5	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-12	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-13	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-14	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-15	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-16	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
WSA-17	Sediment EAZ	P3-3	OB	WB	0.7	15-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
Backfill and Grab Samples from Final Barrier Installation																				
BF-SG-01	Backfill	---	---	---	---	12-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
BF-SG-02	Backfill	---	---	---	---	12-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
BF-SG2	Backfill	---	---	---	---	8-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
BF-SG2-1	Backfill	---	---	---	---	13-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
BF-SG2-2	Backfill	---	---	---	---	13-Jul-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-01	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-02	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-03	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-04	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-05	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-06	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-07	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	**0.0076**	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-08	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	**0.0117**	<0.015	<0.050	<0.050	<0.075	<0.20
GS17-09	Grab	---	---	---	---	4-Jul-17	---	---	---	---	---	---	<100	<100	**0.0151**	<0.015	<0.050	<0.050	<0.075	<0.20
Upgradient Samples from Final Barrier Installation																				
PW17-4@0.1-0.3	Sediment EAZ	P3-3	US	WB	0.1-0.3	2-Oct-17	<200	---	<200	---	<200	<200	<100	<100	**0.123**	<0.015	<0.050	**0.056**	<0.075	<0.20
PW17-4@0.7-0.9	Sediment EAZ	P3-3	US	WB	0.7-0.9	2-Oct-17	<200	---	<200	---	<200	<200	<100	<100	**0.0341**	**0.02**	<0.050	**0.145**	<0.075	<0.20

TABLE 2
CONCENTRATIONS OF PETROLEUM HYDROCARBON PARAMETERS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							$EPH_H(C_{10}$-$C_{19})$ [2]	$EPH_H(C_{10}$-$C_{19})$ (Silica gel) [2]	$EPHw(C^{19}$-$C^{32})$ [2]	$EPHw(C^{19}$-$C^{32})$ (Silica gel) [2]	LEPH	HEPH	VPH	VH	Benzene	Ethylbenzene	Styrene	Toluene	Xylenes	MTBE
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1]							1,000	1,000	1,000	1,000	1,000	1,000	200	NS	6.5	200	5	150	20	8,000
Source							Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	Gen. So.	---	Mat. So.	Mat. So.	Gen. So.	Mat. So.	Mat. So.	Gen. So.
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Area Location**	**Sample Depth (m)**	**SampleDate**														
PW17-16 @0.7-0.9	Sediment EAZ	P6.25-3	US	EB	0.7-0.9	25-Aug-17	<200	---	<200	---	<200	<200	<100	<100	<0.0050	<0.015	<0.050	<0.050	<0.075	<0.20
PW17-21 @0.5-0.7	Sediment EAZ	P7-3	US	EB	0.5-0.7	31-Aug-17	<200	---	<200	---	<200	<200	<100	<100	0.0074	<0.015	<0.050	<0.050	<0.075	<0.20
PW17-26 @0.5-0.7	Sediment EAZ	P8-3	US	EB	0.5-0.7	31-Aug-17	<200	---	<200	---	<200	<200	<100	<100	0.0052	<0.015	<0.050	<0.050	<0.075	<0.20

Notes

< - Sample concentration less than the detection limit indicated.

--- - Sample not analyzed for indicated parameter.

1 - The minimum of the CSR generic numerical soil (Park Land Use [PL]), CSR matrix numerical soil (Park Land Use [PL]), and CSR generic numerical sediment (marine/estuarine typical) was selected as the applicable standard. SedQCts are applicable to all depths at typical sediment sites and to any depth greater than 1 metre of stable sediment at sensitive sediment sites BC (CSR Stage 11 [Housekeeping] Amendment; approved on October 31, 2017 and effective November 1, 2017).

2 - CSR standards are for EPH corrected for PAHs, sample concentrations listed are uncorrected and therefore conservative.

BOLD	Sample concentration is detected
SHADE	Sample concentration greater than CSR sediment (marine/estuarine sensitive for depths less than 1 metre; marine/estuarine typical for depths greater than 1 metre), CSR generic or matrix soil standard for urban park land use Stage 11 Updates.

Abbreviations

µg/g [ppm] - micrograms per gram [parts per million] dry weight

m - meters

Acronyms

ATB - located in anchor trench barrier

CSR - Contaminated Sites Regulation

DS - located down slope

EB - eastern barrier

EPHw - extractable petroleum hydrocarbons in water

Gen .So. - CSR generic numerical soil (Park Land Use [PL]) standard

HEPH - heavy extractable petroleum hydrocarbons

LEPH - light extractable petroleum hydrocarbons

m - metre

Mat.So. - CSR matrix numerical soil (Park Land Use [PL]) standard

MTBE - methyl *tert*-butyl ether

NA - not applicable

NAPL - non-aqueous phase liquid

NS - no standard established for indicated parameter.

OB - located within the original barrier

USAT - located up slope anchor trench

US - Upslope

VPH - volatile petroleum hydrocarbons

WB - western barrier

TABLE 3
CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene [2]	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments EAZ)							0.055	0.079	0.15	0.43	0.47	1	NS	1	0.52	0.084	0.93	0.089	1	0.12	0.24	0.34	0.87	10
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments)							0.11	0.15	0.29	0.83	0.92	1	NS	1	1	0.16	1.8	0.17	1	0.24	0.47	0.65	1.7	20
Source							Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. So.	---	Gen. So.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. So.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Area Location**	**Sample Depth (m)**	**SampleDate**																		
Eastern IRA Barrier Removal																								
EIRA-1	Sediment EAZ	P7-5	ATB	EB	0.4	14-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-2	Sediment EAZ	P7-5	ATB	EB	0.8	14-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-3	Sediment EAZ	P7-3	OB	EB	0.8	14-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.066**	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-4	Sediment EAZ	P7-3	OB	EB	0.4	14-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.061**	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-5	Sediment EAZ	P7-5	ATB	EB	0.4	14-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-6	Sediment EAZ	P7-5	ATB	EB	0.8	14-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.121**	**0.068**	<0.050	<0.050	---
EIRA-7	Sediment EAZ	P4.9-5	ATB	EB	0.2	17-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
DUP-1 (EIRA-7)	Sediment EAZ	P4.9-5	ATB	EB	0.2	17-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EIRA-8	Sediment EAZ	P5-3I	NA	EB	0.5	19-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-9	Sediment EAZ	P5.5-3R	OB	EB	0	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-10	Sediment EAZ	P5.5-3R	OB	EB	0.4	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-11	Sediment EAZ	P5.5-3R	OB	EB	0.8	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-12	Sediment EAZ	P5.5-3R	OB	EB	0	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-13	Sediment EAZ	P5.5-3R	OB	EB	0.4	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-14	Sediment EAZ	P5.5-3R	OB	EB	0.8	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-15	Sediment EAZ	P5.25-5	ATB	EB	0.3	21-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.272**	<0.20	<0.050	<0.050	---
EIRA-16	Sediment EAZ	P6.25-3	OB	EB	0.4	22-Jul-17	<4.0	<2.0	<2.0	<0.60	<0.40	<0.50	**0.569**	<0.30	<2.0	<0.40	<0.90	**8.51**	<0.40	**239**	**142**	**13.7**	**5.56**	---
EIRA-17	Sediment EAZ	P7-5	ATB	EB	0.5	24-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-18	Sediment EAZ	P7.5-3	OB	EB	0.4	26-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
DUP-2 (EIRA-18)	Sediment EAZ	P7.5-3	OB	EB	0.4	26-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EIRA-19	Sediment EAZ	P9-3R	OB	EB	0	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-20	Sediment EAZ	P9-3R	OB	EB	0	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-21	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-22	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
DUP-3 (EIRA-22)	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EIRA-23	Sediment EAZ	P9-3R	OB	EB	0.8	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-24	Sediment EAZ	P9-3R	OB	EB	0.8	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
EIRA-25	Sediment EAZ	P9-5	ATB	EB	0.5	1-Aug-17	<0.50	<0.20	<0.20	<0.060	<0.050	<0.050	<0.050	<0.050	<0.090	<0.050	<0.070	**0.857**	<0.050	**16.8**	**9.27**	**1.43**	**0.547**	---
DUP-5 (EIRA 25)	Sediment EAZ	P9-5	ATB	EB	0.5	1-Aug-17	<0.40	<0.10	<0.20	<0.070	<0.050	<0.050	<0.050	<0.050	<0.10	<0.050	<0.20	**0.693**	<0.050	**14**	**7.89**	**1.41**	**0.651**	---
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	**21%**	---	**18%**	**16%**	**1%**	**17%**	---
EIRA-26	Sediment EAZ	P9-7	DS	EB	0.5	2-Aug-17	<0.070	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.20	**0.114**	<0.050	**1.47**	**0.661**	**0.223**	**0.153**	---
EIRA-27	Sediment EAZ	P9.5-5	ATB	EB	0.5	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
Western IRA Barrier Removal																								
WIRA-1	Sediment	P3-3	OB	WB	0.5	13-Jul-17	<0.050	**0.067**	**0.055**	**0.313**	**0.346**	**0.418**	**0.215**	**0.172**	**0.328**	<0.050	**0.348**	<0.050	**0.212**	<0.050	<0.050	**0.085**	**0.333**	---
WIRA-2	Sediment	P3-3	OB	WB	0.5	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.060	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WIRA-3	Sediment	P3-3	OB	WB	0.5	16-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
Eastern Final Barrier Installation - Limit Samples																								
ESA-1	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-2	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-3	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-4	Sediment EAZ	P4.9-5	ATB	EB	1	17-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-5	Sediment	P4.9-5	ATB	EB	1.3	18-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-6	Sediment EAZ	P5-3S	USAT	EB	0.5	19-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-7	Sediment EAZ	P5-3I	USAT	EB	0.5	19-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-8	Sediment	P5-3I	USAT	EB	1.2	19-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-9	Sediment EAZ	P5.5-3R	OB	EB	1	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.717**	**0.377**	**0.081**	<0.050	---
ESA-10	Sediment	P5.5-3R	OB	EB	1.6	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-11	Sediment EAZ	P5.25-5	ATB	EB	0.3	20-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-12	Sediment EAZ	P6.5-3	OB	EB	0.5	24-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-13	Sediment	P6.5-3	OB	EB	1.2	24-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.284**	**0.145**	<0.050	<0.050	---

TABLE 3
CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene [2]	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments EAZ)							0.055	0.079	0.15	0.43	0.47	1	NS	1	0.52	0.084	0.93	0.089	1	0.12	0.24	0.34	0.87	10
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments)							0.11	0.15	0.29	0.83	0.92	1	NS	1	1	0.16	1.8	0.17	1	0.24	0.47	0.65	1.7	20
Source							Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. So.	---	Gen. So.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. So.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Area Location**	**Sample Depth (m)**	**SampleDate**																		
ESA-14	Sediment EAZ	P6.5-3	OB	EB	0.5	24-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-15	Sediment EAZ	P7-3	OB	EB	0.5	25-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-16	Sediment	P7-3	OB	EB	1.2	25-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.112**	**0.066**	<0.050	<0.050	---
ESA-17	Sediment EAZ	P7-5	ATB	EB	0.5	25-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-18	Sediment EAZ	P7.5-3	OB	EB	0.5	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-19	Sediment	P7.5-3	OB	EB	1.2	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.166**	**0.105**	<0.050	<0.050	---
ESA-20	Sediment EAZ	P7-5	ATB	EB	0.5	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-21	Sediment EAZ	P7-3	OB	EB	0.3	26-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-22	Sediment EAZ	P7-3	OB	EB	0.6	26-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-23	Sediment EAZ	P7-3	OB	EB	0.9	26-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.125**	<0.050	<0.050	<0.050	---
ESA-24	Sediment EAZ	P9-3R	OB	EB	0.3	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-25	Sediment EAZ	P9-3R	OB	EB	0.6	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-26	Sediment EAZ	P9-3R	OB	EB	0.9	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
DUP-4 (ESA-26)	Sediment EAZ	P9-3R	OB	EB	0.6	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
QA/QC RPD						**Duplicates**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ESA-27	Sediment	P9-5	ATB	EB	1.2	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-28	Sediment EAZ	P9-5	ATB	EB	0.5	27-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-29	Sediment EAZ	P9-3R	OB	EB	0.5	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.132**	<0.050	<0.050	<0.050	---
ESA-30	Sediment	P9-7	DS	EB	1.2	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.407**	**0.198**	<0.050	<0.050	---
ESA-31	Sediment EAZ	P9-7	DS	EB	0.5	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.060	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-32	Sediment EAZ	P10-3S	USAT	EB	0.5	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-33	Sediment	P9.5-5	ATB	EB	1.2	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-34	Sediment EAZ	P9.5-5	ATB	EB	0.5	3-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
ESA-35	Sediment EAZ	P10-3I	USAT	EB	0.5	4-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.21
Western Final Barrier Installation - Limit Samples																								
WSA-1	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.061**	---
WSA-2	Sediment EAZ	P3-3	OB	WB	0.8	13-Jul-17	<0.050	<0.050	<0.060	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.089**	---
WSA-3	Sediment EAZ	P3-3	OB	WB	0.75	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.078**	---
WSA-4	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<0.050	<0.050	**0.087**	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-5	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<0.050	<0.050	**0.071**	<0.050	<0.050	**0.051**	<0.050	<0.050	<0.050	<0.050	<0.080	<0.050	<0.050	<0.050	<0.050	<0.050	**0.064**	---
WSA-6	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-7	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-8	Sediment	P3-3	OB	WB	1.2	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-9	Sediment	P3-3	OB	WB	1.2	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-10	Sediment	P3-3	OB	WB	1.2	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-11	Sediment EAZ	P3-3	OB	WB	0.2-0.5	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-12	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-13	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-14	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<0.050	<0.050	<0.050	<0.050	**0.053**	**0.111**	**0.097**	<0.050	**0.069**	<0.050	**0.129**	<0.050	<0.050	<0.050	<0.050	<0.050	**0.123**	---
WSA-15	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-16	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
WSA-17	Sediment EAZ	P3-3	OB	WB	0.7	15-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
Backfill and Grab Samples from Final Barrier Installation																								
BF-SG-01	Backfill	---	---	---	---	12-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
BF-SG-02	Backfill	---	---	---	---	12-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
BF-SG2	Backfill	---	---	---	---	8-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
BF-SG2-1	Backfill	---	---	---	---	13-Jul-17	<0.050	<0.050	<0.050	**0.062**	**0.056**	**0.073**	<0.050	<0.050	**0.074**	<0.050	**0.099**	<0.050	<0.050	<0.050	<0.050	**0.051**	**0.111**	---
BF-SG2-2	Backfill	---	---	---	---	13-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-01	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-02	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-03	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-04	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-05	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-06	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.20	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-07	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---

TABLE 3
CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene[2]	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments EAZ)							0.055	0.079	0.15	0.43	0.47	1	NS	1	0.52	0.084	0.93	0.089	1	0.12	0.24	0.34	0.87	10
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments)							0.11	0.15	0.29	0.83	0.92	1	NS	1	1	0.16	1.8	0.17	1	0.24	0.47	0.65	1.7	20
Source							Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. So.	---	Gen. So.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. So.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.	Gen. Sed.
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Area Location**	**Sample Depth (m)**	**SampleDate**																		
GS17-08	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
GS17-09	Grab	---	---	---	---	4-Jul-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.065**	<0.050	<0.050	---
Upgradient Samples from Final Barrier Installation																								
PW17-4@0.1-0.3	Sediment EAZ	P3-3	US	WB	0.1-0.3	2-Oct-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
PW17-4@0.7-0.9	Sediment EAZ	P3-3	US	WB	0.7-0.9	2-Oct-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
PW17-16 @0.7-0.9	Sediment EAZ	P6.25-3	US	EB	0.7-0.9	25-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
PW17-21 @0.5-0.7	Sediment EAZ	P7-3	US	EB	0.5-0.7	31-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---
PW17-26 @0.5-0.7	Sediment EAZ	P8-3	US	EB	0.5-0.7	31-Aug-17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	---

Notes

< - Sample concentration less than the detection limit indicated.

--- - Sample not analyzed for indicated parameter.

1 - The minimum of the CSR generic numerical soil (Park Land Use [PL]), CSR matrix numerical soil (Park Land Use [PL]), and CSR generic numerical sediment (marine/estuarine typical) was selected as the applicable standard. SedQCts are applicable to all depths at typical sediment sites and to any depth greater than 1 metre of stable sediment at sensitive sediment sites BC (CSR Stage 11 [Housekeeping] Amendment; approved on October 31, 2017 and effective November 1, 2017).

2 - Standard is for benzo (b+j) fluoranthenes

BOLD	Sample concentration is detected
SHADE	Sample concentration greater than CSR sediment (marine/estuarine sensitive for depths less than 1 metre; marine/estuarine typical for depths greater than 1 metre), CSR generic or matrix soil standard for urban park land use Stage 11 Updates.

Abbreviations

µg/g [ppm] - micrograms per gram [parts per million] dry weight

m - meters

Acronyms

ATB- located in anchor trench barrier

B[a]P TPE - Benzo[a]pyrene total potency equivalents

CSR - Contaminated Sites Regulation

DS - located down slope

EAZ - ecologically active zone

EB - eastern barrier

Gen. Sed. - CSR generic numerical sediment (Marine/Estuarine) standard

Gen .So. - CSR generic numerical soil (Park Land Use [PL]) standard

m - metre

Mat.So. - CSR matrix numerical soil (Park Land Use [PL]) standard

MTBE - methyl *tert* -butyl ether

NA - not applicable

NAPL - non-aqueous phase liquid

NS - no standard established for indicated parameter.

OB - located within the original barrier

PAH - polycyclic aromatic hydrocarbons

USAT - located up slope anchor trench

US - Upslope

WB - western barrier

TABLE 4
CONCENTRATIONS OF METALS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

Sample ID	Matrix	Sample Location	Sediment Location	Location Area	Sample Depth (m)	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tin	Uranium	Vanadium	Zinc
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments EAZ)							20	10	700	85-100, 150 [3]	1.0-2.0, 2.6 [3]	60 [2]	25	67	69	0.43	80	70, 150 [3]	1	20	9	50	150	150	150, 170 [3]
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments)							20	10	700	85-100, 150 [3]	1 - 3.5, 5.0 [3]	60 [2]	25	75, 130 [3]	120, 130 [3]	0.84	80	70, 150 [3]	1	20	9	50	150	150	150-200 [3]
Source							Gen.So.	Gen.Sed.	Gen.So.	Mat.So.	Mat So./Gen Sed	Gen.Sed	Mat.So.	Gen.Sed./Gen So.	Gen.Sed./Gen So.	Gen.Sed	Mat So.	Gen.So./Mat So.	Mat So.	Gen.So.	Gen.So.	Gen.So.	Mat. So.	Mat. So.	Gen.Sed./Mat So
Eastern IRA Barrier Removal																									
EIRA-1	Sediment EAZ	P7-5	ATB	EB	0.4	14-Jul-17	**0.17**	**3.39**	**56.1**	**0.27**	**0.119**	**24.3**	**5.19**	**17.4**	**6.4**	<0.050	**0.31**	**20.70**	<0.20	<0.10	<0.050	<2.0	**0.846**	**38.2**	**38.1**
EIRA-2	Sediment EAZ	P7-5	ATB	EB	0.8	14-Jul-17	**0.23**	**3.72**	**41.5**	**0.25**	**0.115**	**20.3**	**5.48**	**17.5**	**6.09**	<0.050	**0.41**	**19.20**	<0.20	<0.10	<0.050	<2.0	**0.756**	**40.9**	**35.2**
EIRA-3	Sediment EAZ	P7-3	OB	EB	0.8	14-Jul-17	**0.15**	**2.42**	**39.4**	**0.29**	**0.066**	**7.62**	**4.07**	**12.3**	**11.80**	<0.050	**0.28**	**6.05**	<0.20	<0.10	<0.050	<2.0	**1.01**	**29.9**	**42**
EIRA-4	Sediment EAZ	P7-3	OB	EB	0.4	14-Jul-17	**0.14**	**2.57**	**28.5**	**0.23**	**0.068**	**8.24**	**4.59**	**13.9**	**10.60**	<0.050	**0.22**	**6.85**	<0.20	<0.10	<0.050	<2.0	**0.783**	**35**	**41.3**
EIRA-5	Sediment EAZ	P7-5	ATB	EB	0.4	14-Jul-17	**0.19**	**3.34**	**88.5**	**0.28**	**0.104**	**20.6**	**6.29**	**17**	**6.21**	<0.050	**0.35**	**19.90**	<0.20	<0.10	<0.050	<2.0	**0.831**	**46.5**	**41.6**
EIRA-6	Sediment EAZ	P7-5	ATB	EB	0.8	14-Jul-17	**0.22**	**3.5**	**83.2**	**0.27**	**0.101**	**20.2**	**6.53**	**17.6**	**6.65**	<0.050	**0.46**	**19.20**	<0.20	<0.10	<0.050	<2.0	**0.802**	**45.6**	**44**
EIRA-7	Sediment EAZ	P4.9-5	ATB	EB	0.2	17-Jul-17	<0.10	**1.31**	**51.1**	**0.18**	**0.051**	**7.2**	**3.03**	**7.08**	**4.23**	<0.050	**0.37**	**5.40**	<0.20	<0.10	<0.050	<2.0	**0.875**	**28.1**	**19.6**
DUP-1 (EIRA-7)	Sediment EAZ	P4.9-5	ATB	EB	0.2	17-Jul-17	<0.10	**1.14**	**40.6**	**0.18**	<0.050	**6.68**	**2.8**	**6.61**	**3.85**	<0.050	**0.23**	**4.77**	<0.20	<0.10	<0.050	<2.0	**0.669**	**29.5**	**18.4**
QA/QC RPD						**Duplicates**	---	14%	23%	---	---	7%	8%	7%	9%	---	---	12%	---	---	---	---	27%	5%	6%
EIRA-8	Sediment EAZ	P5-3I	NA	EB	0.5	19-Jul-17	**0.19**	**2.43**	**53**	**0.28**	<0.050	**29**	**7.53**	**23.5**	**5.81**	<0.050	**0.56**	**11.80**	<0.20	<0.10	<0.050	<2.0	**0.716**	**66.8**	**56.6**
EIRA-9	Sediment EAZ	P5.5-3R	OB	EB	0	20-Jul-17	**0.17**	**3.73**	**89.6**	**0.26**	**0.111**	**18.4**	**5.08**	**17.3**	**6.06**	<0.050	<0.50	**17.70**	<0.20	<0.10	<0.050	<2.0	**0.874**	**36.9**	**38**
EIRA-10	Sediment EAZ	P5.5-3R	OB	EB	0.4	20-Jul-17	**0.17**	**2.95**	**70.2**	**0.25**	**0.097**	**18.5**	**5.32**	**15.8**	**5.50**	<0.050	<0.50	**18.10**	<0.20	<0.10	<0.050	<2.0	**0.812**	**34.9**	**33.4**
EIRA-11	Sediment EAZ	P5.5-3R	OB	EB	0.8	20-Jul-17	**0.16**	**3.68**	**65.3**	**0.26**	**0.11**	**17.8**	**5.39**	**20.5**	**5.63**	<0.050	<0.50	**17.10**	<0.20	<0.10	<0.050	<2.0	**0.809**	**38**	**34.5**
EIRA-12	Sediment EAZ	P5.5-3R	OB	EB	0	20-Jul-17	**0.13**	**3.28**	**73.5**	**0.26**	**0.105**	**20.2**	**5.21**	**15.3**	**5.69**	<0.050	<0.50	**18.70**	<0.20	<0.10	<0.050	<2.0	**0.907**	**35.1**	**35.6**
EIRA-13	Sediment EAZ	P5.5-3R	OB	EB	0.4	20-Jul-17	**0.15**	**3.11**	**76.3**	**0.25**	**0.098**	**17.3**	**5.62**	**17.4**	**5.78**	<0.050	<0.50	**19.40**	<0.20	<0.10	<0.050	<2.0	**0.877**	**39.7**	**37**
EIRA-14	Sediment EAZ	P5.5-3R	OB	EB	0.8	20-Jul-17	**0.17**	**2.82**	**56.4**	**0.24**	**0.098**	**19.7**	**6.46**	**16.2**	**6.11**	<0.050	<0.50	**17.00**	<0.20	<0.10	<0.050	<2.0	**0.716**	**39.3**	**37.6**
EIRA-15	Sediment EAZ	P5.25-5	ATB	EB	0.3	21-Jul-17	**0.14**	**3.19**	**76.8**	**0.24**	**0.102**	**21.8**	**4.99**	**14.8**	**6.21**	<0.050	**0.57**	**17.90**	<0.20	<0.10	<0.050	<2.0	**0.882**	**37.2**	**32.4**
EIRA-16	Sediment EAZ	P6.25-3	OB	EB	0.4	22-Jul-17	**0.12**	**3.53**	**46.4**	**0.4**	**0.089**	**6.47**	**3.66**	**12.1**	**14.60**	<0.050	**0.39**	**5.77**	<0.20	<0.10	<0.050	<2.0	**1.77**	**23.1**	**41.8**
EIRA-17	Sediment EAZ	P7-5	ATB	EB	0.5	24-Jul-17	**0.17**	**3.71**	**52.9**	**0.29**	**0.111**	**22.4**	**5.06**	**15.9**	**6.94**	<0.050	**0.29**	**19.10**	<0.20	<0.10	<0.050	<2.0	**0.964**	**38.9**	**35.7**
EIRA-18	Sediment EAZ	P7.5-3	OB	EB	0.4	26-Jul-17	**0.18**	**3.01**	**54.1**	**0.24**	**0.091**	**25.4**	**5.17**	**16.8**	**5.32**	<0.050	**0.29**	**18.50**	<0.20	<0.10	<0.050	<2.0	**0.708**	**36.6**	**38.7**
DUP-2 (EIRA-18)	Sediment EAZ	P7.5-3	OB	EB	0.4	26-Jul-17	**0.14**	**3.37**	**51.4**	**0.24**	**0.108**	**20.1**	**5.75**	**16.9**	**5.78**	<0.050	**0.3**	**18.10**	<0.20	<0.10	<0.050	<2.0	**0.74**	**41**	**39.5**
QA/QC RPD						**Duplicates**	---	11%	5%	---	---	23%	11%	1%	8%	---	---	2%	---	---	---	---	4%	11%	2%
EIRA-19	Sediment EAZ	P9-3R	OB	EB	0	27-Jul-17	**0.19**	**3.81**	**71.5**	**0.26**	**0.105**	**28.4**	**4.91**	**15.9**	**6.21**	<0.050	**0.36**	**19.00**	<0.20	<0.10	<0.050	<2.0	**0.862**	**37**	**35.3**
EIRA-20	Sediment EAZ	P9-3R	OB	EB	0	27-Jul-17	**0.19**	**3.69**	**105**	**0.26**	**0.08**	**21.5**	**5.31**	**18.7**	**7.10**	<0.050	**0.33**	**20.50**	<0.20	<0.10	<0.050	<2.0	**1**	**41.2**	**37.7**
EIRA-21	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	**0.20**	**3.27**	**64.8**	**0.25**	**0.102**	**20**	**5.11**	**15.6**	**6.29**	<0.050	**0.36**	**17.10**	<0.20	<0.10	<0.050	<2.0	**1.05**	**40**	**34.4**
EIRA-22	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	**0.17**	**2.92**	**37.1**	**0.28**	**0.096**	**23.4**	**5.08**	**16.8**	**6.13**	<0.050	**0.38**	**19.40**	<0.20	<0.10	<0.050	<2.0	**0.874**	**40**	**35.4**
DUP-3 (EIRA-22)	Sediment EAZ	P9-3R	OB	EB	0.4	27-Jul-17	**0.15**	**2.75**	**32.4**	**0.23**	**0.088**	**17.9**	**4.56**	**15.6**	**6.17**	<0.050	**0.25**	**16.80**	<0.20	<0.10	<0.050	<2.0	**0.844**	**35.7**	**32.6**
QA/QC RPD						**Duplicates**	---	6%	14%	---	---	27%	11%	7%	1%	---	---	14%	---	---	---	---	3%	11%	8%
EIRA-23	Sediment EAZ	P9-3R	OB	EB	0.8	27-Jul-17	**0.18**	**2.36**	**39**	**0.22**	**0.074**	**11.2**	**4.04**	**11.7**	**5.57**	<0.050	**0.28**	**9.46**	<0.20	<0.10	<0.050	<2.0	**0.762**	**35.5**	**29.7**
EIRA-24	Sediment EAZ	P9-3R	OB	EB	0.8	27-Jul-17	**0.18**	**2.06**	**60.6**	**0.3**	**0.081**	**11.9**	**3.54**	**9.55**	**7.11**	<0.050	**0.27**	**8.54**	<0.20	<0.10	<0.050	<2.0	**1.23**	**32.2**	**29.6**
EIRA-25	Sediment EAZ	P9-5	ATB	EB	0.5	1-Aug-17	**0.18**	**2.57**	**33.4**	**0.24**	**0.077**	**10.4**	**4.38**	**13.7**	**8.20**	<0.050	<0.50	**10.90**	<0.20	<0.10	<0.050	<2.0	**0.893**	**32.1**	**38.7**
DUP-5 (EIRA 25)	Sediment EAZ	P9-5	ATB	EB	0.5	1-Aug-17	**0.17**	**2.86**	**43.7**	**0.27**	**0.079**	**16.4**	**4.75**	**14.4**	**8.61**	<0.050	<0.50	**15.30**	<0.20	<0.10	<0.050	<2.0	**0.917**	**34.3**	**40.5**
QA/QC RPD						**Duplicates**	---	11%	27%	---	---	45%	8%	5%	5%	---	---	34%	---	---	---	---	3%	7%	5%
EIRA-26	Sediment EAZ	P9-7	DS	EB	0.5	2-Aug-17	**0.13**	**2.23**	**45.5**	**0.21**	**0.074**	**14.9**	**4.26**	**14.3**	**6.31**	<0.050	<0.50	**11.30**	<0.20	<0.10	<0.050	<2.0	**0.671**	**33.6**	**32.8**
EIRA-27	Sediment EAZ	P9.5-5	ATB	EB	0.5	3-Aug-17	**0.15**	**2.93**	**38.6**	**0.25**	**0.069**	**21.3**	**5.24**	**16.5**	**7.04**	<0.050	**0.58**	**18.70**	<0.20	<0.10	<0.050	**12.8**	**1.05**	**38.4**	**33.7**
Western IRA Barrier Removal																									
WIRA-1	Sediment EAZ	P3-3	OB	WB	---	13-Jul-17	**0.16**	**2.79**	**38.9**	**0.33**	**0.057**	**9.1**	**5.31**	**15.7**	**20.20**	<0.050	**0.59**	**6.99**	<0.20	<0.10	<0.050	<2.0	**1.38**	**36.1**	**52.9**
WIRA-2	Sediment EAZ	P3-3	OB	WB	---	13-Jul-17	**0.21**	**4.62**	**39.8**	**0.31**	**0.097**	**10.7**	**6.79**	**16.6**	**15.10**	<0.050	**0.4**	**8.58**	<0.20	<0.10	<0.050	<2.0	**1.04**	**46.8**	**59.3**
WIRA-3	Sediment EAZ	P3-3	OB	WB	---	25-Aug-17	**0.21**	**2.95**	**24**	<0.050	**0.088**	**10.5**	**6.07**	**22.1**	**19.40**	<0.050	<0.50	**8.46**	<0.20	<0.10	<0.050	**6.1**	**0.422**	**46.4**	**55.5**
Eastern Final Barrier Installation - Limit Samples																									
ESA-1	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	**0.22**	**3.88**	**55.1**	**0.27**	<0.050	**17.9**	**8.77**	**17.9**	**7.73**	<0.050	**0.75**	**7.64**	**0.29**	<0.10	**0.056**	<2.0	**0.917**	**83**	**47.1**
ESA-2	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	**0.14**	**1.62**	**52.2**	**0.23**	<0.050	**12.6**	**4.31**	**14.3**	**5.58**	<0.050	**0.44**	**6.29**	<0.20	<0.10	<0.050	<2.0	**0.855**	**54.5**	**33.9**
ESA-3	Sediment EAZ	P4.9-5	ATB	EB	0.5	17-Jul-17	**0.14**	**1.89**	**67.1**	**0.42**	<0.050	**16.2**	**10.8**	**35.4**	**7.17**	<0.050	**0.37**	**11.90**	<0.20	<0.10	**0.06**	<2.0	**0.498**	**65.5**	**57.8**
ESA-4	Sediment EAZ	P4.9-5	ATB	EB	1	17-Jul-17	**0.18**	**1.55**	**27**	**0.21**	<0.050	**12.8**	**5.75**	**21**	**6.93**	<0.050	**0.43**	**6.90**	<0.20	<0.10	**0.055**	<2.0	**0.588**	**59.5**	**46**
ESA-5	Sediment	P4.9-5	ATB	EB	1.3	18-Jul-17	**0.46**	**2.61**	**73.2**	**0.31**	<0.050	**13.5**	**10.2**	**27**	**4.93**	<0.050	**0.36**	**7.95**	**0.21**	<0.10	**0.078**	<2.0	**0.499**	**68.3**	**58.1**
ESA-6	Sediment EAZ	P5-3S	USAT	EB	0.5	19-Jul-17	**0.17**	**1.91**	**45**	**0.35**	<0.050	**16.5**	**17**	**38.7**	**8.44**	<0.050	**0.3**	**9.45**	<0.20	<0.10	**0.071**	<2.0	**0.529**	**76.9**	**56.8**
ESA-7	Sediment EAZ	P5-3I	USAT	EB	0.5	19-Jul-17	**0.22**	**2.12**	**38.8**	**0.35**	<0.050	**20.7**	**6.76**	**29.6**	**5.34**	<0.050	**0.35**	**8.07**	**0.31**	<0.10	**0.061**	<2.0	**0.941**	**108**	**49.8**
ESA-8	Sediment	P5-3I	USAT	EB	1.2	19-Jul-17	**0.19**	**2.45**	**83.7**	**0.43**	**0.063**	**14.8**	**12.2**	**35.8**	**6.77**	<0.050	**0.34**	**8.68**	<0.20	<0.10	<0.050	<2.0	**0.487**	**78.6**	**58.4**
ESA-9	Sediment EAZ	P5.5-3R	OB	EB	1	20-Jul-17	<0.10	**0.74**	**3.1**	<0.10	<0.050	**0.93**	**0.59**	**0.99**	**0.82**	<0.050	**0.13**	**1.82**	**0.51**	<0.10	<0.050	<2.0	**0.128**	**2**	**3.3**
ESA-10	Sediment	P5.5-3R	OB	EB	1.6	20-Jul-17	**0.14**	**1.48**	**120**	**0.47**	<0.050	**14.7**	**9.95**	**31.4**	**4.57**	<0.050	**0.13**	**8.44**	<0.20	<0.10	**0.081**	<2.0	**0.505**	**82**	**71**
ESA-11	Sediment EAZ	P5.25-5	ATB	EB	0.3	20-Jul-17	**0.16**	**2.09**	**30.4**	**0.13**	**0.067**	**9.57**	**4.39**	**14.9**	**8.88**	<0.050	**0.41**	**6.22**	<0.20	<0.10	<0.050	<2.0	**0.459**	**35.3**	**40.6**
ESA-12	Sediment EAZ	P6.5-3	OB	EB	0.5	24-Jul-17	**0.13**	**1.22**	**65.3**	**0.45**	<0.050	**15.7**	**11.9**	**38.1**	**7.03**	<0.050	**0.28**	**8.83**	<0.20	<0.10	**0.062**	<2.0	**0.498**	**64.5**	**67.1**
ESA-13	Sediment	P6.5-3	OB	EB	1.2	24-Jul-17	**0.16**	**1.3**	**95.5**	**0.41**	**0.127**	**22.8**	**8.71**	**32.7**	**4.45**	<0.050	**0.19**	**9.56**	<0.20	<0.10	<0.050	<2.0	**0.592**	**81.4**	**68.8**
ESA-14	Sediment EAZ	P6.5-3	OB	EB	0.5	24-Jul-17	**0.13**	**1.4**	**65.2**	**0.27**	<0.050	**9.78**	**10.6**	**36.5**	**4.54**	<0.050	**0.23**	**5.08**	<0.20	<0.10	<0.050	<2.0	**0.481**	**49.8**	**52.9**
ESA-15	Sediment EAZ	P7-3	OB	EB	0.5	25-Jul-17	**0.18**	**1.69**	**65.8**	**0.4**	<0.050	**12.1**	**8.14**	**33.4**	**6.70**	<0.050	**0.14**	**6.99**	<0.20	<0.10	**0.058**	<2.0	**0.394**	**72.4**	**54**
ESA-16	Sediment	P7-3	OB	EB	1.2	25-Jul-17	**0.13**	**1.27**	**74.8**	**0.33**	**0.062**	**13**	**7.88**	**25.5**	**4.09**	<0.050	**0.24**	**9.66**	<0.20	<0.10	<0.050	<2.0	**0.479**	**62.2**	**50.8**
ESA-17	Sediment EAZ	P7-5	ATB	EB	0.5	25-Jul-17	**0.26**	**3.99**	**129**	**0.49**	**0.051**	**21.4**	**11.9**	**44.5**	**5.37**	<0.050	**0.24**	**10.60**	<0.20	<0.10	**0.07**	<2.0	**0.465**	**83.6**	**61.1**
ESA-18	Sediment EAZ	P7.5-3	OB	EB	0.5	27-Jul-17	**0.12**	**3.03**	**56.1**	**0.36**	**0.068**	**11.4**	**10.1**	**18**	**4.36**	<0.050	**0.11**	**7.75**	<0.20	<0.10	**0.11**	<2.0	**0.5**	**61.7**	**50.3**
ESA-19	Sediment	P7.5-3	OB	EB	1.2	27-Jul-17	**0.11**	**1.37**	**104**	**0.35**	**0.053**	**12.3**	**9.45**	**26.8**	**4.27**	<0.050	**0.16**	**8.99**	<0.20	<0.10	<0.050	<2.0	**0.45**	**61.2**	**53.7**
ESA-20	Sediment EAZ	P7-5	ATB	EB	0.5	27-Jul-17	**0.14**	**1.91**	**73.3**	**0.36**	**0.053**	**14.9**	**10.2**	**29.4**	**10.00**	<0.050	**0.15**	**8.23**	<0.20	<0.10	**0.066**	<2.0	**0.381**	**58.3**	**59.5**
ESA-21	Sediment EAZ	P7-3	OB	EB	0.3	26-Jul-17	**0.19**	**1.32**	**45.6**	**0.31**	**0.064**	**13.7**	**7.85**	**22.4**	**5.81**	<0.050	**0.2**	**8.25**	<0.20	<0.10	**0.054**	<2.0	**0.517**	**65.2**	**52**
ESA-22	Sediment EAZ	P7-3	OB	EB	0.6	26-Jul-17	**0.19**	**1.25**	**55.4**	**0.38**	**0.053**	**17.5**	**10.5**	**29.4**	**5.30**	<0.050	**0.15**	**7.16**	<0.20	<0.10	**0.057**	<2.0	**0.6**	**73.3**	**59.9**
ESA-23	Sediment EAZ	P7-3	OB	EB	0.9	26-Jul-17	**0.21**	**1.49**	**49.2**	**0.33**	<0.050	**12.8**	**8.49**	**26.9**	**5.13**	<0.050	**0.13**	**6.16**	<0.20	<0.10	**0.056**	<2.0	**0.411**	**65**	**52.3**
ESA-24	Sediment EAZ	P9-3R	OB	EB	0.3	27-Jul-17	**0.19**	**1.29**	**110**	**0.43**	**0.069**	**21.8**	**10.8**	**34.2**	**6.55**	<0.050	**0.11**	**10.50**	<0.20	<0.10	**0.082**	<2.0	**0.509**	**84.1**	**68.1**
ESA-25	Sediment EAZ	P9-3R	OB	EB	0.6	27-Jul-17	**0.20**	**2.26**	**63.8**	**0.44**	**0.115**	**26.9**	**10.5**	**34.9**	**5.81**	<0.050	**0.19**	**12.00**	<0.20	<0.10	**0.103**	<2.0	**0.517**	**84.6**	**72**
ESA-26	Sediment EAZ	P9-3R	OB	EB	0.9	27-Jul-17	**0.10**	**0.78**	**58.2**	**0.37**	<0.050	**12.7**	**7.13**	**24.3**	**3.69**	<0.050	<0.10	**7.83**	<0.20	<0.10	**0.091**	<2.0	**0.419**	**55.3**	**59.7**
DUP-4 (ERA-26)	Sediment EAZ	P9-3R	OB	EB	0.5	27-Jul-17	**0.10**	**0.74**	**58.7**	**0.32**	<0.050	**12.4**	**7.16**	**23.2**	**3.61**	<0.050	<0.10	**7.58**	<0.20	<0.10	**0.096**	<2.0	**0.439**	**55.6**	**58.1**
QA/QC RPD						**Duplicates**	---	5%	1%	---	---	2%	0%	5%	2%	---	---	3%	---	---	---	---	5%	1%	3%
ESA-27	Sediment	P9-5	ATB	EB	1.2	27-Jul-17	<0.10	**0.77**	**87.4**	**0.27**	<0.050	**9.76**	**7.93**	**24.5**	**4.06**	<0.050	<0.10	**6.30**	**0.24**	<0.10	<0.050	<2.0	**0.45**	**54.8**	**53.8**
ESA-28	Sediment EAZ	P9-5	ATB	EB	0.5	27-Jul-17	**0.13**	**1.56**	**62.9**	**0.32**	<0.050	**11.8**	**9.57**	**29**	**4.64**	<0.050	**0.27**	**6.09**	<0.20	<0.10	**0.069**	<2.0	**0.294**	**58**	**50.9**
ESA-29	Sediment EAZ	P9-3R	OB	EB	0.5	3-Aug-17	**0.16**	**1.07**	**146**	**0.52**	**0.053**	**17.9**	**10.5**	**48.8**	**5.51**	<0.050	**0.19**	**10.30**	<0.20	<0.10	**0.065**	<2.0	**0.523**	**101**	**74.6**
ESA-30	Sediment	P9-7	DS	EB	1.2	3-Aug-17	**0.12**	**0.8**	**345**	**0.39**	**0.083**	**15.8**	**7.27**	**26.5**	**4.49**	<0.050	**0.11**	**8.21**	<0.20	<0.10	<0.050	<2.0	**0.48**	**67.3**	**59.1**
ESA-31	Sediment EAZ	P9-7	DS	EB	0.5	3-Aug-17	**0.18**	**1.91**	**46**	**0.24**	**0.071**	**13.4**	**6.77**	**19.6**	**7.56**	<0.050	**0.33**	**8.67**	<0.20	<0.10	<0.050	<2.0	**0.401**	**52**	**50.7**
ESA-32	Sediment EAZ	P10-3S	USAT	EB	0.5	3-Aug-17	**0.14**	**2.01**	**86.2**	**0.42**	<0.050	**13.8**	**9.73**	**30.2**	**4.97**	<0.050	**0.12**	**7.40**	<0.20	<0.10	**0.084**	<2.0	**0.348**	**65.5**	**56.7**
ESA-33	Sediment	P9.5-5	ATB	EB	1.2	3-Aug-17	**0.14**	**0.67**	**73.7**	**0.4**	**0.061**	**16.4**	**8.76**	**31.5**	**4.11**	<0.050	<0.10	**8.47**	<0.20	<0.10	**0.084**	<2.0	**0.444**	**76.2**	**63.9**
ESA-34	Sediment EAZ	P9.5-5	ATB	EB	0.5	3-Aug-17	**0.15**	**0.87**	**80.1**	**0.48**	**0.197**	**16.1**	**11.4**	**31**	**8.02**	<0.050	**0.12**	**8.60**	<0.20	**0.11**	**0.079**	<2.0	**0.508**	**88.1**	**57.7**
ESA-35	Sediment EAZ	P10-3I	USAT	EB	0.5	4-Aug-17	**0.14**	**1.26**	**44.2**	**0.36**	<0.050	**12.9**	**7.91**	**25**	**4.36**	<0.050	**0.15**	**6.44**	<0.20	<0.10	**0.06**	<2.0	**0.465**	**62.4**	**48.2**
Western Final Barrier Installation - Limit Samples																									
WSA-1	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	**0.25**	**2.81**	**26.2**	**0.26**	**0.096**	**14.9**	**5.64**	**20.7**	**5.96**	<0.050	**1.29**	**8.26**	<0.20	<0.10	<0.050	<2.0	**4.12**	**59.5**	**43.4**
WSA-2	Sediment EAZ	P3-3	OB	WB	0.8	13-Jul-17	**0.28**	**2.53**	**28.7**	**0.21**	**0.062**	**13.6**	**6.4**	**15.7**	**12.70**	<0.050	**1.22**	**8.38**	<0.20	<0.10	**0.06**	<2.0	**3.73**	**54.1**	**44.3**
WSA-3	Sediment EAZ	P3-3	OB	WB	0.75	13-Jul-17	**0.28**	**3.01**	**24.8**	**0.15**	**0.094**	**13.8**	**6.45**	**13.1**	**28.00**	<0.050	**1.79**	**8.13**	<0.20	<0.10	<0.050	<2.0	**3.8**	**56.3**	**41.6**
WSA-4	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	**0.20**	**5.02**	**31.9**	**0.21**	**0.052**	**13.8**	**8.69**	**20.4**	**16.20**	<0.050	**1.56**	**8.58**	<0.20	<0.10	<0.050	<2.0	**3.47**	**60.2**	**43.5**
WSA-5	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	**0.21**	**3.83**	**38.6**	**0.31**	**0.059**	**10.8**	**7.43**	**20.5**	**21.90**	<0.050	**1.38**	**7.67**	<0.20	<0.10	<0.050	**19.7**	**2.92**	**41.9**	**50.6**
WSA-6	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	**0.21**	**3.09**	**21.9**	**0.19**	**0.077**	**11.2**	**8.4**	**20.8**	**16.70**	<0.050	**0.9**	**9.11**	<0.20	<0.10	<0.050	<2.0	**0.363**	**50.8**	**63.5**
WSA-7	Sediment EAZ	P3-3	OB	WB	0.5	13-Jul-17	**0.36**	**4.74**	**38.2**	**0.24**	**0.188**	**15.9**	**9.29**	**23.5**	**10.90**	<0.050	**1.89**	**12.60**	<0.20	<0.10	**0.091**	<2.0	**1.11**	**58.8**	**55.9**
WSA-8	Sediment	P3-3	OB	WB	1.2	13-Jul-17	**0.22**	**2.63**	**35.8**	**0.24**	<0.050	**15.3**	**7.49**	**26.4**	**7.47**	<0.050	**0.39**	**7.80**	<0.20	<0.10	<0.050	<2.0	**2.07**	**70.2**	**53**
WSA-9	Sediment	P3-3	OB	WB	1.2	13-Jul-17	**0.19**	**1.93**	**36.3**	**0.24**	**0.071**	**19.3**	**9.89**	**31.9**	**5.60**	<0.050	**0.25**	**8.95**	<0.20	<0.10	**0.061**	<2.0	**1.36**	**74.2**	**55.9**
WSA-10	Sediment	P3-3	OB	WB	1.2	15-Jul-17	**0.17**	**1.94**	**122**	**0.26**	<0.050	**12.6**	**8.72**	**27.2**	**5.84**	<0.050	**0.32**	**8.20**	<0.20	<0.10	<0.050	<2.0	**0.774**	**70.6**	**52.2**
WSA-11	Sediment EAZ	P3-3	OB	WB	0.2-0.5	15-Jul-17	**0.27**	**3.41**	**27.8**	**0.25**	**0.057**	**14.9**	**7.35**	**23.2**	**11.70**	<0.050	**0.94**	**9.24**	<0.20	<0.10	<0.050	<2.0	**2.48**	**62.6**	**47.3**
WSA-12	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	**0.25**	**4.04**	**24.4**	**0.21**	**0.069**	**15**	**6.77**	**18.9**	**12.70**	<0.050	**1.07**	**9.57**	**0.23**	<0.10	<0.050	<2.0	**2.6**	**54.1**	**39.6**
WSA-13	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	**0.20**	**3.3**	**26.6**	**0.18**	**0.083**	**19.3**	**7.78**	**16.2**	**4.78**	<0.050	**1.13**	**9.13**	<0.20	<0.10	**0.053**	<2.0	**2.62**	**58.1**	**35.9**
WSA-14	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	**0.26**	**3.32**	**24.8**	**0.21**	**0.11**	**11.8**	**6.87**	**21.4**	**15.80**	**0.235**	**0.64**	**9.02**	<0.20	<0.10	<0.050	<2.0	**0.706**	**47.8**	**62.9**
WSA-15	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	**0.33**	**2.66**	**33.5**	**0.19**	**0.526**	**20**	**12.4**	**27.3**	**4.93**	<0.050	**0.64**	**10.70**	**0.4**	<0.10	**0.179**	<2.0	**4.04**	**73.5**	**47.5**
WSA-16	Sediment EAZ	P3-3	OB	WB	0.5	15-Jul-17	**0.22**	**2.14**	**28**	**0.27**	<0.050	**14.2**	**9.44**	**31.9**	**6.92**	<0.050	**0.31**	**7.84**	<0.20	<0.10	**0.056**	<2.0	**2.55**	**84.5**	**52.2**
WSA-17	Sediment EAZ	P3-3	OB	WB	0.7	15-Jul-17	**0.20**	**3.7**	**32.3**	**0.22**	<0.050	**18.3**	**8.35**	**30**	**4.76**	<0.050	**0.67**	**9.13**	<0.20	<0.10	**0.067**	<2.0	**1.69**	**75.6**	**45.1**
Backfill and Grab Samples from Final Barrier Installation																									
BF-SG-01	Backfill	---	---	---	---	12-Jul-17	<0.10	**2.3**	**52.8**	**0.29**	<0.050	**5.05**	**4.14**	**41.2**	**5.57**	<0.050	**0.67**	**3.07**	<0.20	<0.10	<0.050	<2.0	**0.265**	**20.4**	**40.5**
BF-SG-02	Backfill	---	---	---	---	12-Jul-17	<0.10	**2.03**	**52.7**	**0.32**	<0.050	**3.31**	**3.75**	**4.46**	**1.13**	<0.050	**1.08**	**1.28**	<0.20	<0.10	<0.050	<2.0	**0.273**	**17.4**	**36.8**
BF-SG2	Backfill	---	---	---	---	8-Aug-17	<0.10	**1.57**	**29.1**	**0.25**	<0.050	**5.31**	**3.45**	**3.74**	**1.22**	<0.050	**2.45**	**2.73**	<0.20	<0.10	<0.050	<2.0	**0.263**	**18.7**	**32.4**
BF-SG2-1	Backfill	---	---	---	---	13-Jul-17	**0.57**	**3.83**	**79.2**	**0.2**	**0.162**	**20.3**	**6.97**	**21.7**	**6.68**	<0.050	**1.19**	**21.20**	<0.20	<0.10	<0.050	<2.0	**0.326**	**43.1**	**62.6**
BF-SG2-2	Backfill	---	---	---	---	13-Jul-17	**0.34**	**3.23**	**44.9**	**0.19**	**0.075**	**23.2**	**5.87**	**13.2**	**1.91**	<0.050	**0.93**	**17.90**	<0.20	<0.10	<0.050	<2.0	**0.264**	**40.7**	**37.4**
GS17-01	Grab	---	---	---	---	4-Jul-17	**0.19**	**3.8**	**42.6**	**0.18**	**0.111**	**22.8**	**6.61**	**19.7**	**1.88**	<0.050	**0.31**	**25.20**	<0.20	<0.10	<0.050	<2.0	**0.205**	**44.5**	**41.8**
GS17-02	Grab	---	---	---	---	4-Jul-17	**0.16**	**2.89**	**46.6**	**0.16**	**0.089**	**22.6**	**6.04**	**16.5**	**1.60**	<0.050	**0.26**	**22.40**	<0.20	<0.10	<0.050	<2.0	**0.175**	**39.1**	**34.9**
GS17-03	Grab	---	---	---	---	4-Jul-17	**0.20**	**6.41**	**46.9**	**0.17**	**0.109**	**31.7**	**6.72**	**19**	**1.86**	<0.050	**0.26**	**27.50**	<0.20	<0.10	<0.050	<2.0	**0.182**	**47.5**	**38.4**
GS17-04	Grab	---	---	---	---	4-Jul-17	<0.10	**5.75**	**58.6**	**0.83**	**0.159**	**2.42**	**1.02**	**2.38**	**22.70**	<0.050	**2.13**	**3.22**	<0.20	<0.10	<0.050	<2.0	**6.95**	**2.16**	**47.2**
GS17-05	Grab	---	---	---	---	4-Jul-17	<0.10	**6.24**	**60.9**	**0.92**	**0.194**	**2.52**	**0.95**	**2.91**	**24.20**	<0.050	**2.25**	**3.49**	<0.20	<0.10	<0.050	<2.0	**7.83**	**1.77**	**52.2**
GS17-06	Grab	---	---	---	---	4-Jul-17	<0.10	**5.27**	**51.2**	**0.79**	**0.145**	**2.35**	**0.77**	**2.18**	**20.00**	<0.050	**1.95**	**2.93**	<0.20	<0.10	<0.050	<2.0	**6.54**	**1.42**	**45.5**
GS17-07	Grab	---	---	---	---	4-Jul-17	**0.24**	**3.95**	**26.8**	**0.5**	**0.084**	**3.49**	**0.63**	**6.99**	**15.10**	<0.050	**1.34**	**2.26**	<0.20	<0.10	<0.050	<2.0	**4.61**	**2.13**	**29.7**

TABLE 4
CONCENTRATIONS OF METALS IN SEDIMENT SAMPLES (µg/g [ppm])
FORESHORE
PARKLAND BURNABY REFINERY

							Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tin	Uranium	Vanadium	Zinc
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments EAZ)							20	10	700	85-100, 150 [3]	1.0-2.0, 2.6 [3]	60 [2]	25	67	69	0.43	80	70, 150 [3]	1	20	9	50	150	150	150, 170 [3]
Applicable Stage 11 (Housekeeping Amendment) Updated Standard [1] (Sediments)							20	10	700	85-100, 150 [3]	1 - 3.5, 5.0 [3]	60 [2]	25	75, 130 [3]	120, 130 [3]	0.84	80	70, 150 [3]	1	20	9	50	150	150	150-200 [3]
Source							Gen.So.	Gen.Sed.	Gen.So.	Mat.So.	Mat So./Gen Sed	Gen.Sed	Mat.So.	Gen.Sed./Gen So.	Gen.Sed./Gen So.	Gen.Sed	Mat So.	Gen.So./Mat So.	Mat So.	Gen.So.	Gen.So.	Gen.So.	Mat. So.	Mat. So.	Gen.Sed./Mat So
Sample ID	**Matrix**	**Sample Location**	**Sediment Location**	**Location Area**	**Sample Depth (m)**	**Sample Date**																			
GS17-08	Grab	---	---	---	---	4-Jul-17	**0.23**	**4.31**	**27.8**	**0.57**	**0.106**	**3.52**	**0.65**	**7.56**	**15.40**	<0.050	**1.46**	**2.35**	<0.20	<0.10	<0.050	<2.0	**4.74**	**2.2**	**40.5**
GS17-09	Grab	---	---	---	---	4-Jul-17	**0.23**	**4.02**	**25.7**	**0.53**	**0.09**	**3.22**	**0.62**	**7.03**	**14.00**	<0.050	**1.37**	**2.19**	<0.20	<0.10	<0.050	<2.0	**4.58**	**2.12**	**29.5**
Upgradient Samples from Final Barrier Installation																									
PW17-4@0.1-0.3	Sediment EAZ	P3-3	US	WB	0.1-0.3	2-Oct-17	**0.26**	**3.77**	**25.5**	**0.25**	**0.129**	**18.5**	**7.66**	**19.7**	**5.43**	<0.050	**1.01**	**11.60**	**0.29**	<0.10	<0.050	<2.0	**3.24**	**61.9**	**43.2**
PW17-4@0.7-0.9	Sediment EAZ	P3-3	US	WB	0.7-0.9	2-Oct-17	**0.26**	**4.92**	**24.1**	**0.22**	**0.166**	**16.9**	**10.7**	**21**	**5.21**	<0.050	**0.89**	**8.74**	**0.28**	<0.10	**0.07**	<2.0	**3.56**	**72.2**	**48.0**
PW17-16 @0.7-0.9	Sediment EAZ	P6,25-3	US	EB	0.7-0.9	25-Aug-17	**0.14**	**1.68**	**50.5**	**0.27**	<0.050	**14.9**	**7.52**	**23.5**	**5.01**	<0.050	**0.22**	**10.30**	<0.20	<0.10	<0.050	<2.0	**0.494**	**57.1**	**45.6**
PW17-21 @0.5-0.7	Sediment EAZ	P7-3	US	EB	0.5-0.7	31-Aug-17	**0.14**	**1.7**	**48.3**	**0.26**	**0.065**	**16.4**	**8.25**	**25.6**	**9.32**	<0.050	**0.2**	**12.20**	<0.20	<0.10	<0.050	<2.0	**0.533**	**60.7**	**46.5**
PW17-26 @0.5-0.7	Sediment EAZ	P8-3	US	EB	0.5-0.7	31-Aug-17	**0.17**	**1.11**	**122**	**0.49**	**0.053**	**17.1**	**12.7**	**35.8**	**4.94**	<0.050	**0.15**	**10.30**	<0.20	<0.10	**0.069**	<2.0	**0.433**	**89.1**	**72.1**

Notes
< - Sample concentration less than the detection limit indicated.
--- - Sample not analyzed for indicated parameter.
***** - Excavated for IRA Installation
4. - Excavated during refurbishment of the eastern IRA barrier.
1 - The minimum of the CSR generic numerical soil (Park Land Use [PL]), CSR matrix numerical soil (Park Land Use [PL]), and CSR generic numerical sediment (marine/estuarine typical) was selected as the applicable standard. SedQCIs are applicable to all depths at typical sediment sites and to any depth greater than 1 metre of stable sediment at sensitive sediment sites BC (CSR Stage 11 [Housekeeping] Amendment; approved on October 31, 2017 and effective November 1, 2017).

2 - Standard is for Chromium (6+)
3 - Standard is pH dependant, which was derived from either the matrix and/or generic standards. See Stage 10 Updates for details.

BOLD	Sample concentration is detected
SHADE	Sample concentration greater than CSR sediment (marine/estuarine sensitive for depths less than 1 metre; marine/estuarine typical for depths greater than 1 metre), CSR generic or matrix soil standard for urban park land use Stage 11 Updates.

Abbreviations
µg/g [ppm] - micrograms per gram [parts per million] dry weight
m - meters

Acronyms
ATB- located in anchor trench barrier
CS - located cross slope
CSR - Contaminated Sites Regulation
DS - located down slope
EAZ - ecologically active zone
EB - eastern barrier
Gen. Sed. - CSR generic numerical sediment (Marine/Estuarine) standard
Gen .So. - CSR generic numerical soil (Park Land Use [PL]) standard
IRA - interim remedial action
m - metre
NA - not applicable
NAPL - non-aqueous phase liquid
NS - no standard established for indicated parameter.
OB - located within the original barrier
USAT - located up slope anchor trench
WB - western barrier

Appendix A - Additional Background

Chevron Canada Limited (CCL) first observed non-aqueous phase liquid (NAPL) seeps on the north, downward slope of the Parkland (formerly Chevron) Burnaby Refinery towards Burrard Inlet during an inspection on April 21, 2010. The seeps were immediately reported to the Provincial Emergency Program and addressed using soaker pads and booms. Small volumes of NAPL were visually observed at the Site at the base of the approximately four metre high rip-rap embankment leading up to the railway. The seeps were initially observed along an approximately 20 metre long section of the Site.

The source of the NAPL is unknown but believed to be associated with historical Refinery operations and the north process sewer (decommissioned in June 2011).. Chemical analysis of the NAPL indicated that it consists of a mixture of semi-refined petroleum hydrocarbons in the diesel and straight-run gasoline ranges, along with the potential for small amounts of jet fuel and/or crude oil. None of the NAPL samples contained appreciable concentrations of metals (URS, 2011a). A ten well extraction well system was installed along the northern Refinery fence line in the summer of 2010 and has been operating since August 5, 2010 (URS, 2012b). In 2011, an additional 30 wells and pumps were added to the east and west of the initial extraction system and in June 2012, two new deeper extraction wells were installed in the centre of the original ten well system and replaced two of the original extraction wells (URS, 2013a). In addition, an interception trench system was installed along the Canadian Pacific Railway (CPR) Right of Way (ROW) in the spring of 2011.

1. PRELIMINARY AND DETAILED SITE INVESTIGATIONS

In June 2010, a Preliminary Site Investigation (PSI) was conducted that was followed by a Detailed Site Investigation (DSI) in January through April 2011 (URS, 2011a), by AECOM Canada Ltd. (formerly URS Canada Inc.) PCOCs identified during the PSI and DSI in porewater[6], and surface water[7] samples were compared to British Columbia (BC) Water Quality Guidelines (WQGs) for marine aquatic life. If no BC WQGs were available for certain PCOCs, then 1/10 the Contaminated Site Regulation (CSR) aquatic life (AW) standards were used for screening. If neither standard was available, a background approach based on Reference Area concentrations was used for the screening. A select number of PSI or DSI porewater samples analyzed exceeded the applicable regulatory screening levels for the following PCOCs in one or more samples:

- Volatile Petroleum Hydrocarbons in Water (VPHw);
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX);
- Light/Heavy Extractable Petroleum Hydrocarbons in Water (LEPHw / HEPHw);
- Polycyclic Aromatic Hydrocarbons (PAHs); and
- Metals (aluminum, boron, cadmium, cobalt, copper, iron, manganese, nickel, selenium, thallium, and zinc).

All eighteen of the surface water samples collected and analyzed during the DSI exceeded one or more of the applicable regulatory screening levels for xylenes and metals (aluminum, boron, iron, and cadmium).

DSI ambient air samples were compared to the CSR Schedule 11 Urban Park (PLv) Generic Numerical Vapour Standards. One air sample collected during the excavation component of the organoclay mats installation exceeded the applicable regulatory screening standard for benzene.

2. INTERIM REMEDIAL ACTION

In February and March 2011, IRA Barriers were constructed at the NAPL seep locations (URS, 2011b). The IRA Barriers consisted of: (a) excavating the beach sand to depths of approximately 0.6 metres immediately down slope of the seep locations; (b) back-filling with sand-organoclay mixture (2 to 3 parts of native beach sand to 1 part of organoclay) in order to intercept the seep and minimize NAPL mobilization below ground; (c) placing additional sand-organoclay mixture around large immovable boulders; (d) covering the surface and down slope portions of the sand-organoclay mixtures with a CETCO Reactive Core Material (RCM) mat; and finally (e) the placement of

[6] In the DSI report water from wells screened from ground surface to 1 metre bgs was referred to as “porewater”. The term “groundwater” was used to describe water collected from wells screened deeper than 1 metre bgs. However, since the update of ENV Technical Guidance 15, all subsurface water on the foreshore is now considered porewater. In this report, porewater in the top 1 metre is defined as “porewater ecologically active zone (EAZ)” and porewater deeper than 1 metre is defined as “porewater”.

[7] In the DSI report surface water was referred to as “seawater”.

polyethylene sheeting, geogrid and large boulders to protect the RCM mat and the sand-organoclay barrier from the elements.

In November 2011, an assessment was completed by URS to assess the nature and extent of NAPL within and down slope of the sand-organoclay portions of both the Eastern and Western IRA Barriers. Based on field observations coupled with analytical results, NAPL impacts were encountered within the sand-organoclay mixture in both the Eastern and Western IRA Barriers and, to a lesser extent, down slope in the adjacent beach sand anchor trench in the Eastern IRA Barrier.

Based on the findings of the NAPL assessment, URS refurbished the Eastern IRA Barrier in March and April 2012. The refurbishment consisted of: (a) excavating the beach sand anchor trench to approximately 1 metre in depth to the base of the existing horizontal RCM mat, located immediately down slope of the original Eastern IRA Barrier; (b) installing a layer of RCM mat over the existing top surface of the Eastern IRA Barrier and down into the southern wall of the excavation; (c) installing a layer of RCM mat and polyethylene sheeting down into the northern wall of the new sand-organoclay excavation and folding the RCM back to the north over the native beach sand; (d) back-filling the trench with a sand-organoclay mixture (3 parts of imported sand to 1 part of organoclay), inserting baffles within the mixture, and folding the RCM mat and polyethylene sheeting over the newly installed, and original, RCM matting and polyethylene sheeting; and finally (e) installing a third layer of RCM mat over the existing Eastern IRA Barrier, the newly installed sand organoclay trench and 2 to 3 metres down slope towards Burrard Inlet.

During the course of the refurbishment of the Eastern IRA Barrier, approximately 368 cubic metres of sediment were excavated and disposed at an approved off-site facility. Twenty-seven confirmatory sediment samples collected from the base and sidewalls of the excavation contained concentrations less than the screening levels, and in most cases, less than the laboratory detection limit, indicating that all contamination was removed in the excavated area.

3. PREVIOUS MONITORING REPORTS

A monitoring plan and eight monitoring reports have been prepared and submitted to the ENV for the Site:

Foreshore Monitoring Plan, Chevron Burnaby Refinery, Burnaby, British Columbia. URS Canada Inc., June 29, 2012.

Foreshore Quarterly Monitoring Program Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia September to December 2011 URS Canada Inc., November 1, 2012.

Foreshore 2012 First Semi-Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia URS Canada Inc., December 19, 2012.

Foreshore 2012 Second Semi-Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia URS Canada Inc., March 26, 2013.

Foreshore 2013 First Semi-Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia URS Canada Inc., October 31, 2014.

Foreshore 2013 Second Semi-Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia URS Canada Inc., August 28, 2015.

Foreshore 2014 Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia AECOM, July 13, 2016.

Foreshore 2015 Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia AECOM, December 21, 2016.

Foreshore 2016 Annual Report Below Area 2 Eastern Impounding Basin, Chevron Burnaby Refinery, British Columbia AECOM, September 26, 2017.

The Foreshore 2015 Annual Monitoring Report (AECOM, 2016e) is available on the Parkland Community Advisory Panel website: http://chevroncap.com/files/current-issues.php. The most recent 2016 monitoring report (AECOM, 2017b) will be released online in 2018.

Appendix B - Regulatory Context

Several provincial and federal regulatory agencies share authority for assessing and managing contaminated sites in BC. The agencies that have regulatory power include the Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), and the BC Ministry of Environment and Climate Change Strategy (ENV). The Site is under the jurisdiction of the VFPA. VFPA operates under the Canada Marine Act, and is a responsible agency under the Canadian Environmental Assessment Act. The ENV has taken the lead role in reviewing the remediation of the contamination at the Site.

Appropriate sections of the following laws and regulations applied during the design and construction of the FPTS:

- Canadian Environmental Protection Act, 1999 (S.C. 1999, c. 33) and associated regulations; Fisheries Act (R.S.C. 1985, c. F-14) and associated regulations
- Canada Marine Act (S.C. 1998, c. 10)
- Transportation of Dangerous Goods Act, 1992 (S.C. 1992, c. 34)
- Heritage Conservation Act (HCA) (R.S.B.C. 1996) c.187

Provincial statutes and regulations that apply to the management of sediment and porewater quality include:

- BC Environmental Management Act (EMA) (S.B.C. 2003, c. 53), effective July 8, 2004
- Contaminated Sites Regulation (CSR), BC Reg. 375/96, effective April 1, 1997 (including Stage 11 amendments, effective November 1, 2017)
- Hazardous Waste Regulation (HWR), BC Reg. 63/88, effective April 1, 1988 (including amendments up to B.C. Reg. 52/95)
- For surface water, the ENV Approved and Working WQG for marine aquatic life apply.

1. CANADIAN ENVIRONMENTAL PROTECTION ACT

Within the federal government jurisdiction, the Canadian Environmental Protection Act (CEPA) is the primary element of the legislative framework for preventing pollution and protecting the environment and human health. In general, CEPA:

- Makes pollution prevention the cornerstone of national efforts to reduce toxic substances in the environment;
- Sets out processes to assess the risks to the environment and human health posed by substances in commerce (in use) or used for manufacturing purposes in Canada;
- Imposes time frames for managing toxic substances;
- Provides a wide range of tools to manage toxic substances, other pollution and wastes; and,
- Ensures the most harmful substances are phased out or not released into the environment in any measurable quantity.

2. FISHERIES ACT

Under the authority of the Fisheries Act, DFO has decision-making authority for the conservation and protection of fish and fish habitat. The fish and fish habitat protection provisions of the Fisheries Act provide mechanisms to allow development of projects to occur while providing for the protection of fish and fish habitat.

The key sections within the act that directly apply to this project are:

- Section 35(1) of the Fisheries Act which prohibits the harmful alteration, disruption or destruction of fish habitat; and
- Section 36(3) of the Fisheries Act which prohibits the discharge of deleterious substances to water frequented by fish either directly or indirectly.

3. CONTAMINATED SITES REGULATION

The CSR under the EMA is the principal regulatory document defining requirements for contaminated sites management in BC. The CSR came into effect on April 1, 1997 and has been amended several times, with the most recent significant changes on November 1, 2017 via the Stage 11 Housekeeping Amendments. The EMA and CSR have provisions for both the numerical standards and risk-based standards approaches to managing site contamination. They outline the procedures for site assessment, remediation and application for environmental closure for a property. Numerical standards are key components of the requirements in the CSR as they define whether or not a site is contaminated. Land Remediation staff of the ENV currently oversee the ongoing investigation and remediation.

Under the CSR, there are three types of numerical remediation standards. 1) The Generic Numerical Standards refer to concentrations of given substances in soil or water for a particular land use. 2) Matrix Numerical Standards are applied for some substances in soil, taking into account various site-specific factors such as proximity to receiving waters, likelihood of human ingestion, and use of land for livestock rearing. 3) Site-Specific Numerical Standards involve the generation of a standard for a specific site, based on a protocol outlined by ENV.

3.1. STAGE 11 HOUSEKEEPING AMENDMENTS

ENV approved the Stage 10 Amendment (Omnibus) to the Contaminated Sites Regulation (CSR) on October 27, 2016. The Omnibus amendment updated over 8500 environmental quality standards and came into effect November 1, 2017. Since the introduction of the Omnibus, five Errata updates have been issued (Versions 1 - 5) with the most recent amendment being the Stage 11 (Housekeeping) Amendment, approved October 31, 2017, which corrected a number of errors in the Omnibus found during the year of transition prior to coming into legal force. Any submissions for Ministry services after November 1, 2017, have to be in compliance with the new standards. In conjunction with the Stage 11 Amendments, ENV has updated various protocols, guidance, procedures and policies.

The Stage 11 Amendments have included updates to all existing soil, water, vapour, and sediment standards to reflect contemporary science and have simplified the formatting and consolidation of the existing CSR schedules into four new schedules:

- Schedule 3.1 – Part 1, Matrix Numerical Soil Standards;
- Schedule 3.1 – Part 2, Generic Numerical Soil Standards to Protect Human Health;
- Schedule 3.1 – Part 3, Generic Numerical Soil Standards to Protect Ecological Health;
- Schedule 3.2, Generic Numerical Water;
- Schedule 3.3, Generic Numerical Vapour Standards; and
- Schedule 3.4, Generic Numerical Sediment Standards.

4. HAZARDOUS WASTE REGULATION

The HWR, formerly the Special Waste Regulation, classifies substances as Hazardous Wastes if they contain leachable contaminants at concentrations in excess of a specified maximum, contain total concentrations in excess of a specified maximum, or are a listed waste type. The Toxicity Characteristic Leaching Procedure, United States Environmental Protection Agency Method 1311, is employed to assess contaminant leachability. Materials with contaminants detected in the leachate at concentrations exceeding the leachate quality standards specified in Table 1 of Schedule 4 of the HWR are considered a leachable toxic waste, and hence Hazardous Wastes. Hazardous Wastes defined by total concentrations include polychlorinated biphenyls waste, waste containing dioxin, waste oil, waste asbestos, waste containing tetrachloroethylene, and waste containing PAHs. Waste types listed in Schedule 7 of the HWR are considered hazardous wastes. Hazardous Wastes must be handled, stored and disposed of in accordance with the HWR.

Appendix C - Vancouver Fraser Port Authority Permit: 16-180

	VANCOUVER FRASER PORT AUTHORITY PROJECT AND ENVIRONMENTAL REVIEW REPORT AND PERMIT
PER No.:	**16-180**
Tenant:	**Chevron Canada Limited**
Project:	**Chevron Refinery Foreshore Final Remedy**
Project Location:	**5201 Penzance Drive, Burnaby**
VFPA SID No.:	**BBY089**
Land Use Designation:	**Port Water**
Applicant(s):	**AECOM, on behalf of Chevron Canada Limited**
Applicant Address:	**3292 Production Way, Burnaby, BC, V5A 4R4**
Category of Review:	**B**
Date of Approval:	**May 24, 2017**
Date of Expiry:	**May 31, 2022**

1 INTRODUCTION

The Vancouver Fraser Port Authority (VFPA), a federal port authority, manages lands under the purview of the *Canada Marine Act*, which imparts responsibilities for environmental protection. VFPA accordingly conducts project and environmental reviews of works and activities undertaken on these lands to ensure that the works and activities will not likely cause significant adverse environmental effects. This project and environmental review report and project permit (the Permit) documents VFPA's project and environmental review of PER No. 16-180: Chevron Refinery Foreshore Final Remediation (the Project) proposed by AECOM working on behalf of Chevron Canada Limited (the Applicant).

This project and environmental review was carried out to address VFPA's responsibilities under the *Canada Marine Act*, and to meet the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), as applicable. The proposed Project is not a CEAA 2012 "designated project" and an environmental assessment as described in CEAA 2012 is not required. However, VFPA authorization is required for the proposed Project to proceed and in such circumstances, where applicable, Section 67 of CEAA 2012 requires federal authorities to assure themselves that projects will not likely cause significant adverse environmental effects. This review provides that assurance. In addition, VFPA considers other interests, impacts and mitigations through the project and environmental review.

The project and environmental review considered the application along with supporting studies, assessments and consultations carried out or commissioned by the Applicant, as well as other information provided by the Applicant. In addition, this project and environmental review considered other information available to VFPA and other consultations carried out by VFPA. A full list of information sources germane to the review is provided in the following pages of this report.

This Permit is the authorizing document allowing the Applicant to proceed with the Project subject to the listed project and environmental conditions.

2 PROJECT DESCRIPTION

The Project is the final step in Chevron's Foreshore Remedial Action Plan (RAP) to remediate soil and groundwater near Chevron's Burnaby Refinery at 5201 Penzance Drive, Burnaby, BC. The Project is to mitigate environmental risk by managing the non-aqueous phase liquid (NAPL) and associated contaminants of concern in porewater and surface water in the vicinity of the NAPL seeps. The site of the NAPL seepage and of the Project is located in the northern portion of the refinery in and near the foreshore of Burrard Inlet. The proposed work will be conducted within 250m of archaeological site DhRr-0230.

After the initial observation of the seeps in April 2010, contaminants of concern were recorded in sediment, air, and ground and surface water, including petroleum hydrocarbons and select metals. The seeps were identified as two areas: Western Seep Area (WSA) and Eastern Seep Area (ESA), which are approximately 30m apart. Interim interceptor trenches were first installed in 2011, at both the WSA and ESA, as an interim measure to manage the seeps while more permanent solutions were studied. VFPA issued Permit 10-161 for the interim remediation project.

The works for the remediation activities are planned early July 2017 to late September 2017 at low tide during the day at normal operation hours. The footprint of the work site (including the ESA, WSA, rip-rap, and monitoring wells) is approximately 140m x 30m, or 4200m^2. The excavation footprint will range from 950m^2 to 1500m^2, depending on the extent of contaminated soils in the WSA. The site is not accessible by road; therefore, all equipment will be loaded on a barge and mobilized via Burrard Inlet to the site.

The Project consists of removing the interim remediation barriers installed in 2011 in the foreshore, and installing new permanent remediation measures. The ESA will have subsurface treatment cells installed; the WSA is not expected to require subsurface treatment cells and will be backfilled with appropriate matching subgrade material, provided no contaminated soils are found. If contaminated soils are discovered in the WSA, the size of the WSA excavation will be expanded and subsurface treatment cells will be installed in the same manner as the ESA. Rip-rap will be installed on the foreshore to protect the remediation structures and also to prevent scouring of the slope near the CP Rail right-of-way. Approximately 23 monitoring wells are proposed to be installed. A qualified remediation contractor will conduct these works.

The Applicant completed a *Fisheries Act* self-assessment and submitted a Request for Project Review to Fisheries and Oceans Canada (DFO). DFO responded that a *Fisheries Act* authorization is not required for the project given that serious harm to fish can be avoided by following standard measures. The Applicant will only work in the foreshore during low tide to keep works dry. No equipment or open excavations will be left in intertidal areas overnight or during high tides.

The Applicant has prepared a Construction Environmental Management Plan (CEMP) that includes measures to mitigate potential environmental impacts including: sediment transport and turbidity, contaminated soil and groundwater, riparian vegetation, and spills and leaks. An Environmental Monitor will ensure compliance with the CEMP, this Permit, and applicable environmental regulations. The Environmental Monitor will prepare weekly reports. A qualified archaeological monitor will be on site during ground disturbance to native soils. Aboriginal groups will be given the opportunity to participate in archaeological and environmental monitoring during the Project.

Confirmatory excavation sampling will follow the BC Ministry of Environment's *Technical Guidance 1 Site Characterization and Confirmation Testing (2009)* with samples collected every metre vertically and every 5 metres horizontally from the base and side walls of excavations. Soils and groundwater that are confirmed to be contaminated will be removed and transported to an

approved disposal site. Confirmed contaminated soil will be removed to the extent allowed without affecting geotechnical stability of the CP Rail slope and right-of-way.

The Applicant plans to monitor contamination for a minimum of three (3) years post-construction. The Applicant will conduct ongoing vegetation maintenance and management near the Project site over the life of the remediation structures (~30 years). Rip-rap replacement may be required in the future, subject to a separate subsequent approval by VFPA.

The BC Ministry of Environment (BC MOE) has reviewed the Project and supports the planned works, as outlined in their letter to Chevron dated September 9, 2016.

In this project permit, the Project means the physical activities authorized by VFPA to be carried out pursuant to **PER No. 16-180**, as described below.

2.1 Proposed Works

1. Access to foreshore by loading equipment on a barge and mobilizing via Burrard Inlet to the site, and returning equipment to the barge prior to high-tide.
2. Removal of an estimated 150m^2 of riparian vegetation, including trees, shrubs, and ferns. Vegetation maintenance will be performed over the lifetime of the remedy to prevent damage to the remedy structures.
3. Removal of the boom near the ESA.
4. Excavation and removal of the existing interim remediation barriers (approximately 44m) from the WSA and ESA. The excavations will be staged in 5 to 10 metre segments along the length of the foreshore. Each segment will be excavated, backfilled and covered by the end of each work day before the tide covers the site; there will be minimal in-water works.
5. Contaminated soil and groundwater will be removed and transported on a barge in polypropylene super sack bags. All disposals will be at approved disposal sites.
6. Installation of the new permanent remediation barrier at the ESA within trench segments (5 to 10 metres) in the foreshore. This includes imported fill (e.g., gravel, sand, clay), geogrid filter fabric, and poly sheeting. The ESA subsurface treatment cells will be covered by an oleophilic biobarrier geocomposite to capture potential NAPL sheens. A layer of cobbles 20 centimetres (cm) thick will anchor the oleophilic biobarrier composite.
7. Installation of natural, non-leaching rip-rap of a median 0.7 metres in diameter and total rip rap thickness of 1.4 metres to protect the ESA remediation structures and for scour protection of the CP Rail right-of-way slope from wave forces generated by 100-year storm events and ship wakes.
8. The WSA trench segments will be backfilled with appropriate matching subgrade materials unless additional contamination is discovered, upon which the WSA excavation area will be extended and will receive similar remedy structures as the ESA.
9. Installation of 23 monitoring wells with concrete risers to protect them from shifting rip-rap. Porewater wells will be placed up slope, within and down slope of the ESA and WSA to monitor performance and establish compliance with applicable standards.

3 VANCOUVER FRASER PORT AUTHORITY INTERNAL REVIEWS

The following VFPA departments have reviewed the application and support approval of the Project subject to the listed project and environmental conditions.

☒ Planning	☒ Environmental Programs	☒ Engineering
☒ Marine Operations	☒ Project Communications	☒ Aboriginal Affairs

4 ABORIGINAL CONSULTATION

VFPA Aboriginal Affairs reviewed the proposed works and determined that the project may have the potential to adversely impact Aboriginal rights.

Scope of Consultation

- Tsleil-Waututh Nation
- Squamish Nation
- Musqueam Indian Band
- Sto:lo Nation
- Hul'qumi'num Treaty Group
    - Halalt First Nation
    - Lake Cowichan First Nation
    - Lyackson First Nation
    - Penelakut Tribe
    - Cowichan Tribes
    - Stz'uminus First Nation

All Aboriginal groups listed above were consulted on the proposed project.

Overview of Consultation Activities

On December 14, 2016, a referral package was sent to each of the Aboriginal groups listed above. The referral package included:

- Referral Letter
- Permit Application
- Project Overview Map
- Project Remedial Action Plan

Comments were requested from Aboriginal groups within 40 business days, by February 10, 2017. VFPA elected to extend the review period from the usual 30 business days to account for office closures over the December holiday in some Aboriginal communities.

On January 12, 2017, VFPA sent an update email, reminding Aboriginal groups about the project review and requesting comments by the February 10, 2017 deadline.

VFPA received comments from Aboriginal groups via letters and email. VFPA responded to all comments from Aboriginal groups.

Summary of Issues

Below is a table summarizing comments received by VFPA and how they were considered as part of the project and environmental review.

Issue	VFPA Considerations	Action Required
Current use of lands and resources for traditional purposes		
Contamination of Burrard Inlet	The project involves installing barriers to impede remaining contamination from entering the inlet, and installing long-term monitoring wells to monitor contamination and to assess whether or not further action needs to be taken. This project will reduce contamination and provide an overall environmental benefit to Burrard Inlet. In acknowledgement of the concerns of Aboriginal groups about the contamination, the Applicant committed to making communications relating to monitoring available.	VFPA included the following permit condition (no. 43): The Applicant shall make monitoring reports available to Aboriginal groups.
Presence of Aboriginal group environmental monitors on-site during installation	VFPA acknowledges that the environmental health of Burrard Inlet is of high importance to Aboriginal groups. VFPA is interested in working with Aboriginal groups to allow environmental monitors to be on-site during project works.	VFPA included the following permit condition (no. 25): The Applicant shall make opportunities available for Aboriginal groups to participate in environmental monitoring during project works.
Monitoring and Sampling of Project Area	The Applicant will undertake a monitoring and sampling program for three years, after which the program will be reviewed. Monitoring will likely occur for five years or more, but likely at a reduced frequency, subject to the analytical results from the first three years. The Applicant committed to copying Aboriginal groups on communications related to this issue.	VFPA included the following permit condition (no. 43): The Applicant shall make monitoring reports available to Aboriginal groups.
Preservation of sandy beach	The Applicant has completed the remedial design to limit the amount of sandy beach that will be altered while still installing a robust system that is protective of the environment.	None

Issue	VFPA Considerations	Action Required
Principle of net environmental gain, rather than no net environmental loss	VFPA continues to seek opportunities to work with Aboriginal groups and others to improve environmental management practices and to provide net environmental benefits through various initiatives. VFPA is also keen to continue identifying shared interests and to focus on collaborative projects with Aboriginal groups that will result in net environmental gains within Burrard Inlet. The Applicant provided a response recognizing that Aboriginal groups are leaders in environmental stewardship in Burrard Inlet. Chevron is working with Aboriginal groups and others on environmental initiatives that benefit Burrard Inlet.	None
Monitoring of future cumulative effects of ground and surface water contamination	The Applicant will undertake a monitoring and sampling program for three years, after which the program will be reviewed. Monitoring will likely occur for five years or more, but likely at a reduced frequency, subject to the analytical results from the first three years. The Applicant committed to copying Aboriginal groups on communications related to this issue. The Applicant developed risk-based management targets (RBMTs) which were finalised in 2014 and approved by the BC MOE. The RBMTs are site-specific concentration limits for the parameters of concern in the site porewater, and are designed to be protective of aquatic life that may experience potentially long-term exposures. As long as the concentrations of the parameters are below the RBMTs (which the remedy is designed to ensure), the ecological function and viability of aquatic life in the foreshore will be maintained. The RBMTs form an integral part of the performance monitoring program described in the RAP.	VFPA included the following permit condition (no. 43): The Applicant shall make monitoring reports available to Aboriginal groups.
Impacts to fish and fish habitat as a result of ground and surface water contamination	Impacts to fish and fish habitat are not expected as a result of the project. An analysis of the potential effect on the physical fish habitat was completed and submitted to Fisheries and Oceans Canada as part of the Request for Review process. That analysis showed that the physical changes to the Foreshore area would not result in significant harm to fish.	None

Issue	VFPA Considerations	Action Required
Loss of riparian vegetation resulting from lowering of groundwater levels	The drawdown from the Perimeter Extraction System is limited to 10 to 30 meters from the well. The wells are located far enough from Burrard Inlet to affect the water table near the inlet. Therefore, the project is not expected to have an effect on riparian vegetation as a result of lowering groundwater levels.	None
Loss of wildlife habitat resulting from lowering groundwater levels	The drawdown from the Perimeter Extraction System is limited to 10 to 30 meters from the well. The wells are located far enough from Burrard Inlet to affect the water table near the inlet. Therefore, the project is not expected to have an effect on wildlife habitat as a result of lowering groundwater levels.	None
Cultural Heritage		
Project area holds high cultural value for TWN	VFPA acknowledges the importance of the area to Aboriginal groups. The Applicant recognizes the cultural sensitivity of the site and has been working with an Aboriginal-owned business to ensure all activities are carried out in regards to this sensitivity.	None
Impacts to archaeological resources	VFPA understands that the Applicant is working with Aboriginal groups to address potential impacts to archaeology. This includes the use of Aboriginal cultural monitors during project works.	VFPA included the following permit condition (no. 24): The Applicant shall make opportunities available for Aboriginal groups to provide archaeological monitors during project works.
Additional Issues		
Outstanding project design considerations	VFPA will endeavor to share details around materials used with Aboriginal groups when they become available from the Applicant. This may occur through a post-construction report, which will be shared with Aboriginal groups.	None

Based on the record of consultation, VFPA is of the view that the duty to consult has been met.

5 NOTIFICATIONS

5.1 Community Notification

The proposed Project was assessed by VFPA to have minimal or no potential impacts to community interests in the surrounding area either during construction or once the project is completed. Therefore no community consultation or construction notification was required.

6 INFORMATION SOURCES

VFPA has relied upon the following sources of information in its review of the Project.

- Application form and materials submitted by the Applicant on behalf of the tenant on November 23-December 16, 2016.
- Foreshore Remedial Action Plan Below Area 2 Eastern Impounding Basin – Chevron Burnaby Refinery, Burnaby, BC" October 27, 2016, AECOM
- Letter titled "Final Remediation Action Plan Below Area 2 Eastern Impounding Basin – Chevron Refinery", September 9, 2016, Lavinia Zanini of the BC Ministry of Environment
- Email dated 2016-10-04, from Michael Engelsjord of DFO to Chris Boys of Chevron, "Serious harm to fish can be avoided or mitigated."
- Draft Construction Environmental Management Plan (CEMP) for the Foreshore Final Remedy submitted by Aecom February 3, 2017.
- Email correspondence from Michael Gill May 15, 2017 re: Cost Proposal for tree planting at EIB in Area 2.
- All plans and drawings labelled PER No. 16-180-A to D.

7 PROJECT AND ENVIRONMENTAL CONDITIONS

VFPA has undertaken and completed a review of the Project in accordance with the *Canada Marine Act* and Section 5 of the Port Authorities Operations Regulations and, as applicable, Section 67 of the *Canadian Environmental Assessment Act, 2012*.

If at any time the Applicant fails to comply with any of the project and environmental conditions set out in the project permit (the Permit) below, or if VFPA determines that the Applicant has provided any incomplete, incorrect or misleading information in relation to the Project, VFPA may, in its sole and absolute discretion, cancel its authorization for the Project or change the project and environmental conditions to which such authorization is subject.

Pursuant to Section 29 of the Port Authorities Operations Regulations, VFPA may also cancel its authorization for the Project, or change the project and environmental conditions to which such authorization is subject, if new information is made available to VFPA at any time in relation to the potential adverse environmental and other effects of the Project.

The following are the minimum conditions that must be followed by the Applicant to mitigate potential or foreseeable adverse environmental and other effects.

No.	GENERAL CONDITIONS
1.	This Permit is conditional on a valid tenure agreement with respect to the subject premises being in place. **No construction or any other physical activities may commence in the absence of a valid tenure agreement.**
2.	This Permit is granted subject to the fulfillment of all other requirements of VFPA, relating to the Project. Furthermore, prior to commencing construction or any other physical activities the Applicant shall ensure that it has complied with all other necessary legal requirements and that all necessary regulatory approvals have been obtained.
3.	This Permit in no way endorses or warrants the design, engineering, or construction of the Project and no person may rely upon this Permit for any purpose other than the fact that VFPA has permitted the construction of the Project, in accordance with the terms and conditions of this Permit.

4.	In consideration of the granting of this Permit by VFPA the Applicant agrees to indemnify and save harmless VFPA against any and all actions, claims, loss, damages or other expenses in any way arising or following from or caused by the granting of this Permit or the construction or operation of the Project as contemplated by this Permit.
5.	The Applicant is responsible for locating all existing site services and utilities including any located underground and to employ best practices and meet applicable code requirements with respect to protection of existing site services and clearance between existing and proposed site services. The Applicant is responsible for repair or replacement of any damage to existing site services and utilities, to the satisfaction of VFPA, that result from construction and operation of the Project.
6.	The Applicant shall undertake and deliver the Project to total completion in a professional, timely and diligent manner in accordance with the Application submitted by the Applicant and the applicable standards and specifications set out in the sections above entitled Project Description and Information Sources. The Applicant shall not carry out any other physical activities unless expressly authorized by VFPA.
7.	The Applicant shall establish a spill prevention, containment and clean-up plan for hydrocarbon products (including fuel, oil and hydraulic fluid) and any other deleterious substances using standards, practices, methods and procedures to a good commercial standard, conforming to applicable law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances. The Applicant shall ensure that appropriate spill containment and clean-up supplies are available on site at all times and that all personnel working on the project are familiar with the spill prevention, containment and clean-up plan.
8.	The Applicant shall have due regard to the potential application of the *Migratory Birds Convention Act* (Canada) and/or the *Wildlife Act* (British Columbia). To reduce the risk of Project-related harm to birds and/or their active nests and eggs, the Applicant may wish to avoid certain physical activities during the general bird breeding season, which falls between **April 1 and July 31**, or outside of this time span if occupied nests are present. The Applicant shall exercise all due diligence to avoid causing harm to birds and/or their active nests and eggs. The Applicant shall also have due regard to nests of those species of birds protected by Applicable Law at all times of the year, regardless of the time of year or whether or not the nests are occupied. The Applicant should, where circumstances warrant, retain the services of qualified environmental professionals to assist in developing and undertaking appropriate bird nest surveys immediately before, during and after the general bird breeding season.
9.	The Applicant shall cooperate fully with VFPA in respect of any review by VFPA of the Applicant's compliance with these conditions including, without limitation, providing any information or documentation required by VFPA.
10.	The Applicant shall make a copy of this Permit available to all employees, agents, contractors, licensees and invitees prior to commencing any physical activities. The Applicant shall be solely responsible for ensuring that all such employees, agents, contractors, licensees and invitees comply with these conditions.

11.	The Applicant shall make available upon request by any regulatory authority (such as a Fishery Officer) a copy of this Permit.	
12.	Unless otherwise noted, the Applicant shall submit all documents required for VFPA approval to **email: per@portvancouver.com; fax: 1-866-284-4271 and referencing PER No.16-180.**	
	CONDITIONS – PRIOR TO COMMENCING CONSTRUCTION OR ANY PHYSICAL ACTIVITIES	**SUBMISSION TIMING (business days)**
13.	The Applicant shall notify the Fisheries and Oceans Canada (DFO), Conservation and Protection Field Supervisor for Fraser Valley West in Langley, British Columbia (tel: 604-607-4150; fax: 604-607-4199). The Applicant shall copy VFPA Environmental Programs and the Harbour Master on this notification EnvironmentalPrograms@portvancouver.com and Harbour_Master@portvancouver.com; or fax 1-866-284-4271.	2 days before commencing construction or any physical activities
14.	The Applicant shall submit signed and sealed drawings for proposed works approved for construction by a professional engineer licensed to practice in the Province of British Columbia.	5 days before commencing construction or any physical activities
15.	The Applicant shall distribute a construction notice to the City of Burnaby describing the works and activities, hours of construction, and contact information. The Applicant shall copy VFPA when the construction notice is distributed.	10 days before commencing construction or any physical activities
16.	Prior to the commencement of any vessel-related activities, the Applicant shall contact the appropriate Canadian Coast Guard ("CCG") Marine Communications and Traffic Services ("MCTS") centre regarding the issuance of a Notice to Shipping ("NOTSHIP") to advise the marine community of potential hazards associated with the Project. The Applicant must advise CCG that works are planned to occur near a CCG-owned radar tower.	As per Coast Guard requirements
17.	The Applicant shall submit a Vegetation Compensation Plan to the satisfaction of VFPA. The Vegetation Compensation Plan must include a description of the type and area of vegetation to be removed and describe how impacts will be compensated.	10 days before commencing construction or any physical activities
18.	The Applicant shall submit a finalized Construction Environmental Management Plan (CEMP) to the satisfaction of VFPA.	10 days before commencing construction or any physical activities
	CONDITIONS – DURING CONSTRUCTION OR ANY PHYSICAL ACTIVITIES	
19.	The Applicant shall notify VFPA upon commencement of construction or any physical activities of the Project.	

20.	The Project shall be monitored by an appropriately qualified Environmental Monitor. The Environmental Monitor shall be empowered in writing to direct works to ensure compliance with this Permit and the Construction Environmental Management Plan. Monitoring events shall occur when the Environmental Monitor deems it appropriate but in no case less than weekly, and shall be full time during works with potential to cause adverse effects on fish or fish habitat.
21.	The Environmental Monitor shall provide monitoring reports to VFPA on a weekly basis or more frequently if circumstances warrant. The VFPA reserves the right to rule on the adequacy of the monitoring and the content of the reports.
22.	All general construction and physical activities related to the Project shall be conducted from **Monday to Saturday** between the hours of **7:00am and 8:00pm.** No construction and physical activities shall occur during Sundays or holidays. These hours shall not be modified without prior approval from VFPA.
23.	The Applicant shall ensure that an appropriately qualified archaeological monitor be on site at all times during ground disturbing activities that may intrude into native soils.
24.	The Applicant shall make opportunities available for Aboriginal groups to provide archaeological monitors during project works.
25.	The Applicant shall make opportunities available for Aboriginal groups to participate in environmental monitoring during project works.
26.	In the event that evidence of what is suspected to be an archaeological resource is encountered, the Applicant shall: a) Immediately stop any activities that might disturb the archaeological resource or the site in which it is contained ("Site"). b) Not move or otherwise disturb the artifacts or other remains present at the Site. c) Stake or flag off the Site to prevent additional disturbances. d) Immediately notify VFPA.
27.	The Applicant shall not, directly or indirectly: (a) deposit or permit the deposit of a deleterious substance of any type in water frequented by fish in a manner contrary to Section 36(3) of the *Fisheries Act*; or (b) adversely affect fish or fish habitat in a manner contrary to Section 35(1) of the *Fisheries Act*.
28.	The Applicant shall ensure that debris and waste material resulting from the Project are contained, collected, and disposed of at suitable upland locations using standards, practices, methods and procedures to a good commercial standard, conforming to applicable law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances.
29.	The Applicant shall ensure that all equipment is in good mechanical condition and maintained free of fluid leaks, invasive species, and noxious weeds.

30.	The Applicant shall not permit barges or other vessels used during the Project to ground on the foreshore or seabed or otherwise disturb the foreshore or seabed (including disturbance as a result of vessel propeller wash), excepting only such disturbance as is reasonably required to complete the Project.
31.	Works in shoreline shall be limited to the project area as defined in the Construction Environmental Plan and PER No. 16-180-A to D. The Applicant shall be responsible for the repair of any damage, contamination, or erosion resulting from disturbance to the intertidal foreshore during the Project.
32.	Existing native riparian vegetation shall be retained where possible, and disturbance or clearing of vegetation shall be staged and strictly limited to that required for Project implementation.
33.	Works in the intertidal area shall be undertaken in the dry (i.e., above the water surface).
34.	The Applicant shall use a clean excavator bucket. The bucket and any portion of the excavator arm that will be in contact with or near Burrard Inlet shall be clean prior to the start of works.
35.	The direct or indirect release or deposit of sediment or sediment laden water into the aquatic environment shall be minimized during the works. In this regard, reference should be made to the water quality criteria described in the British Columbia Water Quality Guidelines (Criteria): May 2015 Edition produced by the BC Ministry of Environment.
36.	Should contaminated materials be encountered, the Applicant shall ensure that all contaminated materials, including contaminated drill cuttings and equipment wash water, are removed, contained, and disposed of at appropriate off-site facilities using standards, practices, methods and procedures to a good commercial standard, conforming to Applicable Law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances. Suspect materials should be treated as contaminated or stockpiled until their environmental quality has been determined.
37.	Materials brought onto the property to be used for backfilling, site preparation, or other uses shall be from sources demonstrated to be clean and free of environmental contamination.

38.	During any vessel-related activities, the Applicant shall: a) Position vessels and equipment associated with the Project in such a manner so as not to obstruct line of sight to navigational aids or markers. b) As per the International Regulations for Preventing Collisions at Sea, exhibit the appropriate lights and day shapes at all times. c) Monitor the VHF channel used for MCTS communications in the respective area at all times and participate as necessary. d) Be familiar with vessel movements in areas affected by the Project. The Applicant shall plan and execute the Project in a manner that will not impede navigation or interfere with vessel operations. e) During night hours, unless working 24 hrs per day, the rig and associated equipment shall be moored outside the navigation channel and lit in accordance with all applicable regulations.	
	CONDITIONS – UPON COMPLETION	**SUBMISSION TIMING (Business Days)**
39.	The Applicant shall notify VFPA upon completion of the Project.	Within 10 days of completion
40.	The Applicant shall provide record drawings, in both AutoCAD and Adobe (PDF) format to VFPA.	Within 40 days of completion
41.	The Applicant shall confirm the Project was constructed within the tenured area by providing to VFPA: a) Digital photographs of the tenured area, both before and after construction of the Project, from the land and water side of the tenured area. b) A survey plan. c) A letter from an engineer confirming the Project was constructed within the tenured area.	Within 40 days of completion
42.	The Applicant shall submit a comprehensive post-construction report, to VFPA's satisfaction, which shall include: • A description of any known or suspected contamination that remains at the site, and any new contamination characteristics that can be attributed to the site; • A summary of all environmental monitoring and environmental incidents for the Project; • Copies of all manifest for contaminated soils and groundwater removed from the Project location; and • Plans and schedules for post-construction monitoring as detailed in "Section 8: Performance Verification Plan" of the Applicant's Foreshore Remedial Action Plan dated October 27, 2016.	Within 40 days of completion

43.	The Applicant shall provide VFPA all future environmental monitoring data and reports that are related to the Project until such time that environmental monitoring at the Project site is completed. Monitoring data and reports shall include, at minimum, monitoring as detailed in "Section 8: Performance Verification Plan" of the Applicant's Foreshore Remedial Action Plan dated October 27, 2016. The Applicant shall also make monitoring reports available to Aboriginal groups and the BC MOE.	Within 30 days of each monitoring period

VFPA reserves the right to rescind or revise these conditions at any time that new information warranting this action is made available to VFPA.

LENGTH OF PERMIT VALIDITY

The Project must be completed no later than May 31, 2022 (the Expiry Date).

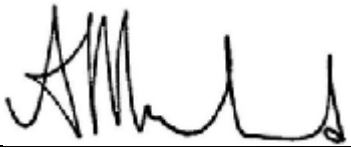
AMENDMENTS

- Details of any material proposed changes to the Project, including days and hours when construction and any physical activities will be conducted, must be submitted to VFPA for consideration of an amendment to this Permit.
- For an extension to the Expiry Date, the Applicant must apply in writing to VFPA no later than 30 days prior to that date.

Failure to apply for an extension as required may, at the sole discretion of VFPA, result in termination of this Permit.

8 ENVIRONMENTAL REVIEW DECISION

In completing the environmental review, VFPA has reviewed and taken into account relevant information available on the proposed project, has considered the information and proposed mitigations provided by the Applicant and other information as listed elsewhere in this document, and concludes that with the implementation of proposed mitigation measures and conditions described in the project and environmental conditions section above, the Project is not likely to cause significant adverse environmental effects.



ANDREA MACLEOD
MANAGER, ENVIRONMENTAL PROGRAMS

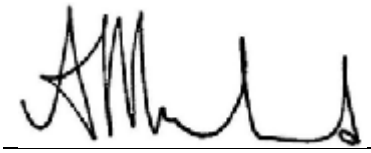
May 24, 2017
DATE OF DECISION

9 CONCLUSION

In completing the project and environmental review, VFPA concludes that with the implementation of proposed mitigation measures and conditions described in the project and environmental conditions section above, the Project has appropriately addressed all identified concerns.

PROJECT AND ENVIRONMENTAL REVIEW DECISION

Project Permit PER No. 16-180 is approved by:



ANDREA MACLEOD
MANAGER, ENVIRONMENTAL PROGRAMS

May 24, 2017
DATE OF APPROVAL

CONTACT INFORMATION

Vancouver Fraser Port Authority (VFPA)
100 The Pointe, 999 Canada Place
Vancouver BC V6C 3T4 Canada

Project & Environmental Review
Tel.: 604-665-9047
Fax: 1-866-284-4271
Email: PER@portvancouver.com
Website: www.portvancouver.com

Canada

PER No. 16-180-A

Chevron Refinery Foreshore Final Remedy

PER #16-180

Proposed Project Area

VFPA Boundary

N

20 10 0 20

m

PORT of vancouver

VFPA Spatial Data Group
May 2017
PLAN # G2016-133

Any areas marked "proposed" represent approximate locations.

PER No. 16-180-B

VANCOUVER FRASER PORT AUTHORITY

This drawing has been reviewed by the Vancouver Fraser Port Authority solely for the purpose of VFPA's issuance of a Project Permit. This permit in no way denotes design, engineering or structural approval or endorsement.

B NORTH

B' SOUTH

RECEPTORS

HUMAN HEALTH
Recreational Users

ECOLOGICAL
Aquatic

ELEVATION (metres) (Chevron's Mill Datum)

40 (10) 35 (5) 30 (0) 25 (-5) (masl)

Approximate Low Tide Line

Approximate Mid Tide Line

Toe of Slope and Approximate High Tide Line

BURRARD INLET

Boom Location

P6-12D

P6-8D

P5.25-5

P5.5-3R

Infrequent sheens & odours

NAPL Detection Core Samples April, 2012

CPR Interceptor Trench

CPR ROW

MW12-1S*

Culverts

Perforated Pipe

MW12-1S July, 2012 NAPL last observed

January 2011 CP Rail Ditch NAPL last observed

Foreshore April, 2010 NAPL last observed

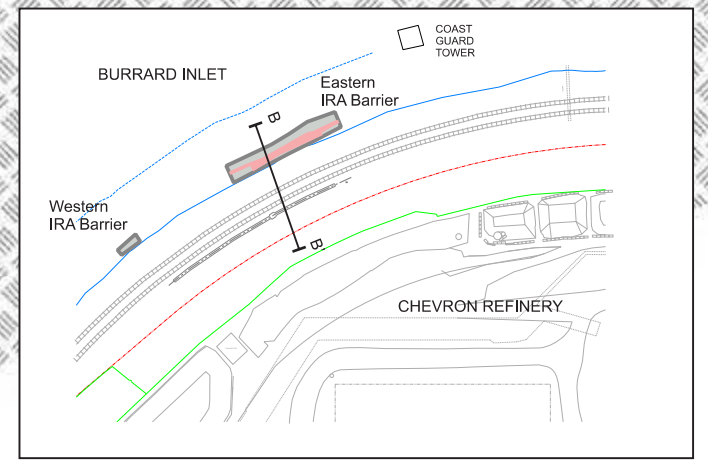
Porewater Elevation (High Tide)

Porewater Elevation (Low Tide)

September, 2011 NAPL last observed

Original Foreshore IRA March, 2011

Foreshore IRA Refurbishment March, 2012



LEGEND:

Borehole/ Monitoring Well

Screened Interval

Groundwater Elevations

Beach Sand

Fill/Alluvium/Colluvium: sand, some gravel, silt and clay imported fill in areas

Till: sandy silt, trace gravel, dense, grey

Organoclay and beach sand mixture

Organoclay and imported sand mixture

Excavation Limit

Geogrid/Filter Fabric

Solid Poly Sheeting

Geogrid and Oleophilic Biobarrier (OBB)

Rip-Rap boulders

Groundwater Table & Flow Direction

NAPL Last Observed Historically

Pump

NOTE: Chevron Mill Datum = Geodetic Datum + 27.85 metres (91.37 feet)

* NAPL detected in CPR ROW Investigation MW12-1S was detected in soil sampes with ultraviolet light.

ABBREVIATIONS:

IRA	Interim Remedial Action
CPR	Canadian Pacific Railway
ROW	Right-of-Way
NAPL	Non-Aqueous Phase Liquid
masl	metres above sea level

0 5 10m

HORIZONTAL

AECOM

FORESHORE CONCEPTUAL SITE MODEL

Remedial Action Plan
Foreshore Below Area 2 - Chevron Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
July 2016	60347433	TS	0	FIGURE 3

H:\URS-CHEVRON\39549154.CCL Foreshore Final Remedy\5. Deliverables\April 2013 Presentation\Figures.J-03 CSM.cdr

PER No. 16-180-C

EXISTING COAST GUARD TOWER

N

BURRARD INLET

UTM: E= 500940.23m
N= 5460273.11m
CHEVRON MILL DATUM
REFERENCE SYSTEM:
X= 138.08m
Y = 268.41m

LIMIT OF CONSTRUCTION

EASTERN SEEP AREA

TOTAL CONSTRUCTION AREA
3111m²

LOW TIDE LINE

ESA CONSTRUCTION AREA
922m²

CPR RAIL CORRIDOR

WESTERN SEEP AREA

CONTINGENCY AREA
524m²

LIMIT OF CONSTRUCTION

WSA CONSTRUCTION AREA
9.4m²

VANCOUVER FRASER PORT AUTHORITY

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LEGEND

TOP OF SLOPE

BOTTOM OF SLOPE

NOTE:

Locations and calculated areas are approximate

PLAN

0 6.25 12.5 m

1:250

NOT FOR CONSTRUCTION

PROJECT

FORESHORE REMEDIAL ACTION PLAN
BELOW AREA 2 EASTERN IMPOUNDING BASIN
CHEVRON BURNABY REFINERY

CLIENT

Chevron Canada Limited
Burnaby Refinery
355 North Willingdon Avenue
Burnaby BC V5C 1X4

CONSULTANT

AECOM
3292 Production Way
Burnaby, BC
1.604.444.6400 tel 1.604294.8597 fax
www.aecom.com

PROJECT NUMBER

60347433

TITLE

FOR PORT OF VANCOUVER
PERMIT REFERENCE

Project Management Initials: Designer: Checked: Approved: ISO A1 594mm x 841mm
Last saved by: TIM.SMYTH(2016-12-14) Last Plotted: 2016-12-14
Filename: H:\URS-CHEVRON\60347433.3954\9154.COL FORESHORE FINAL REMEDY\3. WORKING FILES\2016 CONTRACT DESIGN\900-CAD, GIS\910-CAD\05-MODELS\CPORT OF VANCOUVER PERMIT APPLICATION\60347433-CONSTRUCTION AREAS.DWG
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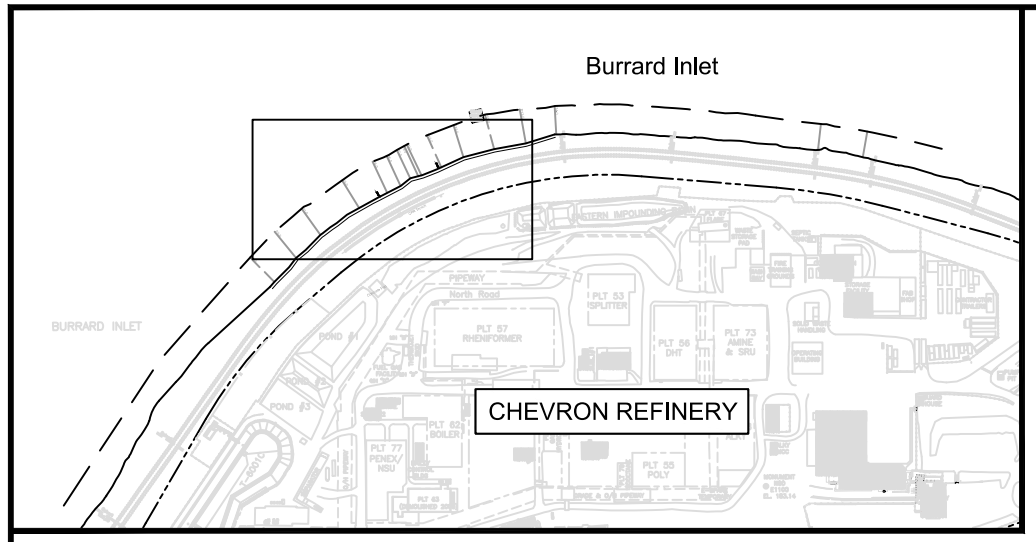
PER No. 16-180-D



Meters
10 0 10 20

REMOVE EXISTING INTERIM REMEDIAL ACTION AND BACKFILL WITH NATIVE SEDIMENT AND BEACH SAND TO MATCH EXISTING STRATIGRAPHY AND RESTORE SURFACE AND RIP RAP

PROPOSED MONITORING WELLS
PROPOSED AQUABLOK
EXISTING INTERIM REMEDIAL ACTION
PROPOSED POINT OF COMPLIANCE FORESHORE MONITORING WELL LOCATIONS
PROPOSED MONITORING WELLS
PROPOSED UPGRADIENT MONITORING WELLS
PROPOSED IMPERMEABLE POLYETHYLENE SHEET
PROPOSED SUBSURFACE COMPONENT
PROPOSED OLEOPHILLIC BIOBARRIER (OBB) EXTENTS
PROPOSED EMBANKMENT
PROPOSED AQUABLOK
PROPOSED RIP-RAP
PROPOSED COBBLES
PROPOSED MONITORING WELLS
SEEPS

EASTERN SEEP AREA
WESTERN SEEP AREA
INBETWEEN AREA

Low Tide Line
Toe of Slope (High Tide Line)
Top of Slope
COAST GUARD SITE
CPR ROW
CPR Trench
UNLINED PORTION OF EIB
PIPEWAY

MW12-14
MW12-3
A2MW09-13
MW12-5.5
MW03-02
A2MW09-12
UEIB-16
UEIB-17
UEIB-15
A2MW
MW03-01
UEIB-10
UEIB-9
MW10-3I
MW10-3D
UEIB-8
A2MW09-02
UEIB-7
CPR-1
MW12-1S
MW12-1I
A2MW09-11
CPR-2
MW10-2I
UEIB-46
UEIB-6
MW10-2D
MW11-10I
UEIB-5
A2MW09-01
MW11-10S
UEIB-45
A2MW09-10
UEIB-4
MW12-2.5
G2-2A
G2-2B
MW12-2
U9
UEIB-3
A2MW09-05I
UEIB-13
U8
UEIB-11
UEIB-2
G2-2WT
MW10-1I
SPT-3
MW10-1D
UEIB-14
UEIB-1
A2

REFERENCES		REVISIONS							REVISIONS								
DRAWING NO.	TITLE	NO.	DESCRIPTION	BY	CHK.	APR.	DATE	CLIENT	NO.	DESCRIPTION	BY	CHK.	APR.	DATE	CLIENT	SCALE:	AS SHOWN
																DESIGNED BY:	RH
																DRAWN BY:	TS
																CHECKED BY:	RK
																PROJECT MNGR:	MG
																CLIENT:	

AECOM
3292 Production Way
Burnaby, BC
T 1.604.444.6400 F 1.604.294.8597

Chevron Canada Limited
Burnaby Refinery

Foreshore Final Remedy

FINAL REMEDY MAP VIEW

PROJECT NO.
FIGURE NO. 16
REV NO. 1
DATE July 2016

PORT of vancouver

Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4
portvancouver.com

September 28, 2017

Mr. Michael Gill
Senior Environmental Engineer
AECOM
3293 Production Way
Burnaby, BC V5A 4R4

Dear Mr. Gill:

Re: **VFPA Project Permit No. 16-180**
Chevron Refinery Foreshore Final Remedy
Request for Extended Hours of Work

The Vancouver Fraser Port Authority (VFPA) has received AECOM's September 19, 2017 request to undertake Project Permit No. 16-180 shoreline remediation activities within VFPA jurisdiction during extended hours of work at night Monday to Saturday 12am to 7am in Burnaby, BC. This constitutes an exemption to Condition 22 of the Permit.

Extended hours of work are understood to be limited to the following dates: from September 28 to November 15, 2017. The shoreline remediation activities proposed during these hours include:

- Minor rip rap placement;
- Excavation and backfill to 0.4 m depth from 8 m to 12 m from the original toe of the slope;
- Placement of a geotextile;
- Placement of 200 mm cobbles on top of geotextile to grade; and
- Installation of monitoring wells using an excavator mounted auger.

Due to AECOM's need to work within the low tide window to mitigate the in-water dispersal of suspended contaminated sediments in conjunction with their Project Permit, **VFPA will allow extended hours of work during the above noted windows provided the following conditions are met:**

1. AECOM shall ensure the scope of works undertaken during extended hours is limited to the activities outlined in their September 20 and 21, 2017 emails detailing the request.

... /2

2. AECOM must implement all proposed mitigation measures and activities outlined in their September 20 and 21, 2017 emails including a construction notification email to the City of Burnaby and the Tsleil Waututh First Nation prior to extended work hours. VFPA must approve the content of the email prior to distribution. It is understood that the proposed works were communicated to the Chevron Burnaby Community Advisory Panel during their September 20, 2017 meeting and that no concerns were raised.

3. All Project Permit No. 16-180 conditions shall be strictly adhered to during extended work windows.

VFPA reserves the right to cancel or revoke authorization for remediation work within the port authority's jurisdiction during extended periods should noise levels or disturbances to surrounding residents exceed reasonable levels.

Should you have any questions please contact Spencer Chaisson, Environmental Coordinator at 604-665-9389 or spencer.chaisson@portvancouver.com.

Yours truly,

VANCOUVER FRASER PORT AUTHORITY

Greg Yeomans
Director, Planning & Development

cc Tegan Smith, Manager, Planning, VFPA
Andrea Macleod, Manager, Environmental Programs
Spencer Chaisson, Environmental Programs, VFPA
Barbara Yandel, Real Estate, VFPA
Jessica Davies, Aboriginal Affairs, VFPA
Cherryl Lam, Project Communications, VFPA

Gauthier, Ken

From: Chaisson, Spencer <Spencer.Chaisson@portvancouver.com>
Sent: Tuesday, November 07, 2017 3:43 PM
To: Southern, Leslie
Cc: Gauthier, Ken; Kannappan, Ram; Horwath, Robert; Gill, Michael (Vancouver); christopher.boys@parkland.ca
Subject: RE: VFPA Permit 16-180 - future sampling events

Hi Leslie,

VFPA has decided that additional approval for ongoing monitoring, during night or day, is not required so long as there are no new intrusive works. This does not limit any of the conditions or requirements of VFPA Permit 16-180.

Several restrictions will apply:

1. Crossing other lease boundaries for access will continue to require prior approval – specifically if you plan night time access across the Penzance rail tracks, which is not a public crossing. You have stated that access will be by boat but we must be alerted if that changes.
2. Share the well sampling/monitoring schedule with the Chevron/Parkland Community Advisory Panel so that they are aware of planned night time works.
3. For all night time works that require access by boat – myself and Marine Operations (Harbour_Master@portvancouver.com) must be notified 2 days in advance via email.

These requirements will be reiterated after VFPA receives the plans and schedules for post-construction monitoring as detailed in condition 42 of VFPA Permit 16-180.

Thank you,

Spencer Chaisson
Environmental Coordinator
Environmental Programs
P 604.665.9389
E spencer.chaisson@portvancouver.com

PORT of vancouver

Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4
portvancouver.com

From: Chaisson, Spencer
Sent: Friday, November 03, 2017 12:10 PM
To: 'Southern, Leslie' <leslie.southern@aecom.com>
Cc: Gauthier, Ken <ken.gauthier@aecom.com>; Kannappan, Ram <ram.kannappan@aecom.com>; Horwath, Robert <robert.horwath@aecom.com>; Gill, Michael (Vancouver) <michael.gill@aecom.com>; christopher.boys@parkland.ca
Subject: RE: VFPA Permit 16-180 - November sampling event

Hello Leslie.

Thank you for providing this information. By way of this email, provided the ongoing activities consist of monitoring and sampling the wells at the site (i.e., no new intrusive works), the period of validity for VFPA Permit 16-180 extended work hours as stated in the attached 2017-09-28 letter is hereby extended to November 16, 2017.

As project construction nears completion and you move on to monitoring, please be sure to fulfill conditions 39 to 43 of VFPA Permit 16-180.

Thank you,

Spencer Chaisson
Environmental Coordinator
Environmental Programs
P 604.665.9389
E spencer.chaisson@portvancouver.com

Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4
portvancouver.com

From: Southern, Leslie [mailto:leslie.southern@aecom.com]
Sent: Friday, November 03, 2017 11:43 AM
To: Chaisson, Spencer <Spencer.Chaisson@portvancouver.com>
Cc: Gauthier, Ken <ken.gauthier@aecom.com>; Kannappan, Ram <ram.kannappan@aecom.com>; Horwath, Robert <robert.horwath@aecom.com>; Gill, Michael (Vancouver) <michael.gill@aecom.com>; christopher.boys@parkland.ca
Subject: VFPA Permit 16-180 - November sampling event

Spencer,

As discussed, we plan on collecting porewater samples from the wells on the Foreshore in November 14-16, approximately 6:30pm to 11:00pm). The sampling must be completed at night, when the tide allows access. A subcontractor will provide access to the site via boat. They will bring a generator and light stands to illuminate the work area - which is comprised of the two barriers. A barge and heavy equipment will not be at the site.

The exemption to condition 22 of the permit provided on September 28, to allow for extended work hours expires on November 15, 2017. Can this be extended to November 16?

Thank you,

Leslie

Leslie Southern M.Sc., P.Ag.
Environmental Scientist
leslie.southern@aecom.com

AECOM
3292 Production Way, Suite 330
Burnaby, BC V5A 4R4
T 604-444-6608 F 604-294-8597
www.aecom.com

Appendix D - Photo Log

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. 1	**Date:** March 29, 2016

Direction Photo Taken:
Looking downwards (south is top of page)

Description:

Pre-construction site conditions – Eastern and Western IRA Barriers. The Eastern IRA Barrier is surrounded by the boom. The Western IRA Barrier is right of the boom.

Photo No. 2	**Date:** August 20, 2015

Direction Photo Taken:

Looking southeast

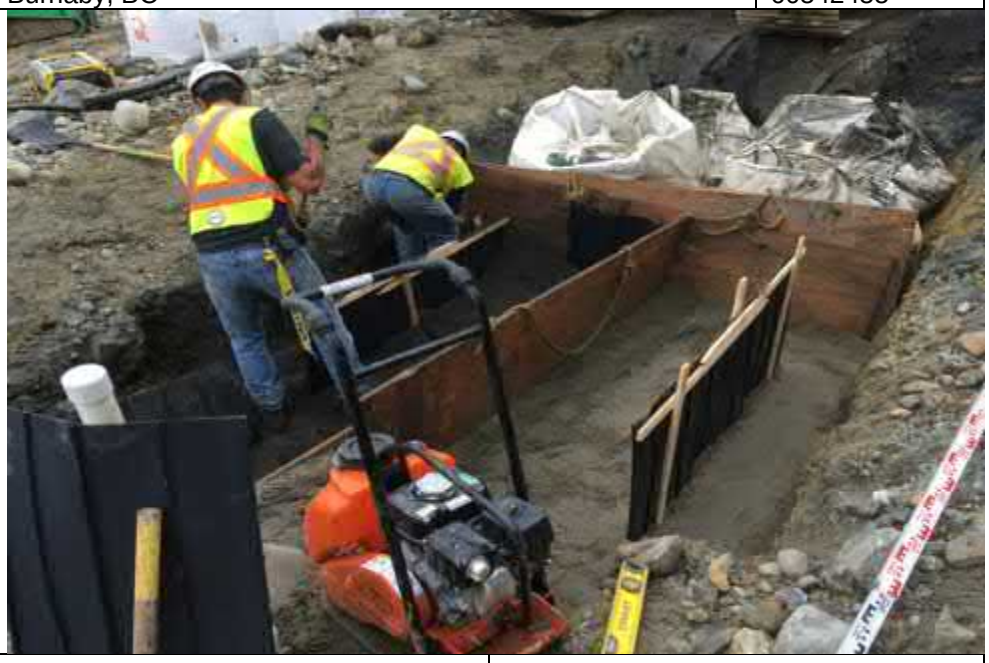
Description:

Pre-construction site conditions – Eastern IRA Barrier.

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. 3	**Date:** July 22, 2017
Direction Photo Taken: Looking northeast	
Description: Below ground components – Plywood reinforced baffles can be seen placed within both cells of the Eastern FPTS. The plywood was removed once backfilling was complete.	



Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. 4	**Date:** July 28, 2017
Direction Photo Taken: Looking east	
Description: Below ground components – Eastern FPTS, after backfilling a small portion of trench and compaction to surface.	

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. 5	**Date:** August 10, 2017

Direction Photo Taken:

Looking south

Description:

Above ground components – Eastern FPTS materials laid out.

Photo No. 6	**Date:** August 18, 2017

Direction Photo Taken:

Looking west

Description:

Above ground components (OBB, filter fabric and geogrid) – Up gradient CPR embankment material placement.

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. 7	**Date:** September 15, 2017

Direction Photo Taken:

Looking northeast

Description:

Above ground component – Western FPTS, placement of concrete protectors, materials and gravel.

Photo No. 8	**Date:** September 6, 2016

Direction Photo Taken:
Looking southeast

Description:

Above ground component – Concrete supports for extended concrete protectors.

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. **9**	**Date:** October 5, 2017
Direction Photo Taken: Looking northeast	
Description: Above ground components – Installation of downgradient cobbling matting in Eastern FPTS.	

Photo No. **10**	**Date:** September 5, 2017
Direction Photo Taken: Looking east	
Description: Above ground component – Placement of rip rap at 2:1 slope of the Eastern FPTS.	

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. **11**	**Date:** October 13, 2017
Direction Photo Taken: Looking south	
Description: Monitoring well installation in east passive treatment system – Bobcat drill rig used to install monitoring wells	

Photo No. **12**	**Date:** October 21, 2017
Direction Photo Taken: Looking east	
Description: Final layout of rip rap with a 2:1 slope of the Eastern FPTS.	

PHOTO LOG

Client Name: Parkland Refining (B.C.) Ltd.	**Site Location:** Foreshore – Downgradient Area 2, Parkland Refinery, Burnaby, BC	**Project Number:** 60542455

Photo No. **13**	**Date:** October, 30 2017
Direction Photo Taken: Looking southeast	
Description: Post-construction conditions. Eastern and Western Foreshore Passive Treatment Systems (FPTS).	

Appendix E - Borehole Logs and Monitoring Well Construction Details

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-01**
LOCATION: Upgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel, rip rap grey moist low density non-cohesive					
		Sand, some gravel, trace cobbles, shell fragments brown-grey fine-medium grained sand moist low density non-cohesive					
		becoming brown, trace silt below 0.4 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/13/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-02**
LOCATION: Crossgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel/ sand grey moist low density non-cohesive					0
		Sand, some gravel/ cobbles, trace silt, shell fragments brown-grey fine-medium grained sand moist low density non-cohesive					
1		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					1
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/11/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-03**
LOCATION: Crossgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel/ sand grey moist low density non-cohesive					0
		Sand, some gravel/ cobbles, trace silt, shell fragments brown-grey fine-medium grained sand moist low density non-cohesive					
1		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					1
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/11/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-04**
LOCATION: Upgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2								2
3			Sand, some gravel/ cobbles, trace silt brown-grey sand fine-medium grained sand wet low density non-cohesive Hydrocarbon odour at 0-0.3m/ no staining				Sample collected at 0.1 - 0.3 m BGS Sample collected at 0.6 - 0.8 m BGS	3
4			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protector and rip rap: 0 - 2.54 m (0 - 2.54 m AGS) Bentonite: 2.54 - 2.84 m (0 - 0.30 m BGS) Sand: 2.84 - 3.44 m (0.30 - 0.90 m BGS) Screen: 2.99 - 3.29 m (0.45 - 0.75 m BGS) Native: 3.44 - 3.54 m (0.90 - 1.00 m BGS) End of Bore: 3.54 m (1.00 m BGS) Rip rap thickness has been approximated based on survey data and field measurements.					4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 10/2/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-05**
LOCATION: Within West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2			Sand and aquagate/organoclay brown-grey fine-medium grained sand moist low density non-cohesive					2
3			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.10 m (0 - 2.10 m AGS) 75% washed sand and 25% aquagate/organoclay: 2.10 - 3.10 m (0 - 1.00 m BGS) Screen: 2.74 - 3.10 m (0.64 - 1.00 m BGS) End of Bore: 3.10 m (1.00 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				3
4								4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 8/17/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-06**
LOCATION: Within West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2			Sand and aquagate/powder activated carbon brown-grey fine-medium grained sand moist low density non-cohesive					2
3			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 1.90 m (0 - 1.90 m AGS) 75% washed sand and 25% aquagate/powder activated carbon: 1.90 - 3.10 m (0 - 1.20 m BGS) Screen: 2.74 - 3.10 m (0.84 - 1.20 m BGS) End of Bore: 3.10 m (1.20 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				3
4								4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP	COMPLETION DEPTH: 1.20 m
REVIEWED BY: LS	COMPLETION DATE: 8/17/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-07**
LOCATION: Downgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel/ sand, shell fragments brown-grey moist low density non-cohesive					0
		Sand, some gravel/ cobbles, trace silt brown-grey fine-medium grained sand wet low density non-cohesive					
1		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.30 m BGS Bentonite: 0.30 - 0.60 m BGS Sand: 0.60 - 1.05 m BGS Screen: 0.70 - 1.00 m BGS Native: 1.05 - 1.40 m BGS End of Bore: 1.40 m BGS					1
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/13/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-08**
LOCATION: Downgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel/ sand brown-grey fine-medium grained sand wet low density non-cohesive					0
		Sand, some gravel/ cobbles, trace silt brown-grey fine-medium grained sand wet low density non-cohesive					
1		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.84 - 1.20 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					1
2							

AECOM

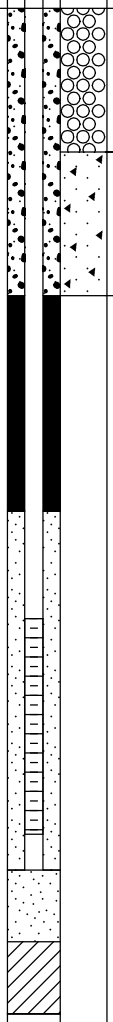
LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/21/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-09**
LOCATION: Upgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND



DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0	Cobbles, modifier gravel, rip rap grey moist low density non-cohesive					
	Sand, some gravel, trace cobbles brown-grey fine-medium grained sand moist low density non-cohesive mottling throughout becoming grey, trace silt below 0.4 m BGS					
1						1
	Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2						

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/13/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-10**
LOCATION: Crossgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel/ sand brown-grey fine-medium grained moist low density non-cohesive					0
		Sand, some gravel/ cobbles, trace silt brown-grey fine-medium grained sand dry low density non-cohesive					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/14/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-11**
LOCATION: Crossgradient - West Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, some gravel/ sand brown/ grey wet low density non-cohesive					
		Sand, some gravel/ cobbles brown/ grey fine to medium grained sand wet low plasticity non-cohesive					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Concrete: 0 - 0.34 m BGS Bentonite: 0.34 - 0.64 m BGS Sand: 0.64 - 1.20 m BGS Screen: 0.74 - 1.10 m BGS Native: 1.20 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/21/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-12**
LOCATION: Downgradient - In between East and West Passive Barriers N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Cobbles, modifier gravel/ sand grey moist low density non-cohesive					0
		Sand, some gravel/ cobbles, trace silt, shell fragments brown-grey fine-medium grained sand moist low density non-cohesive					
1		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					1
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/11/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-13**
LOCATION: Upgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some cobbles/ gravel, trace silt brown-grey sand fine- medium grained sand moist, wet in upper 0.3-0.7m low density non-cohesive					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.37 m BGS Sand: 0.37 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-14**
LOCATION: Crossgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel, trace cobbles brown-grey fine-medium grained sand wet water seepage in upper 0.2 - 0.4 m observed with sheen and hydrocarbon odour low plasticity non-cohesive becoming moist, trace silt below 0.3 m BGS					
1							1
2		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-15**
LOCATION: Crossgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel/ cobbles brown/ grey fine to medium grained sand moist low density non-cohesive					0
		becoming grey, wet, trace silt below 0.5 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.84 - 1.20 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/21/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-16**
LOCATION: Upgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
3			Sand, some cobbles/ gravel light grey medium grained sand moist low density non-cohesive becoming brown, fine-coarse subrounded gravel, trace silt below 0.2 m BGS				Vapour reading at 0.3 m BGS is non-detectable Sample collected at 0.7 - 0.9 m BGS Vapour reading at 0.8 m BGS is non-detectable	3
4			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete protector and rip rap: 0 - 2.83 m (0 - 2.83 m AGS) Bentonite: 2.83 - 3.13 m (0 - 0.30 m BGS) Sand: 3.13 - 3.63 m (0.30 - 0.80 m BGS) Screen: 3.28 - 3.58 m (0.45 - 0.75 m BGS) Native: 3.63 - 3.83 m (0.80 - 1.00 m BGS) End of Bore: 3.83 m (1.00 m BGS) Rip rap thickness has been approximated based on survey data and field measurements.					4
10								10

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 8/25/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-17**
LOCATION: Within East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2								2
2			Sand and aquagate/organoclay brown-grey sand fine-medium grained sand moist low density non-cohesive					2
3								3
3			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.20 m (0 - 2.20 m AGS) 75% washed sand and 25% aquagate/organoclay: 2.20 - 3.20 m (0 - 1.00 m BGS) Screen: 2.84 - 3.20 m (0.64 - 1.00 m BGS) End of Bore: 3.20 m (1.00 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				3
4								4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP | COMPLETION DEPTH: 1.00 m

REVIEWED BY: LS | COMPLETION DATE: 7/21/17

PROJECT ENGINEER: K. Gauthier |

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-18**
LOCATION: Within East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2								2
2			Sand and aquagate/powder activated carbon brown-grey fine-medium grained sand moist low density non-cohesive					2
3								3
3			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.20 m (0 - 2.20 m AGS) 75% washed sand and 25% aquagate/powder activated carbon: 2.20 - 3.40 m (0 - 1.20 m BGS) Screen: 3.04 - 3.40 m (0.84 - 1.20 m BGS) End of Bore: 3.40 m (1.20 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				3
4								4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP	COMPLETION DEPTH: 1.20 m
REVIEWED BY: LS	COMPLETION DATE: 7/21/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-19**
LOCATION: Downgradient East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel/ cobbles, shell fragments brown/ grey fine - medium grained sand moist low plasticity non-cohesive					
		becoming grey, orange mottling throughout below 0.4 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.87 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-20**
LOCATION: Downgradient East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel/ cobbles, shell fragments brown/ grey fine-medium grained sand wet low plasticity non-cohesive					
		becoming grey, trace silt below 0.4 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Concrete: 0 - 0.30 m BGS Bentonite: 0.30 - 0.54 m BGS Sand: 0.54 - 1.10 m BGS Screen: 0.64 - 1.00 m BGS Native: 1.10 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

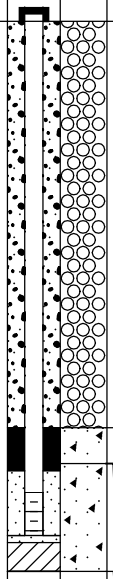
LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/14/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-21**
LOCATION: Upgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND



DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS
0	Concrete protector and rip rap				
3	Sand/ organoclay, some gravel/ cobbles light grey fine-medium grained sand moist low density non-cohesive				Sample collected at 0.5 - 0.7 m BGS Vapour reading at 0.6 m BGS is non-detectable
4	Sand, some gravel (angular/ subangular), trace silt grey fine -medium grained sand moist low density non-cohesive				
5	Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete protector and rip rap: 0 - 2.83 m (0 - 2.83 m AGS) Bentonite: 2.83 - 3.13 m (0 - 0.30 m BGS) Sand: 3.13 - 3.63 m (0.30 - 0.80 m BGS) Screen: 3.28 - 3.58 m (0.45 - 0.75 m BGS) Native: 3.63 - 3.83 m (0.80 - 1.00 m BGS) End of Bore: 3.83 m (1.00 m BGS) Rip rap thickness has been approximated based on survey data and field measurements				
10					

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 8/31/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-22**
LOCATION: Within East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2								2
3			Sand and aquagate/organoclay brown-grey fine-medium grained sand moist low density non-cohesive					3
4			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.50 m (0 - 2.50 m AGS) 75% washed sand and 25% aquagate/organoclay: 2.50 - 3.50 m (0 - 1.00 m BGS) Screen: 3.14 - 3.50 m (0.64 - 1.00 m BGS) End of Bore: 3.50 m (1. 00 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 7/22/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-23**
LOCATION: Within East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2								2
2			Sand and aquagate/powder activated carbon brown-grey fine-medium grained sand moist low density non-cohesive					2
3								3
3			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.20 m (0 - 2.20 m AGS) 75% washed sand and 25% aquagate/powder activated carbon: 2.20 - 3.40 m (0 - 1.20 m BGS) Screen: 3.04 - 3.40 m (0.84 - 1.20 m BGS) End of Bore: 3.40 m (1.20 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				3
4								4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP | COMPLETION DEPTH: 1.20 m

REVIEWED BY: LS | COMPLETION DATE: 7/22/17

PROJECT ENGINEER: K. Gauthier | Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-24**
LOCATION: Downgradient East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel, trace cobbles, shell fragments brown-grey fine-medium grained sand moist low plasticity non-cohesive trace silt below 0.3 m BGS					
1		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.20 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.20 - 1.40 m BGS End of Bore: 1.40 m BGS					1
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-25**
LOCATION: Downgradient East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some grave/cobbles, shell fragments brown-grey fine-medium grained sand wet low density non-cohesive					
		becoming grey, trace silt below 0.4 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

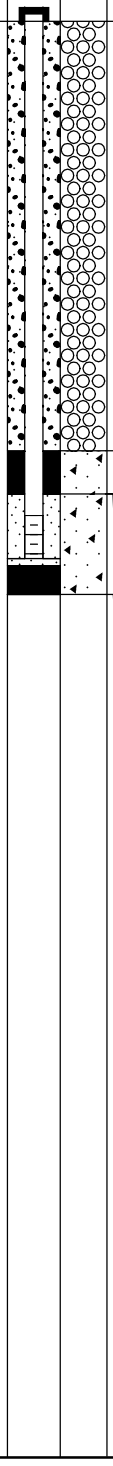
LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/21/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-26**
LOCATION: Upgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND



DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS
0	Concrete well protector and rip rap				Sample collected at 0.5 - 0.7 m BGS Vapour reading at 0.6 m BGS is non-detectable
3	Sand/ organoclay, some gravel/ cobbles light grey fine-medium grained sand moist low density non-cohesive				
4	Sand, some gravel, trace silt brown/grey fine-medium grained sand moist low density non-cohesive				
5	Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protector and rip rap: 0 - 2.99 m (0 - 2.99 m AGS) Bentonite: 2.99 - 3.29 m (0 - 0.30 m BGS) Sand: 3.29 - 3.79 (0.30 - 0.80 m BGS) Screen: 3.44 - 3.74 m (0.45 - 0.75 m BGS) Native: 3.79 - 3.99 m (0.80 - 1.00 m BGS) End of Bore: 3.99 m (1.00 m BGS) Rip rap thickness has been approximated based on survey data and field measurements				
10					

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 8/31/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-27**
LOCATION: Within East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
3			Sand and aquagate/organoclay brown-grey fine-medium grained sand moist low density non-cohesive					3
4			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.80 m (0 - 2.80 m AGS) 75% washed sand and 25% aquagate/organoclay: 2.80 - 3.80 m (0 - 1.00 m BGS) Screen: 3.44 - 3.80 m (0.64 - 1.00 m BGS) End of Bore: 3.80 m (1.00 m BGS) Borehole log details have been extrapolated on field observations. Rip rap thickness has been approximated based on survey data and field measurements.				4
10								10

AECOM

LOGGED BY: EP	COMPLETION DEPTH: 1.00 m
REVIEWED BY: LS	COMPLETION DATE: 7/26/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-28**
LOCATION: Within East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Excavator	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	WELL INSTALLATION	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0			Concrete well protector and rip rap					0
1								1
2			Sand and aquagate/powder activated carbon brown-grey fine-medium grained sand moist low density non-cohesive					2
3								3
4			Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Following well installation, concrete well protector and rip rap were constructed above ground surface. The well stickup was subsequently extended above the ground surface. Concrete well protection and rip rap: 0 - 2.00 m (0 - 2.00 m AGS) 75% washed sand and 25% aquagate/powder activated carbon: 2.00 - 3.20 (0 - 1.20 m BGS) Screen: 2.84 - 3.20 m (0.84 - 1.20 m BGS) End of Bore: 3.20 m (1.20 m BGS) Borehole log details have been extrapolated from field observations. Rip rap thickness has been approximated based on survey data and field measurements.				4
5								5
6								6
7								7
8								8
9								9
10								

AECOM

LOGGED BY: EP	COMPLETION DEPTH: 1.20 m
REVIEWED BY: LS	COMPLETION DATE: 7/26/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-29**
LOCATION: Downgradient East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel, trace cobbles, shell fragments brown/ grey fine-medium grained sand wet low density non-cohesive					0
		becoming grey, trace silt below 0.4 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.20 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.20 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-30**
LOCATION: Downgradient East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel/ cobbles, shell fragments brown/ grey fine-medium grained sand wet low plasticity non-cohesive					0
		becoming grey, trace silt below 0.4 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen (prepacked screen); completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.84 - 1.20 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/21/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-31**
LOCATION: Upgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel, trace cobbles, shell fragments brown/ grey fine-medium grained sand moist low plasticity non-cohesive					
		trace silt below 0.5 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-32**
LOCATION: Crossgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel, trace cobbles, shell fragments brown/ grey fine-medium grained sand moist low plasticity non-cohesive					
		trace silt below 0.5 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

PROJECT: Foreshore Final Remedy	CLIENT: Parkland Refining Ltd.	TESTHOLE NO: **PW17-33**
LOCATION: Crossgradient - East Passive Barrier N 0.0 E 0.0		PROJECT NO.: 60542455
CONTRACTOR: Tervita	METHOD: Bobcat - Solid Stem 8" Auger	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		Sand, some gravel, trace cobbles, shell fragments brown-grey fine-medium grained sand moist low plasticity non-cohesive					
		trace silt below 0.5 m BGS					
1							1
		Well Construction Details: 2" PVC well - Sch 40, 10 slot screen, 20/40 sand filter pack; completed as stick-up Concrete: 0 - 0.40 m BGS Bentonite: 0.40 - 0.70 m BGS Sand: 0.70 - 1.30 m BGS Screen: 0.85 - 1.15 m BGS Native: 1.30 - 1.40 m BGS End of Bore: 1.40 m BGS					
2							

AECOM

LOGGED BY: KG	COMPLETION DEPTH: 1.40 m
REVIEWED BY: LS	COMPLETION DATE: 10/12/17
PROJECT ENGINEER: K. Gauthier	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2017 FORESHORE BH LOGS.SRA.GPJ UMA.GDT 12/7/17

TABLE E-1
FORESHORE MONITORING WELLS CONSTRUCTION DETAILS

Monitoring Well	Well Type	Total Depth (m bgs)	Top of Well Screen (m bgs)	Bottom of Well Screen (m bgs)	Screen type
PW17-1	Upslope	1.20	0.85	1.15	PVC
PW17-2	Sentry	1.20	0.85	1.15	PVC
PW17-3	Compliance	1.20	0.85	1.15	PVC
PW17-4	Upslope	0.80	0.45	0.75	PVC
PW17-5	Performance	1.10	0.64	1.00	SS
PW17-6	Performance	1.30	0.84	1.20	SS
PW17-7	Sentry	1.05	0.7	1.00	PVC
PW17-8	Compliance	1.30	0.84	1.20	SS
PW17-9	Upslope	1.20	0.85	1.15	PVC
PW17-10	Sentry	1.25	0.85	1.15	PVC
PW17-11	Compliance	1.20	0.74	1.10	SS
PW17-12	Compliance	1.20	0.85	1.15	PVC
PW17-13	Upslope	1.20	0.85	1.15	PVC
PW17-14	Sentry	1.20	0.85	1.15	PVC
PW17-15	Compliance	1.30	0.84	1.20	SS
PW17-16	Upslope	0.80	0.45	0.75	PVC
PW17-17	Performance	1.10	0.64	1.00	SS
PW17-18	Performance	1.30	0.84	1.20	SS
PW17-19	Sentry	1.20	0.87	1.15	PVC
PW17-20	Compliance	1.10	0.64	1.00	SS
PW17-21	Upslope	0.80	0.45	0.75	PVC
PW17-22	Performance	1.10	0.64	1.00	SS
PW17-23	Performance	1.30	0.84	1.20	SS
PW17-24	Sentry	1.20	0.85	1.15	PVC
PW17-25	Compliance	1.25	0.85	1.15	PVC [1]
PW17-26	Upslope	0.80	0.45	0.75	PVC
PW17-27	Performance	1.10	0.64	1.00	SS
PW17-28	Performance	1.30	0.84	1.20	SS
PW17-29	Sentry	1.20	0.85	1.15	PVC
PW17-30	Compliance	1.30	0.84	1.20	SS
PW17-31	Upslope	1.20	0.85	1.15	PVC
PW17-32	Sentry	1.20	0.85	1.15	PVC
PW17-33	Compliance	1.20	0.85	1.15	PVC

Notes:
m bgs - metres below ground surface
SS - Stainless steel wrapped screen prepacked with 20/40 sand
PVC - Schedule 40 - 10 slot screen
1 - Screen consisted of a 3" - 10 slot screen surrounding a 2" - 10 slot screen prepacked with 20/40 filter sand (manufactured by Bluemax Drilling)

Appendix F – Field Reports to VFPA

From:	Gill, Michael (Vancouver)
To:	Chaisson, Spencer
Cc:	Southern, Leslie; Chris Boys; O"Neill, Eoghan
Subject:	PER No.16-180 Environmental Monitoring Report October 16 - 21, 2017
Date:	October 23, 2017 4:16:38 PM
Attachments:	20171023.Table 1. Foreshore Field Measurements.xlsx image001.png

Dear Mr. Chaisson,

Construction for the project has been completed with two exceptions: surveying and the installation of the lids for several concrete protectors. This work is scheduled to be completed over the next few weeks, but won't require the use of the barge or heavy equipment. We will let you know when this work is carried out and notify you of completion of the project.

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, October 16 and Saturday, October 21, 2017 under the Port of Vancouver permit PER No.16-180.

No work was completed at the site on the following days: Monday through Thursday, October 16-19, and Saturday, October 21, 2017.

Report

Temperature and turbidity readings exceeded guidelines on October 20, 2017.

During this period, work consisted of: placement of concrete protectors and cobble mat around the barriers, movement of rip rap, and installation of monitoring wells.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

Approximately 300 litres of groundwater was removed from the Site between October 16-21, 2017. No soil was removed during this week.

No incidents occurred at the Site.

No cultural artifacts were identified at the Site.

Michael Gill, P.Eng., CSAP
Senior Environmental Engineer
NEW DIRECT PHONE NUMBER: 604.444.6547
Michael.gill@aecom.com

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Please consider the environment before printing this email.

From: Gill, Michael (Vancouver)
Sent: Monday, October 16, 2017 3:55 PM
To: 'Chaisson, Spencer'
Cc: Southern, Leslie; 'Chris Boys'; 'O'Neill, Eoghan'
Subject: PER No.16-180 Environmental Monitoring Report October 9-14, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, October 9 and Saturday, October 14, 2017 under the Port of Vancouver permit PER No.16-180.

No work was completed at the site on the following day: Monday, October 9, 2017.

Report

Turbidity readings exceeded guidelines on October 12 and 13, 2017.

During this period, work consisted of: placement of concrete protectors and cobble mat around the barriers, movement of rip rap, and installation of monitoring wells.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No soil or groundwater was removed from the Site between October 9 and 14, 2017.

No incidents occurred at the Site.

Cultural artifacts were not identified at the Site.

Cheers,

Michael Gill, P.Eng., CSAP
Senior Environmental Engineer
NEW DIRECT PHONE NUMBER: 604.444.6547
Michael.gill@aecom.com

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From: Gill, Michael (Vancouver)
Sent: Friday, October 06, 2017 2:57 PM
To: 'Chaisson, Spencer'
Cc: Southern, Leslie; 'Chris Boys'; 'O'Neill, Eoghan'
Subject: PER No.16-180 Environmental Monitoring Report October 2-7, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, October 2 and Saturday, October 7, 2017 under the Port of Vancouver permit PER No.16-180.

No work was completed at the site on the following days: No work was completed at the Site on Tuesday, October 3, Friday, October 6, and Saturday, October 7, 2017.

Report

Turbidity readings exceeded the guideline on October 5, 2017.

During this period, work consisted of: well installation, and placement of concrete protectors and rip rap around the western barrier in addition to the partial excavation of the cobble mat in the eastern barrier and subsequent placement of cobble stones.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No soil or groundwater was removed from the Site between October 2-7, 2017.

No incidents occurred at the Site.

Cultural artifacts were not identified at the Site.

Michael Gill, P.Eng., CSAP
Senior Environmental Engineer
NEW DIRECT PHONE NUMBER: 604.444.6547
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Please consider the environment before printing this email.

From: Gill, Michael (Vancouver)
Sent: Tuesday, October 03, 2017 9:33 AM
To: 'Chaisson, Spencer'
Cc: Southern, Leslie; 'Chris Boys'; 'O'Neill, Eoghan'
Subject: RE: PER No.16-180 Environmental Monitoring Report September 18-23, 2017

Dear Mr. Chaisson,

Due to short tidal windows, construction work was not completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, September 25 and Saturday, September 30, 2017 under the Port of Vancouver permit PER No.16-180.

Best regards,

Michael Gill, P.Eng., CSAP
Senior Environmental Engineer
NEW DIRECT PHONE NUMBER: 604.444.6547
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From: Gill, Michael (Vancouver)
Sent: Monday, September 25, 2017 1:22 PM
To: 'Chaisson, Spencer'
Cc: Southern, Leslie; 'Chris Boys'; 'O'Neill, Eoghan'
Subject: PER No.16-180 Environmental Monitoring Report September 18-23, 2017

Dear Mr. Chaisson,

Have you made any progress in getting allowance for Tervita to work nights?

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, September 18 and Saturday, September 23, 2017 under the Port of Vancouver permit PER No.16-180.

No work was completed at the site on the following days: No work was completed at the Site on Wednesday, September 20 and Saturday, September 23, 2017.

Report

Turbidity readings exceeded guidelines on September 18, 19, 21 and 22.

During this period, work consisted of: placement of concrete protectors, constructing concrete collars and placing rip rap around the eastern barrier.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No soil or groundwater was removed from the Site between September 18 through 23, 2017.

No incidents occurred at the Site.

Cultural artifacts were not identified at the Site.

Best regards,

Michael Gill, P.Eng., CSAP
Senior Environmental Engineer
NEW DIRECT PHONE NUMBER: 604.444.6547
Michael.gill@aecom.com

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Please consider the environment before printing this email.

From: Gill, Michael (Vancouver)
Sent: Monday, September 18, 2017 2:52 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: RE: PER No.16-180 Environmental Monitoring Report September 4-9, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, September 11 and Saturday, September 16, 2017 under the Port of Vancouver permit PER No.16-180.

No work was completed at the site on the following days: Monday, September 11, Tuesday, September 12, and Wednesday, September 13, 2017.

Report

On September 14, 15 and 16, samples collected from inside and outside of the construction zone exceeded background values for turbidity.

During this period, work consisted of: placement of concrete protectors and rip rap around the eastern barrier and development of monitoring wells within the eastern barrier trench.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

Approximately 208 litres of porewater from the installed monitoring wells was removed from the Site between September 11 through 16, 2017. No soil was removed from the Site between September 11 through 16, 2017.

Cultural artifacts were not identified at the Site.

Cheers,

Michael Gill, P.Eng., CSAP
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From: Gill, Michael (Vancouver)
Sent: Monday, September 11, 2017 12:22 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: PER No.16-180 Environmental Monitoring Report September 4-9, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, September 4 and Saturday, September 9, 2017 under the Port of Vancouver permit PER No.16-180.

No work was completed at the site on the following days: Monday, September 4, and Friday, September 8 2017.

Report

Turbidity readings exceeded guidelines on September 5, 7 and 9.
Temperature readings exceeded guidelines on September, 5, 6, 7 and 9.

During this period, work consisted of: placement of concrete protectors and pouring of foundations.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred September 4 through 9, 2017.

No soil or groundwater was removed from the Site between September 4 through 9, 2017.

Cultural artifacts were not identified at the Site.

Cheers,

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Please consider the environment before printing this email.

From: Gill, Michael (Vancouver)
Sent: Tuesday, September 05, 2017 12:05 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: PER No.16-180 Environmental Monitoring Report August 28 - September 2, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, August 28 and Saturday, September 2, 2017, under the Port of Vancouver permit PER No.16-180. No work was completed at the site on the following days: Monday, August 28, Tuesday, August 29, and Saturday, September 2, 2017.

Report

On Friday, September 1, two samples collected from within the construction zone were adversely affected by waves from passing boats. The turbidity readings at these times were not considered to be caused by construction activities.

During this period, work consisted of: installation of remedial barrier in Eastern Seep Area, including rip rap placement and well installation.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during August 28 through September 2, 2017.

No soil or groundwater was removed from Site August 28 through September 2, 2017.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Monday, August 28, 2017 2:55 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: PER No.16-180 Environmental Monitoring Report August 21-26, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, August 21 and Saturday, August 26, 2017, under the Port of Vancouver permit PER No.16-180. No work was completed at the site on the following days: Wednesday, August 23, 2017 and Saturday, August 26, 2017.

Please note, due to the Labour Day holiday, the next report will be submitted on Tuesday, September 5, 2017.

Report

During this period, work consisted of: installation of remedial barrier in Eastern Seep Area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during August 21 through 26, 2017.

No soil or groundwater was removed from Site August 21 through 26, 2017.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Monday, August 21, 2017 1:36 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: PER No.16-180 Environmental Monitoring Report August 14-19, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday, August 14 and Saturday, August 19, 2017, under the Port of Vancouver permit PER No.16-180. No work was completed at the site on the following days: Monday, August 14 and Tuesday, August 15.

Report

On August 18, a sample collected from within the construction zone was adversely affected by waves. The turbidity reading at this time was not considered to be caused by construction activities.

During this period, work consisted of: excavation and backfill of a portion of the western seep area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during August 14 through 19, 2017.

Quantity of soil and/or groundwater removed from Site: Approximately 3,000 gallons of groundwater was removed from Site. Approximately 49.4 tons of sediment was removed.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Monday, August 14, 2017 1:42 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: RE: PER No.16-180 Environmental Monitoring Report July 24 -29, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Tuesday August 8 and Saturday, August 12, 2017, under the Port of Vancouver permit PER No.16-180. No work was completed at the site on Sunday, August 13.

Report

During this period, work consisted of: excavation and backfill of a portion of the eastern seep area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during August 8 through 12, 2017.

Quantity of soil and/or groundwater removed from Site: Approximately 5,000 gallons of groundwater was removed from Site. Approximately 10 tons of sediment was removed.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Tuesday, August 08, 2017 2:21 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: RE: PER No.16-180 Environmental Monitoring Report July 24 -29, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Tuesday July 31 and Friday, August 4, 2017, under the Port of Vancouver permit PER No.16-180. No work was completed at the site on the following days: Monday July 31, and Saturday August 5 through Monday August 7.

Report

On August 3, a sample collected from within the construction zone was adversely affected by wave action from passing boats. The turbidity reading at this time was not considered to be caused by construction activities.

During this period, work consisted of: excavation and backfill of a portion of the eastern seep area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during August 1 through 4, 2017.

Quantity of soil and/or groundwater removed from Site: Approximately 20,500 gallons of groundwater was removed from Site. Approximately 126.1 tons of sediment was removed.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Monday, July 31, 2017 1:44 PM
To: Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys; 'per.environment@portvancouver.com'
Subject: PER No.16-180 Environmental Monitoring Report July 24 -29, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday July 24 and Saturday, July 29, 2017, under the Port of Vancouver permit PER No.16-180. Please note, no work will be completed on Monday, August 5, due to the BC day holiday.

Report

On July 24 and 27 samples collected from within the construction zone were adversely affected by wave action from passing boats. Turbidity readings at these times were not considered to be caused by construction activities.

During this period, work consisted of: excavation and backfill of a portion of the eastern seep area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during July 14 through July 29, 2017.

Quantity of soil and/or groundwater removed from Site: Approximately 31,300 gallons of groundwater was removed from Site. Approximately 132.6 tonnes of sediment was removed.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Monday, July 24, 2017 4:43 PM
To: 'per.environment@portvancouver.com'; Chaisson, Spencer (Spencer.Chaisson@portvancouver.com)
Cc: Southern, Leslie; Chris Boys
Subject: RE: PER No.16-180 Environmental Monitoring Report July 17-22, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday July 17 and Saturday, July 22, 2017, under the Port of Vancouver permit PER No.16-180.

Please note that the report submitted on July 17, 2017 was incorrectly labelled as a report for Monday July 17 and Saturday, July 22, 2017. The correct date for that report is Monday, July 10 through Saturday, July 15, 2017.

Report

On July 18, 20 and 22 samples collected from within the construction zone were adversely affected by wave action from passing boats. Turbidity readings at these times were not considered to be caused by construction activities.

During this period, work consisted of: excavation and backfill of a portion of the eastern seep area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during July 17 through July 22, 2017.

Quantity of soil and/or groundwater removed from Site: Approximately 5,000 gallons of groundwater has been removed from Site. Approximately 87 tonnes of sediment has been removed.

Cultural artifacts were not identified at the Site.

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From: Gill, Michael (Vancouver)
Sent: Monday, July 17, 2017 5:06 PM
To: 'per.environment@portvancouver.com'
Cc: Southern, Leslie; Chaisson, Spencer (Spencer.Chaisson@portvancouver.com); Chris Boys
Subject: PER No.16-180 Environmental Monitoring Report July 17-22, 2017

Dear Mr. Chaisson,

Construction work was completed on the Foreshore of Berry Point located down gradient of Area 2 of the Chevron Burnaby Refinery (hereafter referred to as the 'Site') between Monday July 17 and Saturday, July 22, 2017, under the Port of Vancouver permit PER No.16-180.

Background

The Port of Vancouver (PoV) published guidelines for the preparation of Construction Environmental Management Plans (CEMP) in which they describe the roles and responsibilities of the Environmental Monitor (EM). The primary responsibility of the EM is to ensure that the environmental protection objectives of the applicant, and applicable approvals/permits are met by ensuring that the requirements of the CEMP are adhered to. The guidelines specify that monitoring events should be conducted with greater frequency during periods of inclement weather and during critical components of the project.

In order to meet these requirements, seawater samples have been collected from both inside

and outside of the construction zone and tested for temperature, pH, conductivity, and turbidity. The construction zone is defined as areas that may have direct or indirect release or deposit of sediment or sediment laden water into the aquatic environment and, for this project, is an area within 20 metres of any ground disturbance activities. Samples collected from outside of the construction zone have been used to determine background levels of turbidity and temperature. Seawater samples have been compared to BC Ministry of Environment Approved Water Quality Guidelines (BC MoE 2015).

Report

On July 13, 14 and 15 samples collected from within the construction zone were adversely affected by wave action from passing boats. Turbidity readings at these times were not considered to be caused by construction activities.

During this period, work consisted of: excavation and backfill of a portion of the eastern seep area and the entire western seep area.

Field measurements collected from seawater at the Site are provided in Table 1 attached.

No incidents occurred during July 17 through July 22, 2017.

Quantity of soil and/or groundwater removed from Site: no groundwater has been removed from Site. Approximately 1.3 tonnes of sediment has been removed.

Cultural artifacts were not identified at the Site.

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Table F-1 Environmental Monitoring Reports Submitted to the Vancouver Fraser Port Authority

Date	Time[4]	Sample Location	pH	Temperature (°C)	Conductivity (µS/cm)	Turbidity (NTU)	
		Inside / outside of Construction zone/ inside construction zone but not caused by construction activities	7.0 - 8.7	± 1 change from ambient background[2]. Hourly rate of change up to 0.5[3]	NG	Change from background[2] of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters or Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters	**Comments**
10-Jul-17	8:30	inside	NC	NC	NC	4.2	Boat (small craft) pulled up to barge to transport personnel (Chris Boys/Tervita/Mercury) to assess evacuation routes in Area 3 of the Refinery. Sample collected from waves along ban
10-Jul-17	8:35	inside	NC	NC	NC	9.55	Lifted ramp to adjust barge for falling tide. Sample collected along the shore.
10-Jul-17	9:10	inside	NC	NC	NC	3.84	Barge anchors deployed (lock blocks)
10-Jul-17	9:12	inside	NC	NC	NC	**302**	Moving/lifting barge ramp (large sediment plume approximately 3m x 3m lasting one minute in duration. Note, when the barge adjusts ramp the lock block anchors stir up sediment. A discussion with Mercury occurred to try and reduce sediment generatior
10-Jul-17	10:10	inside	8.34	17.96	28377	NC	Sample collected along the shore.
10-Jul-17	11:36	inside	8.63	18.41	28682	NC	Sample collected along the shore.
10-Jul-17	11:51	inside	NC	NC	NC	**63.7**	Moving/lifting barge ramp. Sample collected along the shore.
10-Jul-17	12:00	inside	8.58	18.38	28983	NC	Sample collected along the shore.
10-Jul-17	14:40	inside	**8.83**	18.78	28767	NC	Sample collected along the shore.
11-Jul-17	10:15	inside	NC	NC	NC	**28.2**	Moving/lifting barge ramp. Sample collected along the shore.
11-Jul-17	11:19	inside	**8.84**	18.32	27725	NC	Sample collected along the shore.
11-Jul-17	12:17	inside	8.53	18.35	28713	NC	Sample collected along the shore.
11-Jul-17	12:46	inside	NC	NC	NC	**41**	Moving/lifting barge ramp. Sample collected along the shore.
11-Jul-17	14:22	inside	**8.76**	19.2	28709	NC	Sample collected along the shore.
11-Jul-17	15:01	inside	NC	NC	NC	18.8	Unloading/loading - no barge movement. Sample collected along the shore.
12-Jul-17	13:19	outside	8.45	18.1	30121	19.9	Ambient conditions - outside construction zone. Sample collected along the shore.
12-Jul-17	14:00	inside	8.51	18.06	29887	12.1	Ambient conditions - inside construction zone. Sample collected along the shore.
13-Jul-17	12:01	inside	8.27	16.18	31805	17.8	Ambient conditions - inside construction zone. Sample collected along the shore.
13-Jul-17	12:28	inside	8.37	16.45	31904	**47.7**	Moving/lifting barge ramp. Sample collected along the shore.
13-Jul-17	15:40	outside	8.58	16.58	32513	8.68	Ambient conditions (calm, no waves) - outside construction zone. Sample collected along the shore.
13-Jul-17	15:42	outside	8.55	16.58	32516	**29.6**	Ambient conditions (large waves). Sample collected along the shore.
14-Jul-17	11:13	outside	8.41	17.87	30227	11.6	Ambient conditions (calm, no waves) - outside construction zone. Sample collected along the shore.
14-Jul-17	13:07	inside	8.55	18.57	29657	**36.4**	Moving/lifting barge ramp. Sample collected along the shore.
14-Jul-17	15:16	inside - not caused by construction	8.6	17.94	31666	**44.4**	Big wave silt plumes inside and outside construction zones.
15-Jul-17	12:17	inside	8.37	17.78	31985	**37.2**	Moving/lifting barge ramp. Sample collected along the shore.
15-Jul-17	13:15	inside - not caused by construction	8.41	17.82	32410	**59.8**	Large waves and silt plumes created from passing boats.
15-Jul-17	15:22	inside - not caused by construction	8.45	17.85	33096	**88.2**	Large waves and silt plumes created from passing boats.
17-Jul-17	7:01	Inside	8.19	**15.48**	34075	**37.8**	Barge ramp landing on shore
17-Jul-17	8:00	Outside	8.4	15.8	33832	13.7	50 m east of boom/construction zone
17-Jul-17	9:41	Inside	8.41	16.06	33871	**808**	Skid steer loading/unloading super sacs. Asked Tervita to instead use barge crane to load and unload super sacs to reduce sediment disturbance
17-Jul-17	10:05	Inside	8.35	15.81	34100	17.8	Loading barge for departure
18-Jul-17	7:16	outside	8.12	16.46	32391	22.9	50 m east of boom/construction zone
18-Jul-17	8:13	Inside	8.3	16.36	33013	4.76	Barge ramp along shore
18-Jul-17	8:40	Inside - not caused by construction	8.35	16.53	32818	**64**	Silt plume from passing boat
18-Jul-17	10:15	Outside	8.48	17.17	32448	**64**	Silt plume from passing boat
18-Jul-17	11:00	Outside	8.52	17.67	32449	19.8	Silt plume from passing boat
18-Jul-17	11:00	Inside - not caused by construction	8.52	17.67	32449	11.3	Silt plume from passing boat
18-Jul-17	11:28	Outside	8.4	16.46	33769	9.62	Silt plume from passing boat
18-Jul-17	11:28	Inside - not caused by construction	8.4	16.46	33769	**284**	Silt plume from passing boat
19-Jul-17	7:28	Inside	8.04	17.1	32498	13.4	Unloading excavator
19-Jul-17	8:44	Inside	8.39	17.24	31975	**85.6**	Excavating trench
19-Jul-17	10:33	Inside - not caused by construction	8.59	17.51	32055	**68.9**	Ambient conditions beside barge ramp, no movement
19-Jul-17	10:39	Outside	**8.79**	**17.79**	32153	8.59	Waves outside boom
19-Jul-17	12:01	Inside - not caused by construction	8.62	17.61	32281	**56**	Rising tide
20-Jul-17	7:20	Outside	7.71	16.5	33027	12.1	Ambient conditions beside barge ramp, no movement
20-Jul-17	7:26	Inside	**8.99**	16.39	33163	**93.1**	Barge ramp along shore
20-Jul-17	9:26	Inside	7.85	16.5	33150	3.02	Sample taken from barge end, furthest from shore
20-Jul-17	9:30	Outside	7.95	16.89	32966	17	Boat passed approx. 200 m out, sample collected 30 m west of boom.
20-Jul-17	10:55	Inside	7.92	16.92	32694	4.31	Barge ramp along shore
20-Jul-17	10:58	Outside	8.03	17.13	32750	31.3	Waves from passing boats
20-Jul-17	11:20	Outside	8.07	17.38	32713	**59.7**	Port authority boat passing causing waves
20-Jul-17	11:26	Inside	8.64	17.42	32468	17.4	2 m west of barge inside construction zone
20-Jul-17	11:53	Outside	8.12	**17.87**	32812	11.8	Waves from passing boats
20-Jul-17	12:00	Inside - not caused by construction	7.98	17.06	32518	6.26	Waves from passing boats
20-Jul-17	12:30	Outside	8.14	**17.83**	23209	11.6	Waves from passing boats
20-Jul-17	12:41	Inside - not caused by construction	8.04	**17.63**	31764	4.86	Waves from passing boats
21-Jul-17	7:20	Inside	7.76	16.04	32011	**117**	Barge ramp along shore
21-Jul-17	12:12	Inside - not caused by construction	7.95	16.68	32307	**46.8**	Ambient conditions beside barge ramp, no movement
22-Jul-17	8:12	Inside	7.69	**15.25**	34344	**115**	Dropped barge ramp
22-Jul-17	8:28	Outside	7.77	15.84	33499	15.1	50 m west of boom along shore
22-Jul-17	10:25	Inside - not caused by construction	7.71	**15.25**	34528	16.3	Waves from passing boats
22-Jul-17	10:28	Outside	7.81	**15.25**	34338	**44.6**	50 m west of boom along shore
22-Jul-17	12:16	Inside - not caused by construction	7.78	**14.95**	34997	**158**	Waves from passing boats
22-Jul-17	12:21	Outside	7.7	**14.96**	35022	**126**	Waves from passing boats
24-Jul-17	9:55	Inside	7.71	14.9	35590	**450**	Excavator Unloading
24-Jul-17	10:00	Outside	7.76	15.51	35104	**61.4**	Ambient conditions
24-Jul-17	11:00	Inside - not caused by construction	7.80	15.82	35160	**57.0**	Passing boat
24-Jul-17	11:15	Outside	7.99	15.89	35305	**104**	Passing boat
24-Jul-17	12:35	Inside	7.82	15.35	35383	**62.0**	Beginning to backfill
24-Jul-17	12:35	Outside	NR	NR	NR	39.0	Beginning to backfill
24-Jul-17	14:08	Inside	7.80	15.11	35926	29.7	Ambient conditions (no movement)
25-Jul-17	10:45	Inside	7.31	15.94	35179	16.3	Excavator unloading
25-Jul-17	10:45	Outside	NR	NR	NR	38.3	Excavator unloading
25-Jul-17	12:55	Inside	7.74	15.83	35990	37.0	Excavation of trench
25-Jul-17	12:55	Outside	NR	NR	NR	30.4	Excavation of trench
25-Jul-17	15:10	Outside	7.71	**14.64**	36720	21.9	Backfilling
25-Jul-17	15:10	Outside	NR	NR	NR	**115**	Waves came during sampling
26-Jul-17	11:41	Inside	7.66	16.39	35288	**71.6**	Barge ramp lowered/unloading
26-Jul-17	12:00	Outside	7.65	**16.85**	35572	**52.9**	Ambient conditions
26-Jul-17	13:00	Outside	7.63	16.31	35879	43.1	Ambient beside ramp
26-Jul-17	13:00	Inside	NR	NR	NR	26.0	Excavation of trench
26-Jul-17	15:55	Outside	7.84	15.1	366889	22.6	
26-Jul-17	15:55	Inside	NR	NR	NR	9.84	Backfilling
27-Jul-17	12:00	Inside	7.71	15.65	36356	**51.6**	Unloading, beginning to scrape surface material back
27-Jul-17	12:00	Outside	NR	NR	NR	7.81	
27-Jul-17	16:00	Inside	7.6	15.19	36302	40.7	Small waves coming in
27-Jul-17	17:21	Inside - not caused by construction	7.63	**14.5**	37600	**59.2**	Large waves
28-Jul-17	12:40	Inside	7.71	15.59	36332	14.6	Landing barge / unloading
28-Jul-17	12:40	Outside	NR	NR	NR	6.13	
28-Jul-17	16:00	Outside	7.81	15.9	36576	40.1	Backfilling/ heavy boat traffic

Table F-1 Environmental Monitoring Reports Submitted to the Vancouver Fraser Port Authority

Date	Time[4]	Sample Location	pH	Temperature (°C)	Conductivity (µS/cm)	Turbidity (NTU)	
		Inside / outside of Construction zone/ inside construction zone but not caused by construction activities	7.0 - 8.7	± 1 change from ambient background[2]. Hourly rate of change up to 0.5[3]	NG	Change from background[2] of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters or Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters	**Comments**
28-Jul-17	17:00	Inside	7.84	16.58	35862	40	Passing boat
28-Jul-17	17:00	Outside	NR	NR	NR	40	
29-Jul-17	14:00	Inside	7.74	**16.81**	36204	15.9	Collected off side of barge ~ 15 m from shore
29-Jul-17	16:15	Inside	7.54	16.52	36050	40.3	Beside barge ramp - ambient
29-Jul-17	16:30	Inside	7.44	16.32	36193	33.6	Loading excavator
1-Aug-17	7:00	Inside	7.62	16.59	35177	11	Loading equipment
1-Aug-17	9:45	Inside	7.82	16.15	35838	23.5	Ambient - calm water
1-Aug-17	10:40	Inside	7.75	16.04	36006	7.1	Ambient - beside ramp
2-Aug-17	7:25	Inside	7.56	**16.99**	34748	4.82	Unloading excavator
2-Aug-17	7:25	Outside	NR	NR	NR	4.95	
2-Aug-17	9:50	Inside	7.81	16.59	35850	12.4	Boat passing by
2-Aug-17	11:45	Inside	7.78	15.87	36378	5.5	Beside ramp - ambient
3-Aug-17	7:20	Inside	7.41	16.26	35683	**120**	Unloading excavator
3-Aug-17	10:30	Inside - not caused by construction	7.87	16.52	35643	**102**	Boats passing
3-Aug-17	12:00	Inside	7.82	**16.98**	35631	**129**	Loading excavator
4-Aug-17	7:15	Inside	7.5	16.70	34967	26.0	Unloading excavator
4-Aug-17	12:14	Inside	7.81	15.52	36440	**120**	Moving ramp
4-Aug-17	13:19	Inside	7.75	15.55	36413	**144**	Loading / unloading
8-Aug-17	9:00	inside construction zone	7.8	14.87	36930	13.2	beside ramp - ambient
8-Aug-17	12:30	inside construction zone	7.91	15.25	37188	7.56	ambient
8-Aug-17	8:09	outside construction zone	7.9	15.21	36999	8.49	ambient - along shore
8-Aug-17	15:02	inside construction zone but not caused by construction activities	7.87	14.38	37836	43.9	boats passing - waves
8-Aug-17	15:09	outside construction zone	7.84	14.32	37875	46.1	boats passing - waves
9-Aug-17	10:01	inside construction zone but not caused by construction activities	7.84	15.13	36904	67.3	beside ramp - boats passing - waves
9-Aug-17	10:06	outside construction zone	7.77	15.36	36825	24.1	along shore - waves from passing boats
9-Aug-17	12:46	outside construction zone	8.06	18.93	36195	79.8	along shore - waves from passing boats
9-Aug-17	12:52	inside construction zone but not caused by construction activities	7.99	17.78	36277	47.4	beside ramp - boats passing - waves
9-Aug-17	14:15	outside construction zone	8.11	18.78	36071	41.3	ambient - along shore
9-Aug-17	14:18	inside construction zone	8.13	18.25	36591	16.4	beside ramp - ambient
10-Aug-17	10:30	inside construction zone	7.67	17.19	36735	**43.4**	beside ramp - ambient
10-Aug-17	10:50	inside construction zone but not caused by construction activities	7.773	16.65	37025	16.7	ambient - along shore
10-Aug-17	13:27	inside construction zone but not caused by construction activities	7.92	17.72	37384	75.3	beside ramp - boats passing - waves
10-Aug-17	13:31	outside construction zone	8.1	16.92	37966	17.8	along shore - waves from passing boats
10-Aug-17	16:20	inside construction zone	7.98	17.45	37849	17.9	beside ramp - ambient
10-Aug-17	16:25	outside construction zone	7.91	17.86	37025	14.1	ambient - along shore
11-Aug-17	11:25	inside construction zone	7.78	16.49	38483	**104**	beside ramp - unloading equipment
11-Aug-17	11:30	outside construction zone	7.86	15.88	38117	12.2	ambient - along shore
11-Aug-17	13:37	outside construction zone	7.97	18.24	37141	26.4	ambient - along shore
11-Aug-17	13:41	inside construction zone	7.96	17.5	37228	22.3	ambient - along shore
11-Aug-17	16:13	outside construction zone	8.1	18.36	38361	12.8	ambient - along shore
11-Aug-17	16:19	inside construction zone	8	17.27	37934	13.8	beside ramp - ambient
12-Aug-17	12:21	outside construction zone	7.8	16.42	38193	14.2	ambient - along shore
12-Aug-17	12:26	inside construction zone	7.81	16.36	38084	**76.8**	beside ramp - unloading equipment
12-Aug-17	15:15	outside construction zone	8.03	17.25	38413	33.9	ambient - along shore
12-Aug-17	15:20	inside construction zone	7.97	17.26	38329	24.1	beside ramp - ambient
12-Aug-17	16:41	outside construction zone	7.96	17.04	38572	75.7	ambient - along shore - loading equipment
12-Aug-17	16:46	inside construction zone	7.93	17.7	38991	**33.8**	beside ramp - loading equipment
16-Aug-17	7:50	outside construction zone	7.66	15.28	37396	16.0	Along shore
16-Aug-17	7:55	inside construction zone	7.72	15.13	37555	27.8	Beside ramp
16-Aug-17	10:40	outside construction zone	7.86	14.98	37819	11.4	Along shore
16-Aug-17	10:44	inside construction zone	7.9	**14.74**	38041	14.0	Beside ramp
17-Aug-17	7:30	inside construction zone	7.81	15.09	37470	10.1	Beside ramp
17-Aug-17	7:36	outside construction zone	7.69	15.31	37228	22.3	Along shore
17-Aug-17	10:53	outside construction zone	7.93	16.50	37796	**73.8**	along shore - waves from passing boats
17-Aug-17	10:57	inside construction zone	8.02	16.28	37814	45.2	Beside ramp
17-Aug-17	12:00	inside construction zone	7.82	16.38	38506	**56.4**	Beside ramp
17-Aug-17	12:06	outside construction zone	7.97	16.8	38664	14.9	Along shore
18-Aug-17	7:28	outside construction zone	7.9	15.27	37771	24.9	Along shore
18-Aug-17	7:33	inside construction zone	7.89	15.69	37750	36.0	Beside ramp
18-Aug-17	12:26	outside construction zone	8.05	**17.00**	37922	**127**	Waves from boat passing
18-Aug-17	12:31	inside construction zone not caused by construction activities	8.04	16.59	38151	**140**	Beside ramp - waves
18-Aug-17	13:18	inside construction zone	7.97	14.91	38597	**179**	Loading excavator
19-Aug-17	7:40	outside construction zone	7.66	15.09	37729	17.6	Along shore
19-Aug-17	7:46	inside construction zone	7.69	**14.66**	38161	48.4	Beside ramp
19-Aug-17	11:01	outside construction zone	7.89	16.41	38021	**161**	Along shore
19-Aug-17	11:05	inside construction zone	7.92	15.86	38071	**76.9**	Beside ramp
19-Aug-17	13:50	outside construction zone	8.02	16.42	39339	20.8	Boat waves
19-Aug-17	13:54	inside construction zone	7.91	15.63	39032	24.7	Beside ramp
21-Aug-17	9:40	inside construction zone	7.67	14.59	32893	7.08	Excavator moving material
21-Aug-17	9:45	outside construction zone	7.89	14.72	33005	11.8	Adding organoclay later top of rip rap
21-Aug-17	12:05	inside construction zone	8.19	14.67	33296	14.2	Adding organoclay later to rip rap
21-Aug-17	12:10	outside construction zone	8.19	15.48	33217	28.7	Leisure boats passing by
21-Aug-17	15:15	inside construction zone	8.01	14.26	33776	40.1	Leisure boats in area. Excavator moving rip rap
21-Aug-17	15:20	outside construction zone	8.21	15.12	33533	28.7	Leisure boats in area. Excavator moving rip rap
22-Aug-17	9:35	inside construction zone	7.92	14.12	32592	23.1	Excavator activity
22-Aug-17	9:40	outside construction zone	8	14.31	32581	28.9	Minor leisure boats
22-Aug-17	12:25	inside construction zone	8.06	15.06	32255	38.2	Apply geomembrane to CPR slope
22-Aug-17	12:30	outside construction zone	8.09	15.95	31887	**87.0**	Large waves
22-Aug-17	15:12	inside construction zone	8.2	14.35	32708	14.3	Moving rip rap / installing geogrid
22-Aug-17	15:19	outside construction zone	8.29	15.41	32499	**62.2**	Moving rip rap / installing geogrid
24-Aug-17	11:30	inside construction zone	7.58	**14.08**	33026	15.6	Excavator unloading rip rap
24-Aug-17	11:35	outside construction zone	7.78	**14.06**	33142	24.8	Excavator unloading rip rap
24-Aug-17	13:53	inside construction zone	8.01	14.72	33046	25.3	Excavator unloading rip rap
24-Aug-17	13:58	outside construction zone	8.13	15.03	32994	35.1	Excavator unloading rip rap
24-Aug-17	16:20	inside construction zone	8.05	**13.96**	33145	27.6	Moving rip rap
24-Aug-17	16:25	outside construction zone	8.11	14.78	NR	39.6	Moving rip rap
25-Aug-17	13:05	inside construction zone	8.14	14.99	NR	19.9	Loading materials/ YSI Malfunction/Leisure boats
25-Aug-17	13:10	outside construction zone	7.99	15.01	NR	38.0	Loading materials/ YSI Malfunction/Leisure boats
25-Aug-17	15:30	inside construction zone	8.24	15.02	NR	39.9	Leisure boats/ unloading rip rap
25-Aug-17	15:35	outside construction zone	8.26	15.52	NR	43.1	Leisure boats/ unloading rip rap

Table F-1 Environmental Monitoring Reports Submitted to the Vancouver Fraser Port Authority

Date	Time[4]	Sample Location	pH	Temperature (°C)	Conductivity (µS/cm)	Turbidity (NTU)	
		Inside / outside of Construction zone/ inside construction zone but not caused by construction activities	7.0 - 8.7	± 1 change from ambient background[2]. Hourly rate of change up to 0.5.[3]	NG	Change from background[2] of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters or Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters	**Comments**
25-Aug-17	16:45	inside construction zone	8.1	14.85	NR	42.5	Unloading rip rap off barge / Leisure boats
25-Aug-17	16:50	outside construction zone	8.3	15.79	NR	40.2	Unloading rip rap off barge / Leisure boats
30-Aug-17	7:40	inside construction zone	8.10	15.94	31717	5.15	Excavator emptying gravel bags. Calm water - slack tide
30-Aug-17	7:55	outside construction zone	7.96	16.07	31312	20.7	
30-Aug-17	10:00	inside construction zone	8.17	15.87	31842	4.93	Excavator placing rip rap
30-Aug-17	10:05	outside construction zone	8.14	16.15	32041	9.30	
30-Aug-17	11:00	inside construction zone	8.13	15.5	31684	7.88	End of day / tidying up.
30-Aug-17	11:04	outside construction zone	8.15	16.02	31921	8.07	
31-Aug-17	7:35	inside construction zone	8.12	15.45	31855	5.83	Excavator dumping gravel.
31-Aug-17	7:40	outside construction zone	7.99	15.39	31810	19.6	
31-Aug-17	11:00	inside construction zone	8.06	15.17	31716	12.9	Moving rip rap / installing wells
31-Aug-17	11:05	outside construction zone	8.04	15.39	32235	14.7	Moving rip rap / installing wells
31-Aug-17	11:50	inside construction zone	8.02	15.05	31900	11.0	Moving rip rap / installing wells
31-Aug-17	11:55	outside construction zone	8.10	15.87	31835	13.1	Moving rip rap / installing wells
1-Sep-17	7:26	inside construction zone	8.00	14.91	31553	17.3	Moving rip rap / installing wells
1-Sep-17	7:31	outside construction zone	7.87	14.94	30507	18.8	Moving rip rap / installing wells
1-Sep-17	9:21	inside construction zone but not caused by construction activities	8.17	15.67	31596	**38.2**	Moving rip rap / installing wells. Large tanker, boats passing by
1-Sep-17	9:26	outside construction zone	8.14	15.4	31839	**98**	Moving rip rap / installing wells. Large tanker, boats passing by
1-Sep-17	11:11	inside construction zone but not caused by construction activities	8.10	15.08	31687	**56.1**	End of day. Leisure boat crafts.
1-Sep-17	11:16	outside construction zone	8.09	15.12	31698	**60.7**	
5-Sep-17	9:30	inside construction zone	7.98	16.18	32159	2.94	Relatively calm water. Tervita building concrete forms
5-Sep-17	9:35	outside construction zone	7.95	16.0	32153	13.0	
5-Sep-17	11:51	inside construction zone	8.00	16.11	32260	5.9	Building concrete forms, minor leisure boat traffic
5-Sep-17	11:56	outside construction zone	7.97	15.9	32017	**28.70**	
5-Sep-17	13:45	inside construction zone	7.92	**18.07**	31948	7.82	End of day / tidying up.
5-Sep-17	13:50	outside construction zone	7.92	15.4	32290	**23.5**	
6-Sep-17	9:00	inside construction zone	7.79	15.27	30357	14.8	Building forms
6-Sep-17	9:05	outside construction zone	7.96	15.9	30451	12.8	Building forms
6-Sep-17	11:39	inside construction zone	7.98	15.41	30374	8.61	
6-Sep-17	11:44	outside construction zone	8.08	16.1	30812	14.9	
6-Sep-17	14:08	inside construction zone	7.93	14.94	30348	9.4	Pouring concrete into forms
6-Sep-17	14:16	outside construction zone	8.05	**16.2**	30988	16.1	Pouring concrete into forms
7-Sep-17	10:10	inside construction zone	7.92	15.09	30321	4.91	Calm ambient
7-Sep-17	10:14	outside construction zone	8.01	16.2	30419	6.42	Calm ambient
7-Sep-17	13:40	inside construction zone	7.90	**14.06**	30281	**27.6**	Skid steer moving concrete collars off barge
7-Sep-17	13:46	outside construction zone	7.87	**14.0**	30377	13.2	Skid steer moving concrete collars off barge
7-Sep-17	15:05	inside construction zone	7.92	14.42	30288	17.4	
7-Sep-17	15:09	outside construction zone	7.96	14.5	30301	15.2	
9-Sep-17	10:50	inside construction zone	7.89	**13.86**	29945	**48.9**	Unloading / ramp dropped.
9-Sep-17	10:54	outside construction zone	7.91	**14.0**	30011	17.0	
9-Sep-17	13:20	inside construction zone	7.88	**13.81**	30023	6.84	
9-Sep-17	13:26	outside construction zone	7.86	**13.8**	30069	5.13	
9-Sep-17	16:31	inside construction zone	7.97	14.30	29994	**48.6**	
9-Sep-17	16:37	outside construction zone	8.01	14.3	29918	**27.9**	
14-Sep-17	7:10	inside construction zone	7.94	13.21	29841	29.5	Unloading, no waves
14-Sep-17	7:13	outside construction zone	7.98	13.4	29613	11.0	Unloading, no waves
14-Sep-17	9:46	inside construction zone	7.96	14.01	29687	14.6	
14-Sep-17	9:51	outside construction zone	7.93	14.1	29691	16.8	
14-Sep-17	10:19	inside construction zone	7.98	13.73	29684	**73.1**	Loading Excavator with waves
14-Sep-17	10:23	outside construction zone	7.97	13.9	32290	24.3	Loading Excavator with waves
15-Sep-17	7:04	inside construction zone	7.92	13.51	29326	**112**	Unloading Excavator
15-Sep-17	7:09	outside construction zone	7.94	13.65	29243	24.7	
15-Sep-17	9:36	inside construction zone	7.97	13.66	29639	13.8	Ambient calm
15-Sep-17	9:40	outside construction zone	7.98	13.71	29654	**94.6**	Waves from passing boat
15-Sep-17	11:45	inside construction zone	8.02	14.21	29790	**117**	Very turbid all along shore
15-Sep-17	11:50	outside construction zone	8.00	14.46	29801	**99.8**	Very turbid all along shore
16-Sep-17	7:11	inside construction zone	7.84	13.18	29460	**59.1**	
16-Sep-17	7:15	outside construction zone	7.86	13.22	29503	21.0	
16-Sep-17	9:37	inside construction zone	7.92	13.44	29636	32.2	
16-Sep-17	9:41	outside construction zone	7.93	13.43	29643	24.9	
16-Sep-17	12:07	inside construction zone	7.99	13.82	29951	**101**	Waves from passing boat
16-Sep-17	12:12	outside construction zone	7.99	13.72	29900	**47.8**	
18-Sep-17	8:15	inside construction zone	7.88	12.89	29540	17.6	Unloading excavator
18-Sep-17	8:19	outside construction zone	7.89	12.93	29533	16.8	Unloading excavator
18-Sep-17	10:51	inside construction zone	7.86	13.00	29869	11.4	ambient waves
18-Sep-17	10:55	outside construction zone	7.85	12.99	29871	13.2	ambient waves
18-Sep-17	12:38	inside construction zone	7.88	12.93	29899	**46.4**	Loading excavator
18-Sep-17	12:42	outside construction zone	7.87	12.99	29904	22.8	Loading excavator
19-Sep-17	8:50	inside construction zone	7.87	12.73	29046	**39.9**	Unloading excavator
19-Sep-17	8:54	outside construction zone	7.85	12.76	29055	13.8	Unloading excavator
19-Sep-17	12:13	inside construction zone	7.9	12.66	29426	**28.1**	ambient waves
19-Sep-17	12:17	outside construction zone	7.89	12.61	29419	20.4	ambient waves
19-Sep-17	13:37	inside construction zone	7.94	12.99	29090	15	Loading excavator
19-Sep-17	13:41	outside construction zone	7.94	13.04	28947	11.3	Loading excavator
21-Sep-17	10:40	inside construction zone	7.86	12.86	29720	**31.1**	Unloading excavator
21-Sep-17	10:45	outside construction zone	7.85	12.84	29707	18.7	Unloading excavator
21-Sep-17	12:50	inside construction zone	7.90	13.23	29874	14.6	ambient waves
21-Sep-17	12:54	outside construction zone	7.91	13.31	29891	17.7	ambient waves
21-Sep-17	15:05	inside construction zone	7.87	12.88	29612	**78.9**	Loading excavator
21-Sep-17	15:09	outside construction zone	7.88	12.86	29633	**32.3**	Loading excavator
22-Sep-17	12:04	inside construction zone	7.89	12.92	29536	**88.6**	Unloading excavator
22-Sep-17	12:08	outside construction zone	7.91	12.98	29553	**43.1**	Unloading excavator
22-Sep-17	14:31	inside construction zone	8.01	13.20	29458	**38.9**	ambient waves
22-Sep-17	14:36	outside construction zone	8.00	13.19	29468	**46.8**	ambient waves
22-Sep-17	15:26	inside construction zone	7.95	13.06	29524	11.7	Loading excavator
22-Sep-17	15:30	outside construction zone	7.96	13.09	29526	17.4	Loading excavator
2-Oct-17	7:55	inside construction zone	7.71	12.43	37676	6.43	Excavator on beach moving super sacs / barge set up at western barrier
2-Oct-17	8:00	outside construction zone	7.79	12.04	37136	4.16	50 west of eastern barrier
2-Oct-17	10:20	inside construction zone	7.99	12.47	37847	7.12	calm water, excavator working
2-Oct-17	10:26	outside construction zone	7.98	12.27	37270	14.40	ambient waves
2-Oct-17	12:24	inside construction zone	8.08	12.87	37995	12.10	Gentle waves
2-Oct-17	12:30	outside construction zone	8.19	13.08	37954	8.90	
4-Oct-17	9:00	inside construction zone	7.96	12.15	37590	3.99	Calm water / barge set up at western barrier
4-Oct-17	9:05	outside construction zone	7.92	11.82	37475	7.42	

Table F-1 Environmental Monitoring Reports Submitted to the Vancouver Fraser Port Authority

Date	Time[4]	Sample Location	pH	Temperature (°C)	Conductivity (µS/cm)	Turbidity (NTU)	
		Inside / outside of Construction zone/ inside construction zone but not caused by construction activities	7.0 - 8.7	± 1 change from ambient background[2]. Hourly rate of change up to 0.5[3]	NG	Change from background[2] of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters or Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters	**Comments**
4-Oct-17	11:15	inside construction zone	8.08	12.35	37731	8.52	Excavator moving rip rap
4-Oct-17	11:20	outside construction zone	8.07	12.39	37692	9.01	
4-Oct-17	13:08	inside construction zone	8.07	12.9	38101	7.00	Excavator moving rip rap
4-Oct-17	13:13	outside construction zone	8.09	12.79	38007	14.5	
5-Oct-17	10:23	inside construction zone	7.99	12.25	37852	20.7	Excavator unloading materials from barge / slightly elevated turbidity from barge ramp / barge set up at eastern barrie
5-Oct-17	10:28	outside construction zone	7.95	12.03	37800	56.8	Moderate boat activity in Burrard Inlet
5-Oct-17	12:37	inside construction zone	8.09	12.79	38156	**25.4**	Moderate boat activity in Burrard Inlet
5-Oct-17	12:42	outside construction zone	8.02	12.22	37954	**36.5**	
5-Oct-17	13:36	inside construction zone	8.04	12.63	38246	15.0	
5-Oct-17	13:41	outside construction zone	8.06	12.71	38240	16.1	
10-Oct-17	12:53 AM	inside construction zone	7.59	11.84	38266	7.10	Calm water/ excavator moving rip rap in west trench
10-Oct-17	12:58 AM	outside construction zone	7.75	11.61	38017	4.71	Calm water/ excavator moving rip rap in west trench
10-Oct-17	3:05 AM	inside construction zone	7.87	11.59	37868	4.27	Calm water/ excavator moving rip rap in west trench
10-Oct-17	3:08 AM	outside construction zone	7.79	11.50	37553	3.25	Calm water/ excavator moving rip rap in west trench
10-Oct-17	5:13 AM	inside construction zone	7.86	11.86	38431	2.39	
10-Oct-17	5:18 AM	outside construction zone	7.84	11.89	38411	5.12	
11-Oct-17	1:30 AM	inside construction zone	7.87	11.70	38293	2.99	Calm water
11-Oct-17	1:35 AM	outside construction zone	7.82	11.36	37984	12.6	
11-Oct-17	3:55 AM	inside construction zone	7.87	11.67	38122	17.6	
11-Oct-17	4:00 AM	outside construction zone	7.71	11.52	37661	11.4	
11-Oct-17	6:45 AM	inside construction zone	7.92	11.83	38373	15.3	
11-Oct-17	3:22 AM	outside construction zone	7.90	11.82	38340	17.1	
12-Oct-17	3:26 AM	inside construction zone	7.89	11.72	38086	4.54	Moderate wind and waves, excavating, drilling wells in east section
12-Oct-17	3:26 AM	outside construction zone	7.82	11.32	37706	**60.1**	Wind, waves and falling tide likely impact turbidity
12-Oct-17	6:04 AM	inside construction zone, but not caused by construction activities	7.87	11.61	37869	**33.1**	Wind, waves and falling tide likely impact turbidity
12-Oct-17	6:08 AM	outside construction zone	7.72	11.16	37178	**50.7**	Wind, waves and falling tide likely impact turbidity
12-Oct-17	7:40 AM	inside construction zone	7.84	11.83	38306	9.01	
12-Oct-17	7:45 AM	outside construction zone	7.84	11.82	38290	15.2	
13-Oct-17	3:36 AM	inside construction zone	7.88	11.44	37652	8.15	Set up barge, ramp in place, unloading cobbles to east trench areas.
13-Oct-17	3:31 AM	outside construction zone	7.84	11.10	37309	**43.3**	
13-Oct-17	7:10 AM	inside construction zone	7.93	11.44	37741	16.4	Excavating in west trench. Large tanker boat passed by, leisure boat traffic.
13-Oct-17	7:15 AM	outside construction zone	7.77	10.84	37310	17	
13-Oct-17	9:11 AM	inside construction zone	7.95	11.48	37675	10.1	
13-Oct-17	9:16 AM	outside construction zone	7.97	11.51	37695	15.1	
14-Oct-17	4:27 AM	inside construction zone	7.13	11.43	38293	7.89	Lowered barge ramp, working in east barrier
14-Oct-17	4:32 AM	outside construction zone	7.55	11.29	38157	13	
14-Oct-17	7:00 AM	inside construction zone	7.32	11.15	37142	11.5	
14-Oct-17	7:05 AM	outside construction zone	7.8	11.44	37757	5.64	
14-Oct-17	8:55 AM	inside construction zone	7.82	11.5	38349	7.96	Unloading cobbles from barge
14-Oct-17	9:00 AM	outside construction zone	7.77	11.27	37873	19.7	
20-Oct-17	11:29 PM	inside construction zone	7.76	10.22	27145	6.96	Barge landed near east barrier, calm water
20-Oct-17	11:34 PM	outside construction zone	7.64	**10.17**	26682	13.5	
20-Oct-17	1:45 AM	inside construction zone	8.12	10.02	28991	11.1	Drilling monitoring wells
20-Oct-17	1:50 AM	outside construction zone	8.04	10.01	28901	**14.50**	Excavating cobble matt in west section
20-Oct-17	5:50 AM	inside construction zone	7.98	**10.23**	27198	10.0	
20-Oct-17	5:56 AM	outside construction zone	7.96	**10.20**	27202	15.1	

Notes

[1] BC Ministry of Environment (MoE) 2015. Approved Water Quality Guidelines http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines

[2] Samples were collected from seawater outside of the construction zone to determine background turbidity and temperature.

[3] The natural temperature cycle characteristic of the site should not be altered in amplitude or frequency by human activities.

[4] Seawater samples were collected at the start, mid-way and at the end of each work period or when there was evidence of a direct or indirect release or deposit of sediment or sediment laden water into the aquatic environment.

[5] The construction zone is defined as areas that may potential direct or indirect release or deposit of sediment or sediment laden water into the aquatic environment. For the project, it is set at 50 feet from any ground disturbance activities.

NC = not collected

NG = no guideline

NR = not recorded

NTU = nephelometric turbidity units

µS/cm - microsiemens per centimetre

Concentration exceeds guideline

Work was not completed at the site on the following days: July 31, August 5, 6, 7, 14, 15, 23, 26, 28, 29, September 2, 4, 8, 11, 12, 13, 20, 23, October 3, 6, 7, 9, 16, 17, 18, 19, and 21, 2017.

Data screened against average ambient temperature readings and average background turbidity readings collected outside the construction zone on a weekly basis as follows:

July 10-15 ambient temperature = 18.49; background turbidity =17.45

July 17-22 ambient temperature = 16.73; background turbidity = 31.19

July 24-28 ambient temperature = 15.72; background turbidity = 44.47

July 24-28 ambient temperature = 16.9; August 8-12 background turbidity = 30

August 16-19 ambient temperature = 15.91; background turbidity = 49

August 21-25 ambient temperature = 15.10; background turbidity = 39

August 30 - September 1 ambient temperature = 15.59; background turbidity = 29.2

October 2-5 ambient temperature = 12.37; background turbidity = 18.64

October 10-14 ambient temperature = 11.43; background turbidity = 19.59

October 20 ambient temperature = 14.37; background turbidity = 10.13

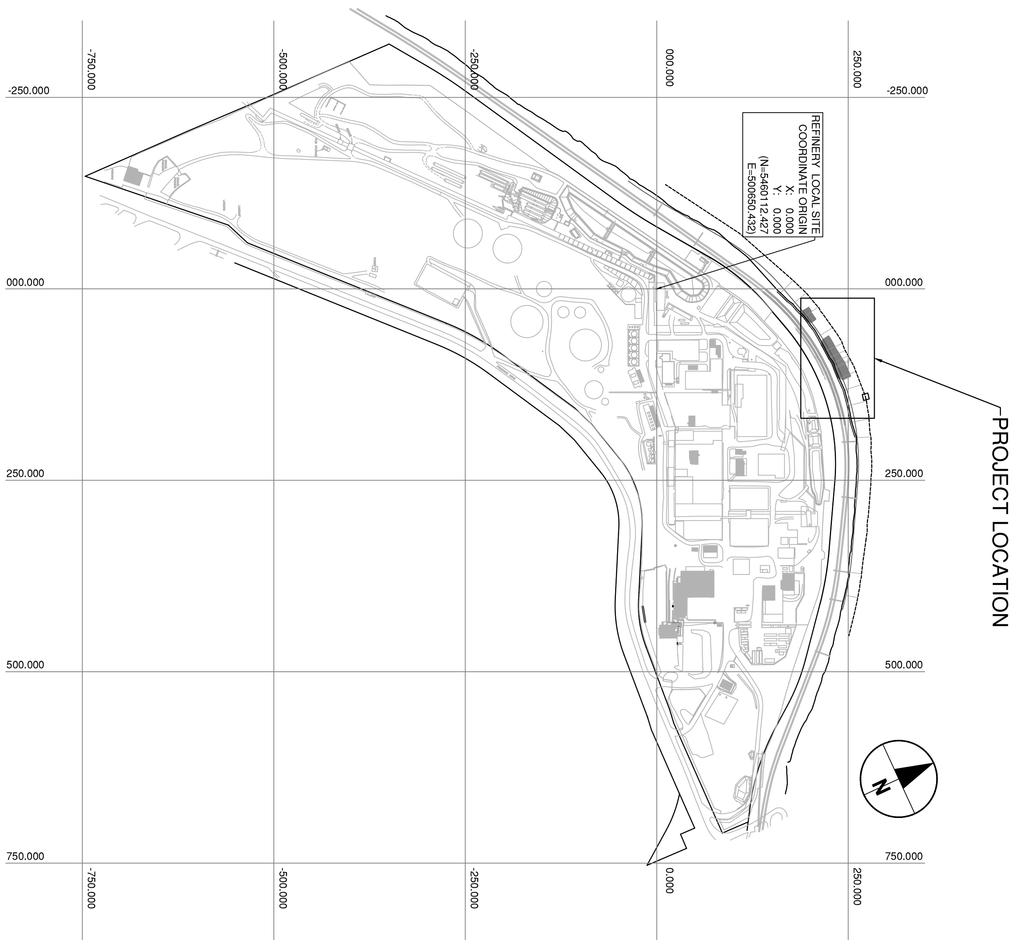
September 4-9 ambient temperature = 15.2; background turbidity = 16.2

September 14-16 ambient temperature = 13.7; background turbidity = 40.5

September 18-23 ambient temperature = 12.97; background turbidity = 22.9

Appendix G - Record Drawings

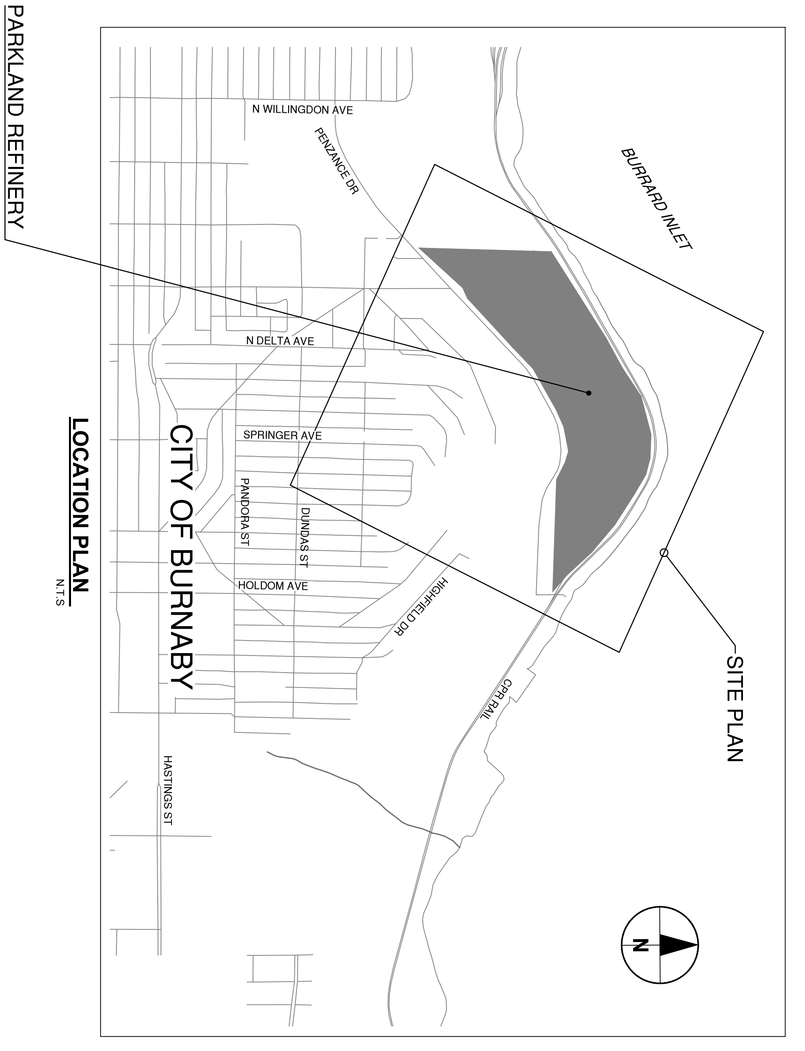
Last saved by: CASTLE-JANSCHP(2017-12-21) Last Plotted: 2017-12-22
Filename: H:\URS-CHEVRON\60542455.FINAL REMEDY INSTALLATION\5. DELIVERABLES\REMEDIATION REPORT\APPENDIX G - AS BUILT DRAWINGS\CAD_FILES\RECORD_PARKLANDFORESHORE_IFR_20171220_PCJ\RECORD_PARKLANDFORESHORE_C-000.DWG
Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm



PROJECT LOCATION

PARKLAND BURNABY REFINERY SITE PLAN

0 125 250 m
1:5000



LOCATION PLAN
N.T.S

DRAWING LIST

SHEET NUMBER	SHEET TITLE
C-000	COVER SHEET
C-101	SITE PLAN - SUBSURFACE & ABOVE GROUND COMPONENTS
C-102	SITE PLAN - BURIED GEOTEXTILE LAYOUT
C-103	SITE GRADING SECTIONS
C-301	TYPICAL SECTION
C-401	TYPICAL DETAILS
C-402	TYPICAL DETAILS

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING AREA

PARKLAND BURNABY REFINERY

Parkland REFINING (B.C.) LTD.

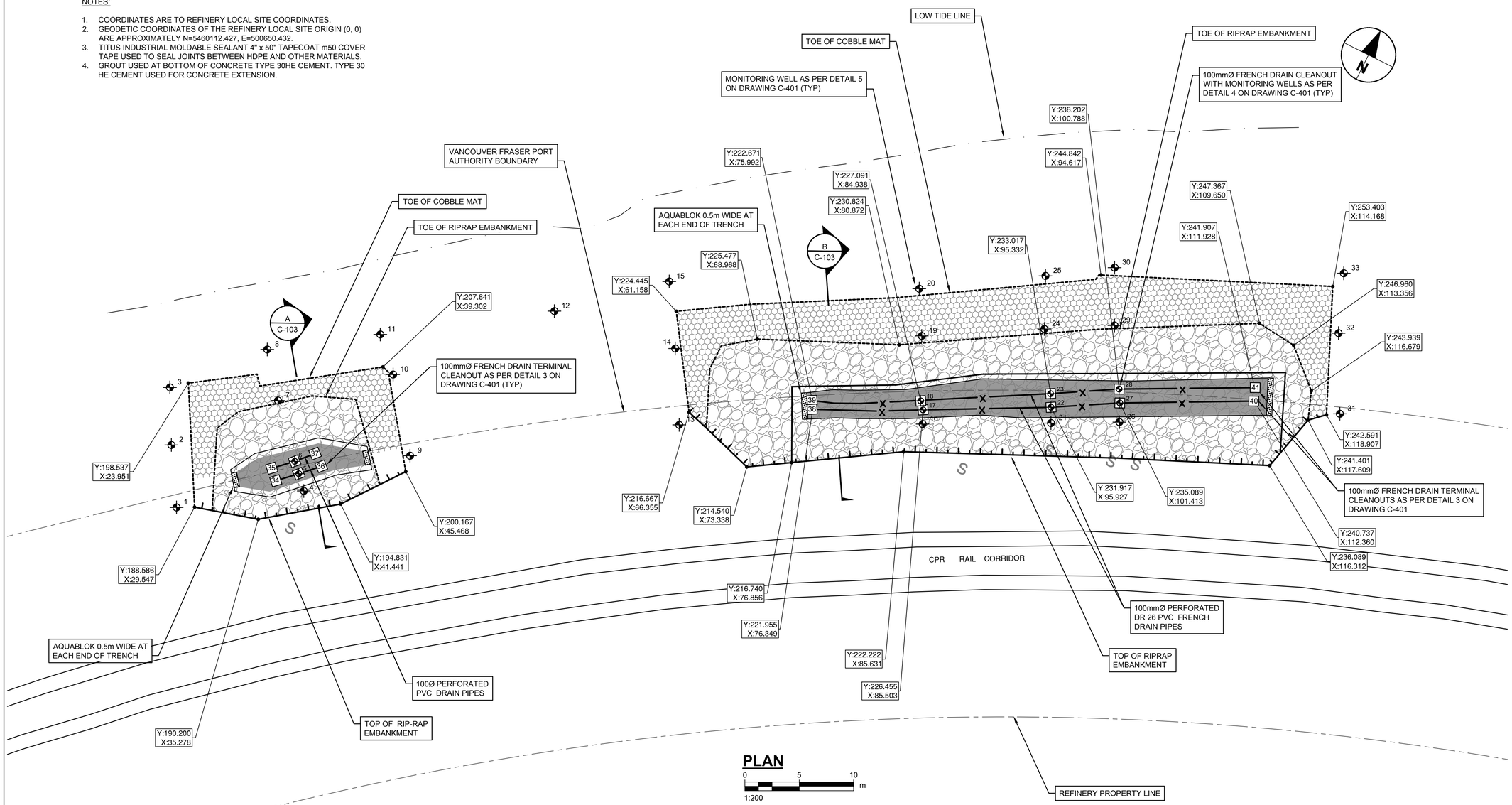
AECOM

ISSUED FOR RECORD - DEC 19, 2017

60542455

NOTES:

1. COORDINATES ARE TO REFINERY LOCAL SITE COORDINATES.
2. GEODETIC COORDINATES OF THE REFINERY LOCAL SITE ORIGIN (0, 0) ARE APPROXIMATELY N=5460112.427, E=500650.432.
3. TITUS INDUSTRIAL MOLDABLE SEALANT 4" x 50" TAPECOAT m50 COVER TAPE USED TO SEAL JOINTS BETWEEN HDPE AND OTHER MATERIALS.
4. GROUT USED AT BOTTOM OF CONCRETE TYPE 30HE CEMENT. TYPE 30 HE CEMENT USED FOR CONCRETE EXTENSION.



PLAN

0 5 10 m

1:200

PROTECTORS, WELLS & CLEANOUTS		
ID NUMBER	CONTENTS (REFER TO DETAILS ON SHEET C-401 & C-402)	PROTECTOR (REFER TO DETAIL ON SHEET C-402)
1	6	A
2	6	A
3	6	A
4	5	D
5	4	C
6	4	B
7	7	A
8	6	A
9	6	A
10	6	A
11	6	A
12	6	A
13	6	A
14	6	A
15	6	A
16	5	E
17	4	E
18	4	F
19	7	A
20	6	A
21	5	E

PROTECTORS, WELLS & CLEANOUTS		
ID NUMBER	CONTENTS (REFER TO DETAILS ON SHEET C-401 & C-402)	PROTECTOR (REFER TO DETAIL ON SHEET C-402)
22	4	E
23	4	F
24	7	A
25	5	A
26	5	E
27	4	E
28	4	F
29	7	A
30	6	A
31	6	A
32	6	A
33	6	A
34	3	C
35	3	F
36	3	F
37	3	F
38	3	E
39	3	F
40	3	E
41	3	F

LEGEND

RIPRAP

COBBLE MAT

TRENCH

41 100mmØ FRENCH DRAIN TERMINAL CLEANOUT AS PER DETAIL 3 ON SHEET C-401

28 MONITORING WELL WITH 100mmØ FRENCH DRAIN CLEANOUT AS PER DETAIL 4 ON SHEET C-401

2 MONITORING WELL AS PER DETAIL 5 ON SHEET C-401

S LOCATION OF SEEPS OBSERVED IN 2010

PROJECT

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING BASIN
PARKLAND BURNABY REFINERY

CLIENT

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CONSULTANT

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
3	DEC.20.2017	ISSUED FOR RECORD
2	JUL.26.2017	REVISED ISSUED FOR CONSTRUCTION
1	MAY.16.17	ISSUED FOR CONSTRUCTION

KEY PLAN

PROJECT NUMBER

60542455

SHEET TITLE

SITE PLAN - SUBSURFACE & ABOVE GROUND COMPONENTS

SHEET NUMBER

C-101

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm
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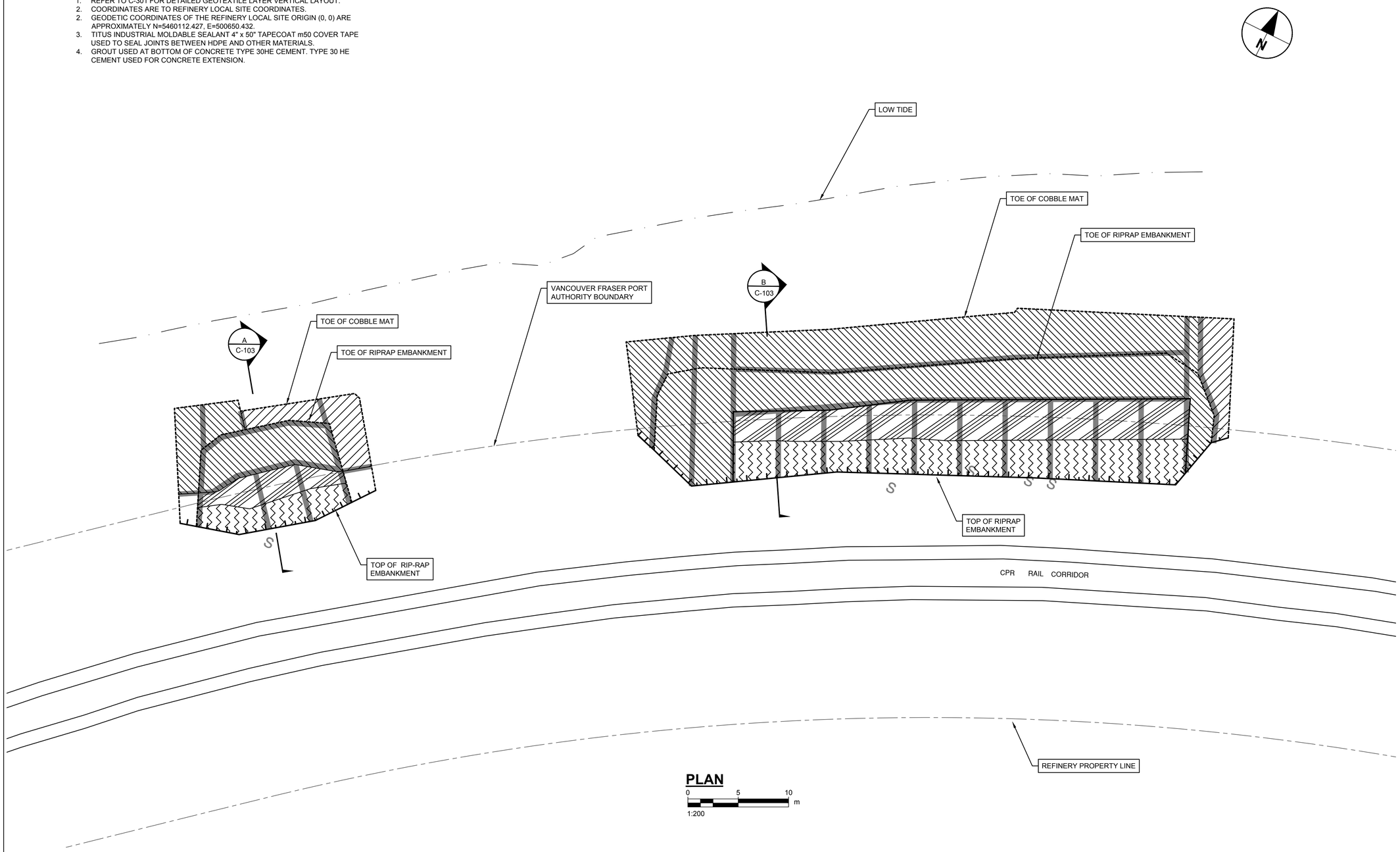
Filename: T:\PROJECT FROM OTHER OFFICES - DO NOT DELETE\60347433.39549154.CCL FORESHORE FINAL REMEDY\3. WORKING FILES\2016 CONTRACT DESIGN\900-CAD, GIS\910-CAD\20-SHEETS\C\RECORD_PARKLANDFORESHORE_C-101.DWG
Printed on ___% Post-Consumer Recycled Content Paper

NOTES:

1. REFER TO C-301 FOR DETAILED GEOTEXTILE LAYER VERTICAL LAYOUT.
2. COORDINATES ARE TO REFINERY LOCAL SITE COORDINATES.
2. GEODETIC COORDINATES OF THE REFINERY LOCAL SITE ORIGIN (0, 0) ARE APPROXIMATELY N=5460112.427, E=500650.432.
3. TITUS INDUSTRIAL MOLDABLE SEALANT 4" x 50" TAPECOAT m50 COVER TAPE USED TO SEAL JOINTS BETWEEN HDPE AND OTHER MATERIALS.
4. GROUT USED AT BOTTOM OF CONCRETE TYPE 30HE CEMENT. TYPE 30 HE CEMENT USED FOR CONCRETE EXTENSION.



PLAN

0 5 10 m

1:200

LEGEND

- NILEX 4510 GEOTEXTILE, GSE HDPE GEOMEMBRANE, NILEX Bx1100 GEOGRID, TENDRAIN II (OBB)
- NILEX 4510 GEOTEXTILE, GSE HDPE GEOMEMBRANE
- NILEX 4510 GEOTEXTILE, NILEX Bx1100 GEOGRID, TENDRAIN II (OBB)
- NILEX 4510 GEOTEXTILE, NILEX Bx1100 GEOGRID, SKAP TRANSNET (OBB)
- 500mm OVERLAP OF GEOTEXTILE MATERIALS
- RIPRAP/ COBBLE BOUNDARY

PROJECT

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING BASIN
PARKLAND BURNABY REFINERY

CLIENT

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1	MAY.16.17	ISSUED FOR CONSTRUCTION
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60542455

SHEET TITLE

SITE PLAN -
BURIED GEOTEXTILE LAYOUT

SHEET NUMBER

C-102

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm
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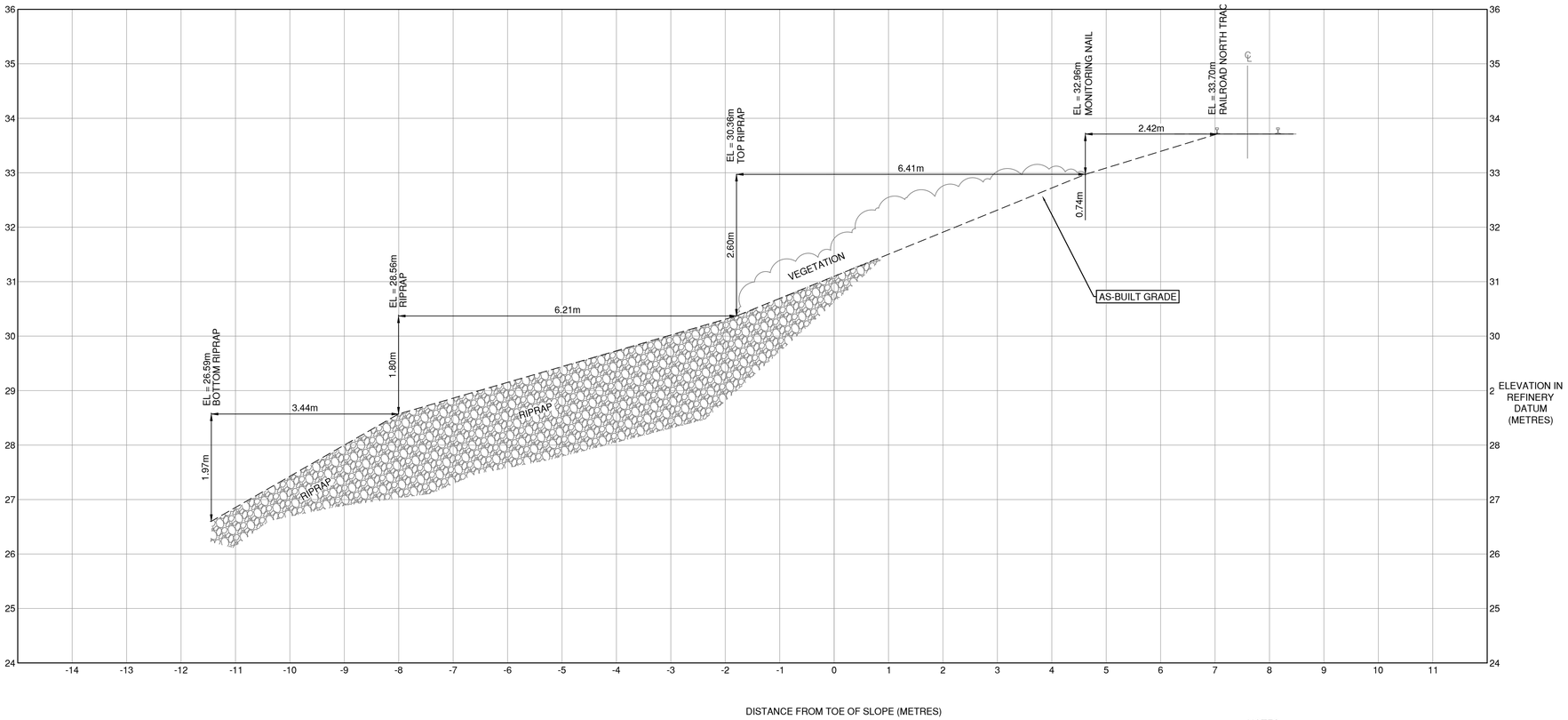
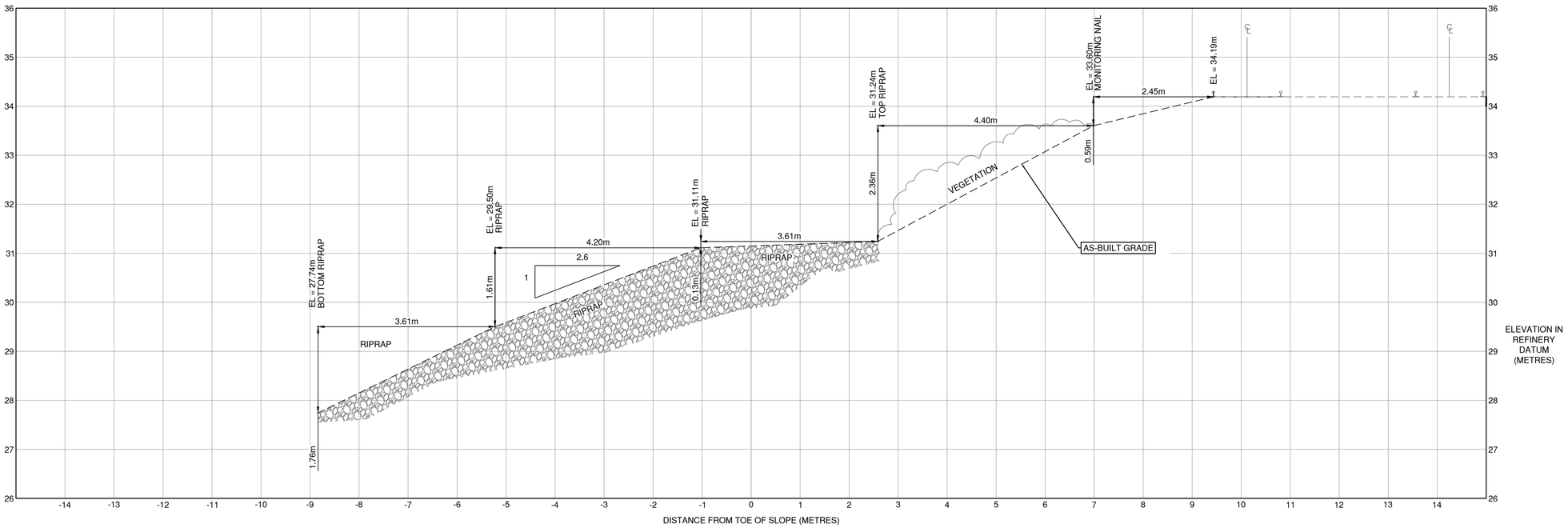


A | SECTION: WEST IRA

C-101

NOTES:

1. SEE C-101 FOR CROSS-SECTION LOCATIONS, AND C-301 FOR CONSTRUCTION DETAILS.
2. ELEVATIONS ARE TO REFINERY SITE LOCAL DATUM. MEAN SEA LEVEL IS 27.9 METRES BELOW THE REFINERY DATUM.



B | SECTION: EAST IRA

C-101

0 1.25 2.5 m

1:50

PROJECT

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING BASIN
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1	MAY.16.17	ISSUED FOR CONSTRUCTION

KEY PLAN

PROJECT NUMBER

60542455

SHEET TITLE

SITE GRADING SECTIONS

SHEET NUMBER

C-103

Last saved by: WITCHARDM(2017-12-21) Last Plotted: 2017-12-22
Filename: H:\URS-CHEVRON\60542455.FINAL REMEDY INSTALLATION\5. DELIVERABLES\REMEDIATION REPORT\APPENDIX G - AS BUILT DRAWINGS\CAD_FILES\RECORD_PARKLANDFORESHORE_C-103.DWG
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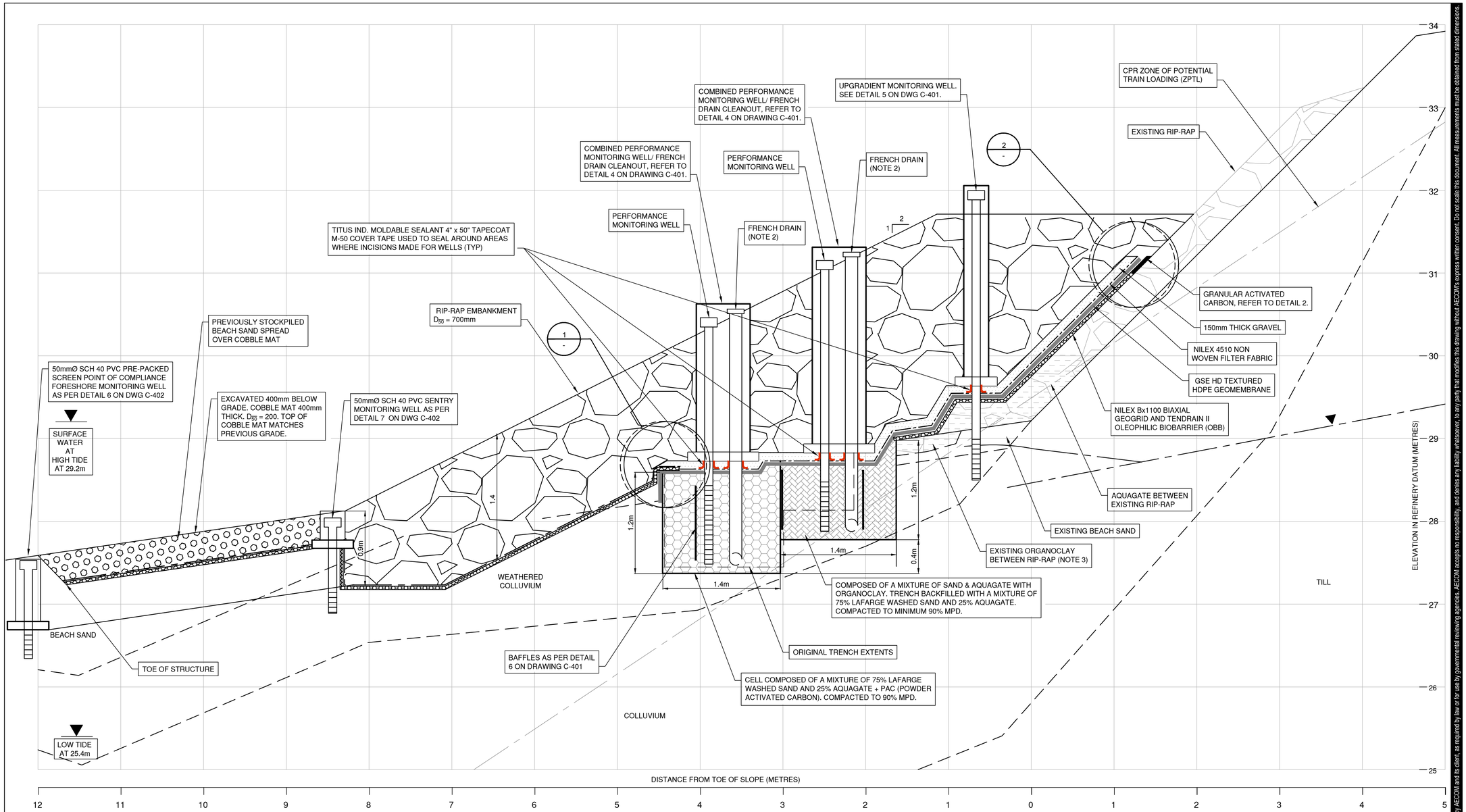
Printed on ___% Post-Consumer Recycled Content Paper

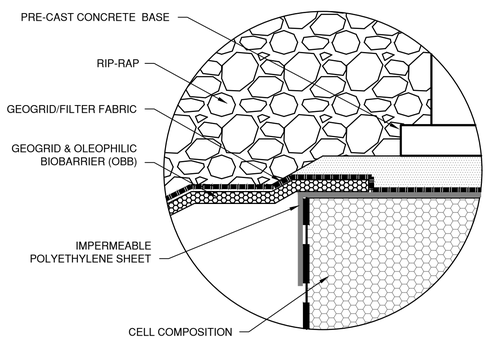


A | SECTION

C-002

0 0.625 1.25 m

1:25



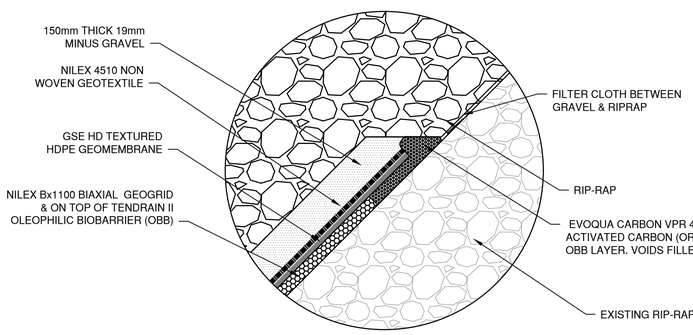
DETAIL 1

0 0.25 0.50 m

1:10

NOTES:

1. ELEVATIONS ARE TO REFINERY SITE LOCAL DATUM. MEAN SEA LEVEL IS 27.9 METRES BELOW THE REFINERY DATUM.
2. FRENCH DRAIN SYSTEM WITH VERTICAL RISERS AND SLOTTED HORIZONTAL PIPES, TO BE USED FOR POTENTIAL EXTRACTION OF DISSOLVED PHASE/NAPL AND/OR ENHANCED BIOREMEDIATION ADDITION.
3. EXISTING RIP-RAP NEAR TOE OF THE EXISTING CPR SLOPE WAS MOVED FOR SLOPE STABILITY AND WAS ENCASED WITH AQUAGATE-ORGANOCLAY.
4. FIVE COMPLIANCE WELLS ((PW17-8, PW17-11, PW17-15, PW17-20, AND PW17-30) WERE INSTALLED USING STAINLESS STEEL WRAPPED SCREENS PREPACKED WITH 20/40 FILTER SAND, RATHER THAN THE STANDARD 2" SCH 40 PVC - 10 SLOT SCREENS.



DETAIL 2

0 0.25 0.50 m

1:10

PROJECT

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING BASIN
PARKLAND BURNABY REFINERY

CLIENT

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KEY PLAN

PROJECT NUMBER

60542455

SHEET TITLE

TYPICAL SECTION

SHEET NUMBER

C-301

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm
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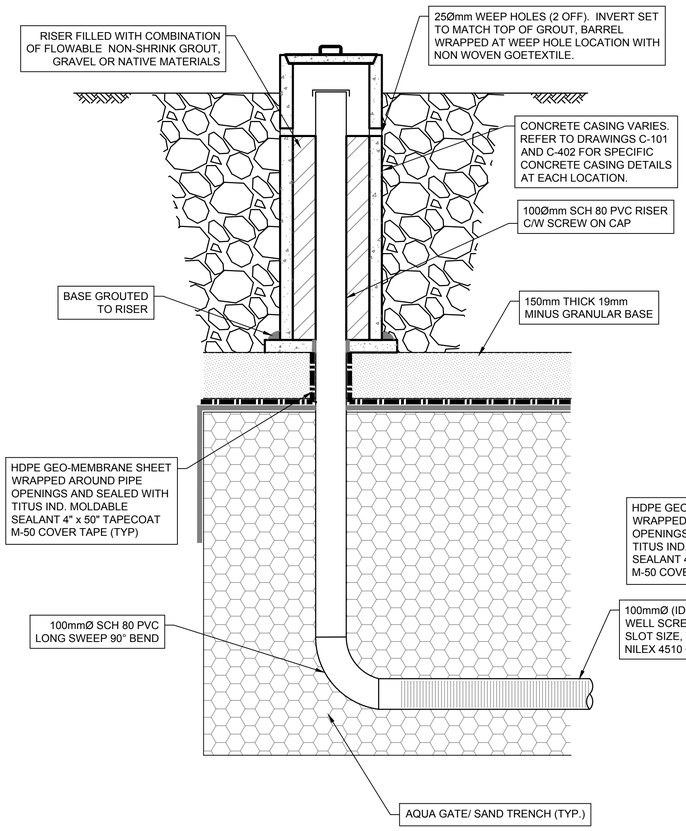
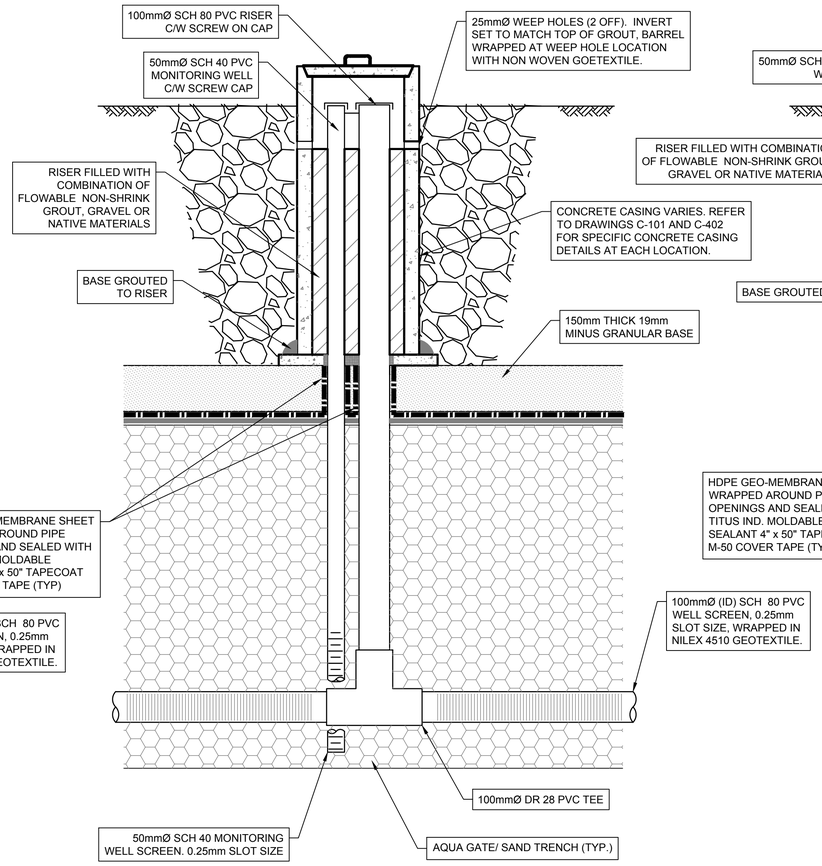


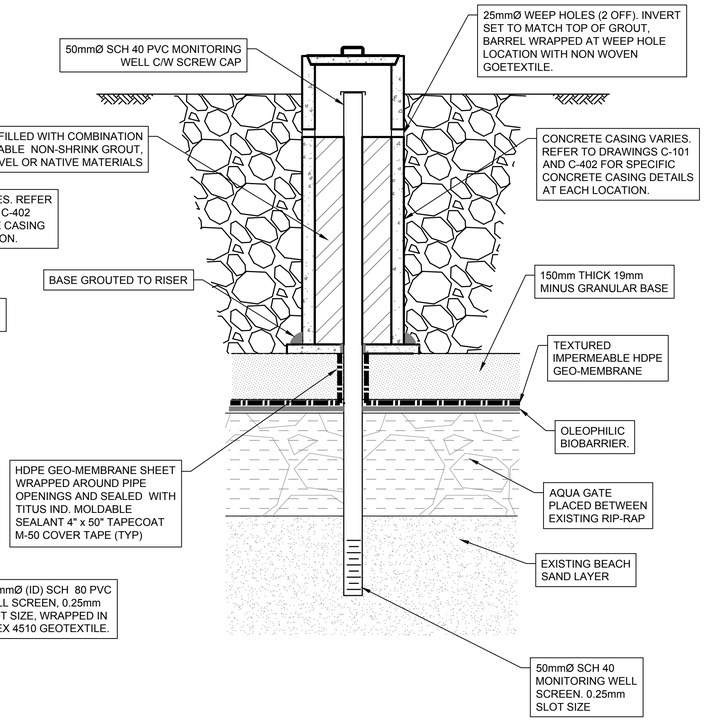
DETAIL 3 - FRENCH DRAIN TERMINAL CLEANOUT

0 0.25 0.50 m
1:10



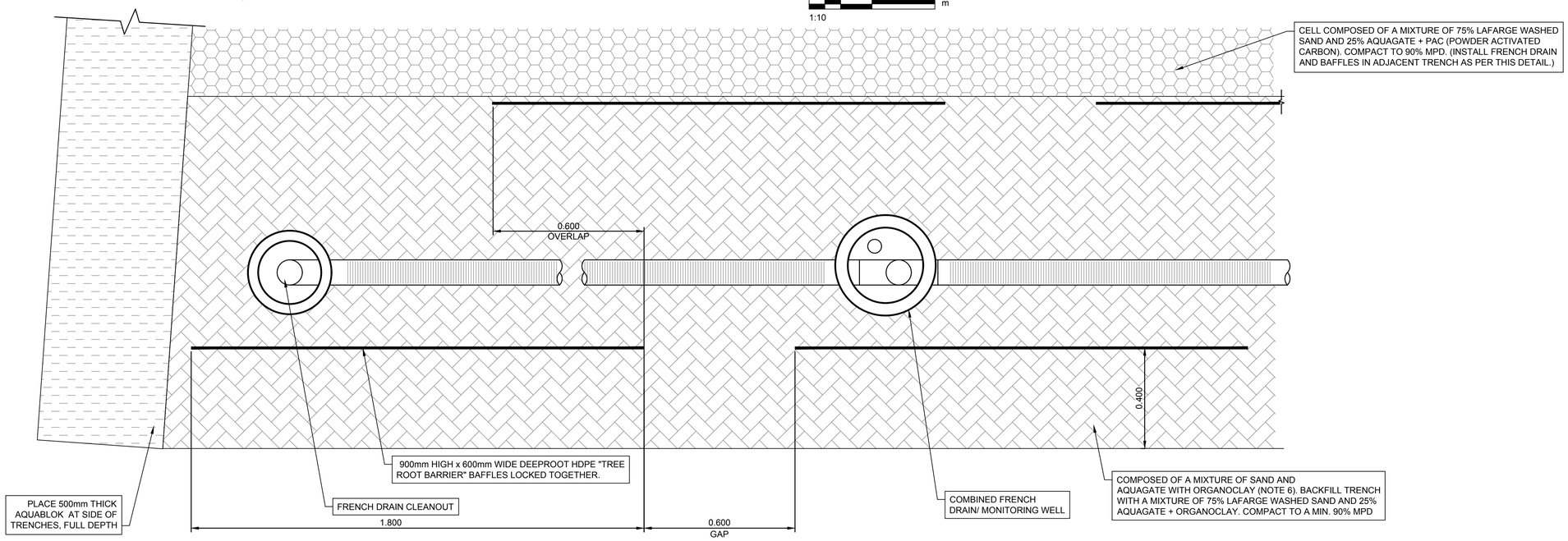
DETAIL 4 - COMBINED PERFORMANCE WELL / FRENCH DRAIN CLEANOUT

0 0.25 0.50 m
1:10



DETAIL 5 - UP-GRADIENT MONITORING WELL

0 0.25 0.50 m
1:10



DETAIL - TRENCH WITH BAFFLE WALL PLAN

0 0.25 0.50 m
1:10

PROJECT

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING BASIN
PARKLAND BURNABY REFINERY

CLIENT

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1	MAY.16.17	ISSUED FOR CONSTRUCTION
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

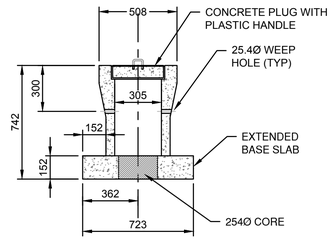
60542455

SHEET TITLE

TYPICAL DETAILS

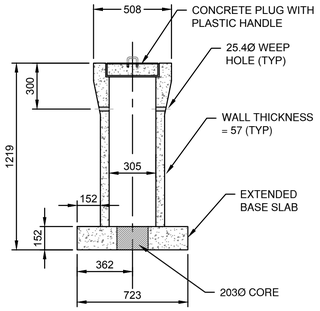
SHEET NUMBER

C-401



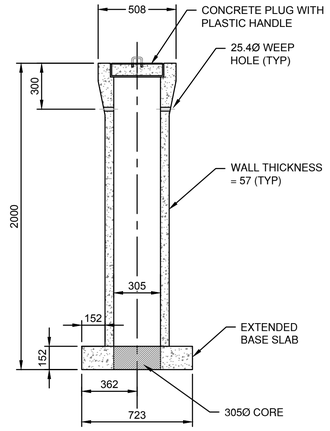
DETAIL A - CONCRETE PROTECTOR

0 0.5 1 m
1:20



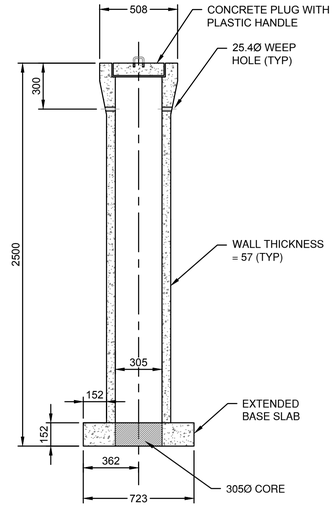
DETAIL B - CONCRETE PROTECTOR

0 0.5 1 m
1:20



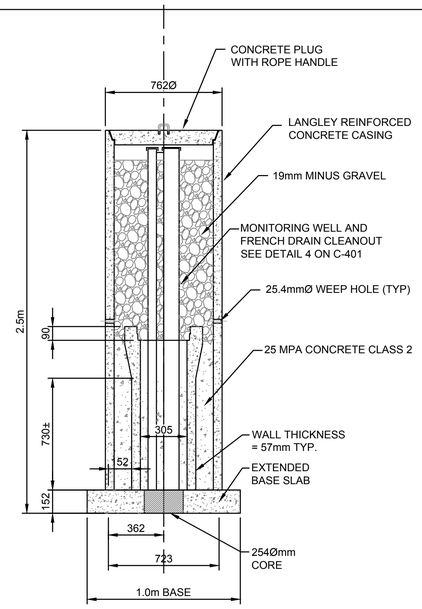
DETAIL C - CONCRETE PROTECTOR

0 0.5 1 m
1:20



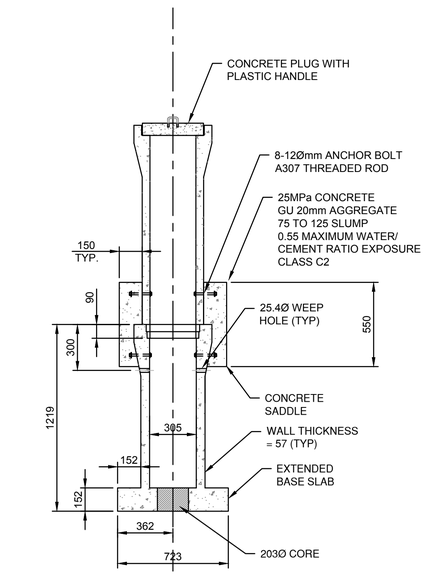
DETAIL D - CONCRETE PROTECTOR

0 0.5 1 m
1:20



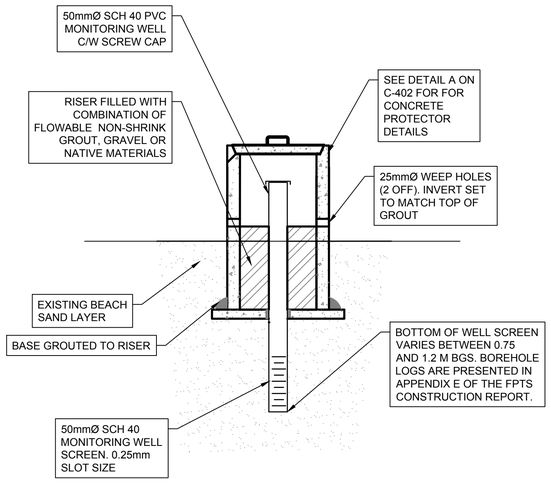
DETAIL E - MODIFIED CONCRETE PROTECTOR

0 0.5 1 m
1:20



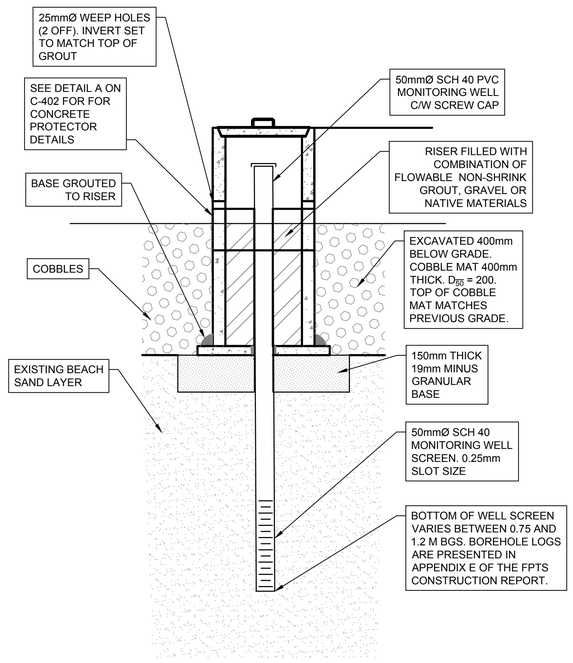
DETAIL F - MODIFIED CONCRETE PROTECTOR WITH SADDLE

0 0.5 1 m
1:20



DETAIL 6 - COMPLIANCE MONITORING WELL

0 0.25 0.50 m
1:10



DETAIL 7 - SENTRY MONITORING WELL

0 0.25 0.50 m
1:10

NOTE:
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

PROJECT

FORESHORE PASSIVE TREATMENT SYSTEM CONSTRUCTION REPORT BELOW AREA 2 EASTERN IMPOUNDING BASIN
PARKLAND BURNABY REFINERY

CLIENT

Parkland REFINING (B.C.) LTD.

CONSULTANT

AECOM
3292 Production Way
Burnaby, BC
1.604.444.6400 tel 1.604294.8597 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	DEC.20.2017	ISSUED FOR RECORD

KEY PLAN

PROJECT NUMBER

60542455

SHEET TITLE

TYPICAL DETAILS

SHEET NUMBER

C-402

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm
Last saved by: TIM.SMYTH (2017-12-22) Last Plotted: 2017-12-22
Filename: H:\URS-CHEVRON\60542455.FINAL REMEDY INSTALLATION\5. DELIVERABLES\REMEDIATION REPORT\APPENDIX G - AS BUILT DRAWINGS\CAD_FILES\RECORD_PARKLANDFORESHORE_C-402.DWG
Filename: H:\URS-CHEVRON\60542455.FINAL REMEDY INSTALLATION\5. DELIVERABLES\REMEDIATION REPORT\APPENDIX G - AS BUILT DRAWINGS\CAD_FILES\RECORD_PARKLANDFORESHORE_IFR_20171220_PCJ.RECORD_PARKLANDFORESHORE_C-402.DWG
Printed on ___% Post-Consumer Recycled Content Paper

Appendix H - Sediment and Groundwater Laboratory COAs

AECOM CANADA LTD.
ATTN: Leslie Southern
330 - 3292 Production Way
Burnaby BC V5A 4R4

Date Received: 04-JUL-17
Report Date: 10-AUG-17 18:03 (MT)
Version: FINAL

Client Phone: 604-444-6400

Certificate of Analysis

Lab Work Order #: L1952865

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 15-607729
Legal Site Desc:

Comments: Samples 4 to 9 were crushed to <2mm before metals analyses. All other analysis were performed on unaltered sample.

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1952865-1 GRAB 04-JUL-17 08:30 GS17-01	L1952865-2 GRAB 04-JUL-17 08:30 GS17-02	L1952865-3 GRAB 04-JUL-17 08:30 GS17-03	L1952865-4 GRAB 04-JUL-17 08:30 GS17-04	L1952865-5 GRAB 04-JUL-17 08:30 GS17-06
SOIL						
Physical Tests	Moisture (%)	4.33	4.36	5.38	5.30	7.33
	pH (1:2 soil:water) (pH)	7.42	7.52	7.51	7.99	8.05
Metals	Antimony (Sb) (mg/kg)	0.19	0.16	0.20	<0.10	<0.10
	Arsenic (As) (mg/kg)	3.80	2.89	6.41	5.75	5.27
	Barium (Ba) (mg/kg)	42.6	46.6	46.9	58.6	51.2
	Beryllium (Be) (mg/kg)	0.18	0.16	0.17	0.83	0.79
	Cadmium (Cd) (mg/kg)	0.111	0.089	0.109	0.159	0.145
	Chromium (Cr) (mg/kg)	22.8	22.6	31.7	2.42	2.35
	Cobalt (Co) (mg/kg)	6.61	6.04	6.72	1.02	0.77
	Copper (Cu) (mg/kg)	19.7	16.5	19.0	2.38	2.18
	Lead (Pb) (mg/kg)	1.88	1.60	1.86	22.7	20.0
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Molybdenum (Mo) (mg/kg)	0.31	0.26	0.26	2.13	1.95
	Nickel (Ni) (mg/kg)	25.2	22.4	27.5	3.22	2.93
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Uranium (U) (mg/kg)	0.205	0.175	0.182	6.95	6.54
	Vanadium (V) (mg/kg)	44.5	39.1	47.5	2.16	1.42
	Zinc (Zn) (mg/kg)	41.8	34.9	38.4	47.2	45.5
Volatile Organic Compounds	VOC Sample Container	Soil Jar	Soil Jar	Soil Jar	Soil Jar	Soil Jar
	Benzene (mg/kg)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	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
	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) (%)	76.6	69.0 SURR-ND	79.8	70.3	83.1
	Surrogate: 1,4-Difluorobenzene (SS) (%)	94.1	87.2	100.2	90.2	103.0
Hydrocarbons	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	<100	<100
	VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	79.6	74.1	73.8	85.9	55.3 SURR-ND

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1952865-6 GRAB 04-JUL-17 08:30 GS17-07	L1952865-7 GRAB 04-JUL-17 08:30 GS17-08	L1952865-8 GRAB 04-JUL-17 08:30 GS17-09	L1952865-9 GRAB 04-JUL-17 08:30 GS17-05	
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
SOIL						
Physical Tests	Moisture (%)	2.09	1.65	2.62	7.86	
	pH (1:2 soil:water) (pH)	9.53	9.46	9.51	8.04	
Metals	Antimony (Sb) (mg/kg)	0.24	0.23	0.23	<0.10	
	Arsenic (As) (mg/kg)	3.95	4.31	4.02	6.24	
	Barium (Ba) (mg/kg)	26.8	27.8	25.7	60.9	
	Beryllium (Be) (mg/kg)	0.50	0.57	0.53	0.92	
	Cadmium (Cd) (mg/kg)	0.084	0.106	0.090	0.194	
	Chromium (Cr) (mg/kg)	3.49	3.52	3.22	2.52	
	Cobalt (Co) (mg/kg)	0.63	0.65	0.62	0.95	
	Copper (Cu) (mg/kg)	6.99	7.56	7.03	2.91	
	Lead (Pb) (mg/kg)	15.1	15.4	14.0	24.2	
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Molybdenum (Mo) (mg/kg)	1.34	1.46	1.37	2.25	
	Nickel (Ni) (mg/kg)	2.26	2.35	2.19	3.49	
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	
	Uranium (U) (mg/kg)	4.61	4.74	4.58	7.83	
	Vanadium (V) (mg/kg)	2.13	2.20	2.12	1.77	
	Zinc (Zn) (mg/kg)	29.7	40.5	29.5	52.2	
Volatile Organic Compounds	VOC Sample Container	Soil Jar	Soil Jar	Soil Jar	Soil Jar	
	Benzene (mg/kg)	ABL 0.0076	ABL 0.0117	ABL 0.0151	<0.0050	
	Ethylbenzene (mg/kg)	ABL <0.015	ABL <0.015	ABL <0.015	<0.015	
	Methyl t-butyl ether (MTBE) (mg/kg)	ABL <0.20	ABL <0.20	ABL <0.20	<0.20	
	Styrene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Toluene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	ortho-Xylene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	meta- & para-Xylene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Xylenes (mg/kg)	<0.075	<0.075	<0.075	<0.075	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	LSRA 1.4	LSRA 1.3	LSRA 1.0	70.7	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	LSRA 2.7	LSRA 3.2	LSRA 3.1	92.9	
Hydrocarbons	Volatile Hydrocarbons (VH6-10) (mg/kg)	ABL <100	ABL <100	ABL <100	<100	
	VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	LSRA 2.4	LSRA 3.2	LSRA 1.8	SURR-ND 63.1	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1952865-1	L1952865-2	L1952865-3	L1952865-4	L1952865-5
Description	GRAB	GRAB	GRAB	GRAB	GRAB
Sampled Date	04-JUL-17	04-JUL-17	04-JUL-17	04-JUL-17	04-JUL-17
Sampled Time	08:30	08:30	08:30	08:30	08:30
Client ID	GS17-01	GS17-02	GS17-03	GS17-04	GS17-06
Grouping / **Analyte**					
SOIL					
Polycyclic Aromatic Hydrocarbons / Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.20 DLCI
Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Surrogate: Acenaphthene d10 (%)	90.6	87.9	96.9	96.3	102.6
Surrogate: Chrysene d12 (%)	94.0	94.1	101.6	Not Reportable SMI	126.2
Surrogate: Naphthalene d8 (%)	89.8	87.1	96.4	92.1	96.9
Surrogate: Phenanthrene d10 (%)	88.2	89.8	95.8	93.2	98.1

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1952865-6	L1952865-7	L1952865-8	L1952865-9	
	Description	GRAB	GRAB	GRAB	GRAB	
	Sampled Date	04-JUL-17	04-JUL-17	04-JUL-17	04-JUL-17	
	Sampled Time	08:30	08:30	08:30	08:30	
	Client ID	GS17-07	GS17-08	GS17-09	GS17-05	
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Acenaphthylene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Anthracene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Benz(a)anthracene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Benzo(a)pyrene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Benzo(b)fluoranthene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Benzo(g,h,i)perylene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Benzo(k)fluoranthene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Chrysene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Dibenz(a,h)anthracene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Fluoranthene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Fluorene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Indeno(1,2,3-c,d)pyrene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	2-Methylnaphthalene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Naphthalene (mg/kg)	ABL <0.050	ABL <0.050	ABL 0.065	<0.050	
	Phenanthrene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Pyrene (mg/kg)	ABL <0.050	ABL <0.050	ABL <0.050	<0.050	
	Surrogate: Acenaphthene d10 (%)	LSRA 6.1	LSRA 8.0	LSRA 8.1	96.8	
	Surrogate: Chrysene d12 (%)	LSRA 0.20	LSRA 0.10	LSRA 0.20	115.7	
	Surrogate: Naphthalene d8 (%)	LSRA 15.5	LSRA 21.5	LSRA 23.2	92.9	
	Surrogate: Phenanthrene d10 (%)	LSRA 0.30	LSRA 0.20	LSRA 0.30	89.8	

* 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)

Qualifiers for Individual Parameters Listed:

Qualifier	Description
ABL	Approximate Result: May Be Biased Low
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
LSRA	Low surrogate recovery observed due to adsorptive material in sample (e.g. charcoal). Associated results represent solvent extractable concentrations.
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**
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

** 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:

15-607729

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
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1952865-COFC

COC Number: 15 - 607729

Page of

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	LESLIE SOUTHERN
Phone:	604-444-6608
	Company address below will appear on the final report
Street:	SAME
City/Province:	
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	leslie.southern@aecom.com
Email 2	
Email 3	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] [ ] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [ ]

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To [X] YES [ ] NO
	Copy of Invoice with Report [ ] YES [ ] NO
Company:	AECOM
Contact:	

Invoice Distribution	
Select Invoice Distribution:	[ ] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler: MARK H.

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	HOLD	Number of Containers
	6517-01	04-07-17	8:30	GRAB	X	1
	-02					1
	-03					1
	-04					1
	-06					1
	-07					1
	-08					1
	-09					1
						1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [ ] NO

Are samples for human drinking water use? [ ] YES [ ] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

WAIT FOR INSTRUCTION FROM LESLIE SOUTHERN

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2.5		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Mark Hocking	04-07-2017						July 4	17:55

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 12-JUL-17
Report Date: 24-JUL-17 19:12 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1957480

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-608377
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1957480-1	L1957480-2			
	Description	SOIL	SOIL			
	Sampled Date	12-JUL-17	12-JUL-17			
	Sampled Time	12:15	12:00			
	Client ID	BF-SG-01	BF-SG-02			
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	1.83	2.32			
	pH (1:2 soil:water) (pH)	8.82	8.78			
Metals	Antimony (Sb) (mg/kg)	<0.10	<0.10			
	Arsenic (As) (mg/kg)	2.30	2.03			
	Barium (Ba) (mg/kg)	52.8	52.7			
	Beryllium (Be) (mg/kg)	0.29	0.32			
	Cadmium (Cd) (mg/kg)	<0.050	<0.050			
	Chromium (Cr) (mg/kg)	5.05	3.31			
	Cobalt (Co) (mg/kg)	4.14	3.75			
	Copper (Cu) (mg/kg)	41.2	4.46			
	Lead (Pb) (mg/kg)	5.57	1.13			
	Mercury (Hg) (mg/kg)	<0.050	<0.050			
	Molybdenum (Mo) (mg/kg)	0.67	1.08			
	Nickel (Ni) (mg/kg)	3.07	1.28			
	Selenium (Se) (mg/kg)	<0.20	<0.20			
	Silver (Ag) (mg/kg)	<0.10	<0.10			
	Thallium (Tl) (mg/kg)	<0.050	<0.050			
	Tin (Sn) (mg/kg)	<2.0	<2.0			
	Uranium (U) (mg/kg)	0.265	0.273			
	Vanadium (V) (mg/kg)	20.4	17.4			
	Zinc (Zn) (mg/kg)	40.5	36.8			
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH			
	Benzene (mg/kg)	<0.0050	<0.0050			
	Ethylbenzene (mg/kg)	<0.015	<0.015			
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20			
	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) (%)	92.1	102.0			
	Surrogate: 1,4-Difluorobenzene (SS) (%)	91.1	99.4			
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			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1957480-1	L1957480-2			
	Description	SOIL	SOIL			
	Sampled Date	12-JUL-17	12-JUL-17			
	Sampled Time	12:15	12:00			
	Client ID	BF-SG-01	BF-SG-02			
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100			
	Surrogate: 2-Bromobenzotrifluoride (%)	84.1	87.7			
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	97.8	114.7			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050			
	Acenaphthylene (mg/kg)	<0.050	<0.050			
	Anthracene (mg/kg)	<0.050	<0.050			
	Benz(a)anthracene (mg/kg)	<0.050	<0.050			
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050			
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050			
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050			
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050			
	Chrysene (mg/kg)	<0.050	<0.050			
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050			
	Fluoranthene (mg/kg)	<0.050	<0.050			
	Fluorene (mg/kg)	<0.050	<0.050			
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050			
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050			
	Naphthalene (mg/kg)	<0.050	<0.050			
	Phenanthrene (mg/kg)	<0.050	<0.050			
	Pyrene (mg/kg)	<0.050	<0.050			
	Surrogate: Acenaphthene d10 (%)	80.4	86.5			
	Surrogate: Chrysene d12 (%)	74.3	94.5			
	Surrogate: Naphthalene d8 (%)	75.0	82.1			
	Surrogate: Phenanthrene d10 (%)	87.5	88.1			

* 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	Copper (Cu)	DUP-H	L1957480-2
Duplicate	Molybdenum (Mo)	DUP-H	L1957480-2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

Reference Information

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-608377

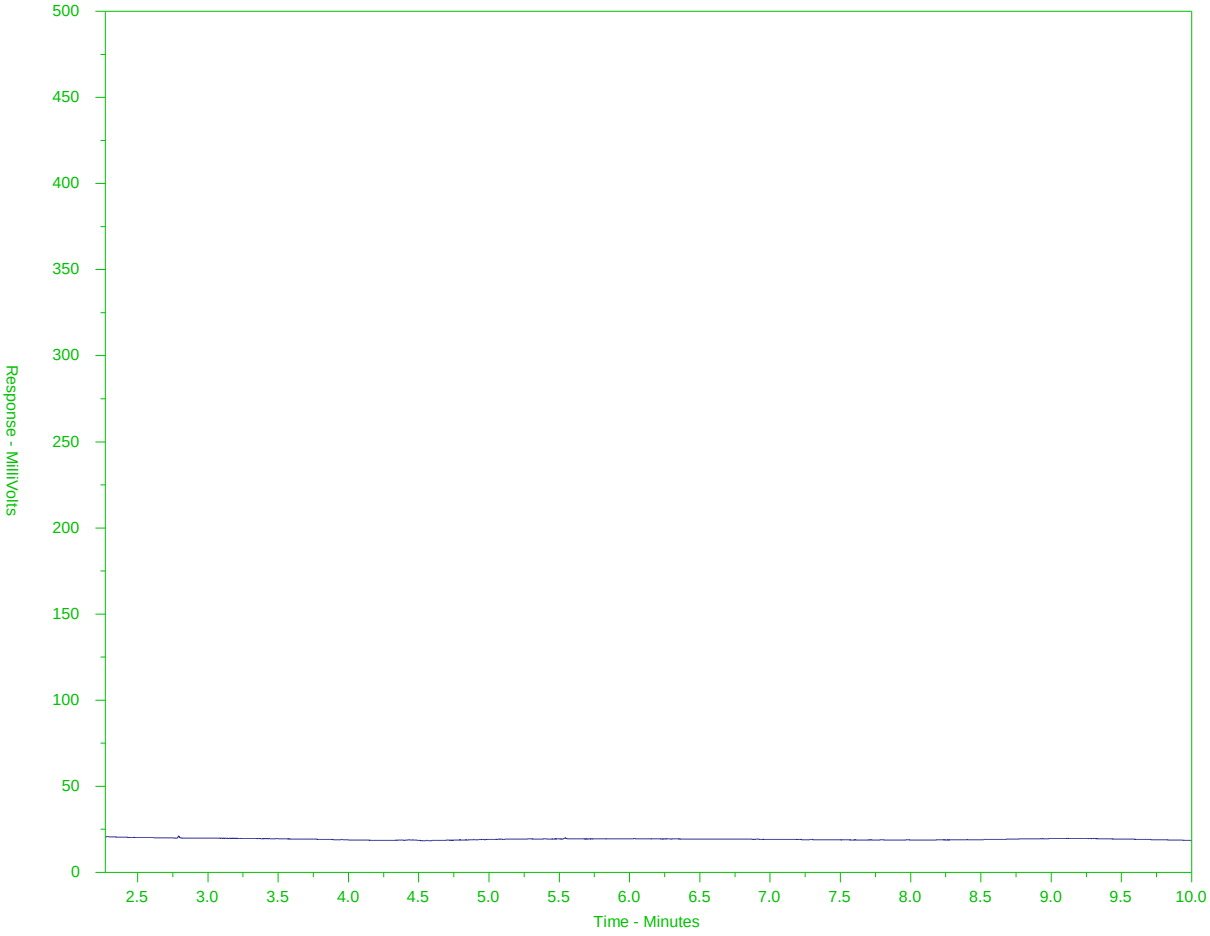
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1957480-1
Client Sample ID: BF-SG-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.

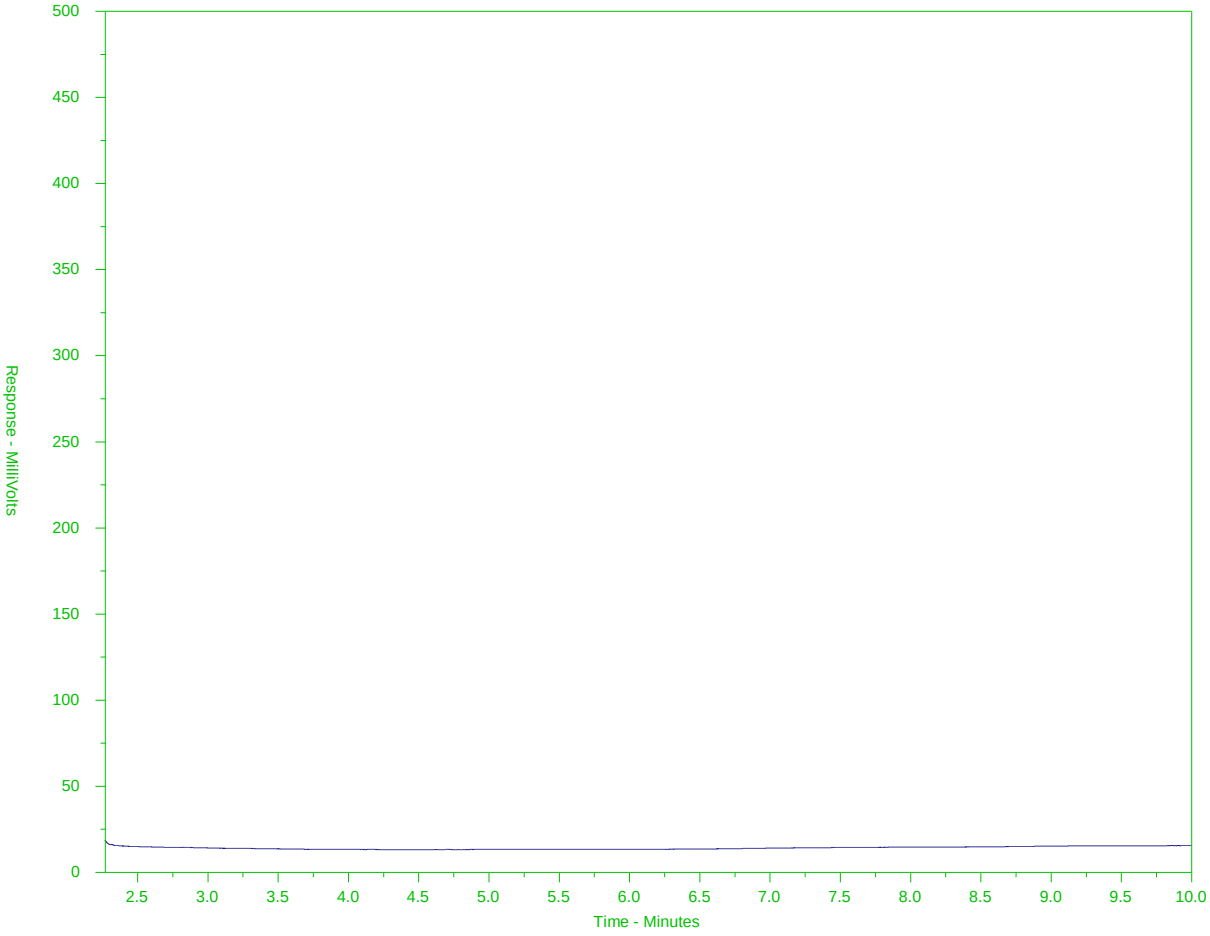
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1957480-2
Client Sample ID: BF-SG-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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1957480-COFC

COC Number: 15 - 608377

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	AECOM	Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] 24 hr ☒ / Same Day, Weekend or Statutory holiday [E0] N/A
Phone:	604 444 6400	☒ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Street:	3292 Production Way	Email 1 or Fax michael.gill@aecom.com	Date and Time Required for all E&P TATs:
City/Province:	Burnaby B.C.	Email 2 leslie.southern@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:		Email 3	

Invoice To		Invoice Distribution	Analysis Request
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☒ YES	Email Same as above	
Company:	Chevron Canada Ltd.	Email 2	
Contact:	Chris Boys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: EAP

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	BF-SG-01	12-Jul-17	12:15	Soil		X	X	X	4
	BF-SG-02	12-Jul-17	12:00	Soil		X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐		
Ice Packs	☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☒	
Cooling Initiated	☐					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			24		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JC	Date: 7/12/17	Time: 14:27

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 13-JUL-17
Report Date: 01-AUG-17 17:11 (MT)
Version: FINAL REV. 2

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1958382

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	15-608375, 15-608376
Legal Site Desc:	Foreshore

Comments: 1-AUG-2017 EPH SG results have been added to samples 6 & 7.

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1958382-1	L1958382-2	L1958382-3	L1958382-4	L1958382-5
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-JUL-17	13-JUL-17	13-JUL-17	13-JUL-17	13-JUL-17
	Sampled Time	12:50	13:09	12:00	13:49	13:35
	Client ID	BF-SG2-1	BF-SG2-2	WIRA-1	WIRA-2	WSA-1
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	3.79	3.33	25.3	20.6	26.1
	pH (1:2 soil:water) (pH)	8.50	8.75	8.43	8.65	7.46
Metals	Antimony (Sb) (mg/kg)	0.57	0.34	0.16	0.21	0.25
	Arsenic (As) (mg/kg)	3.83	3.23	2.79	4.62	2.81
	Barium (Ba) (mg/kg)	79.2	44.9	38.9	39.8	26.2
	Beryllium (Be) (mg/kg)	0.20	0.19	0.33	0.31	0.26
	Cadmium (Cd) (mg/kg)	0.162	0.075	0.057	0.097	0.096
	Chromium (Cr) (mg/kg)	20.3	23.2	9.10	10.7	14.9
	Cobalt (Co) (mg/kg)	6.97	5.87	5.31	6.79	5.64
	Copper (Cu) (mg/kg)	21.7	13.2	15.7	16.6	20.7
	Lead (Pb) (mg/kg)	6.68	1.91	20.2	15.1	5.96
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Molybdenum (Mo) (mg/kg)	1.19	0.93	0.59	0.40	1.29
	Nickel (Ni) (mg/kg)	21.2	17.9	6.99	8.58	8.26
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Uranium (U) (mg/kg)	0.326	0.264	1.38	1.04	4.12
	Vanadium (V) (mg/kg)	43.1	40.7	36.1	46.8	59.5
	Zinc (Zn) (mg/kg)	62.6	37.4	52.9	59.3	43.4
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
	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
	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) (%)	86.6	85.5	74.2	80.7	97.7
	Surrogate: 1,4-Difluorobenzene (SS) (%)	101.0	99.4	89.6	89.8	87.2
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	220	<200	390
	EPH10-19 (sg) (mg/kg)					
	EPH19-32 (mg/kg)	<200	<200	930	680	<200
	EPH19-32 (sg) (mg/kg)					
	LEPH (mg/kg)	<200	<200	220	<200	390

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1958382-6	L1958382-7	L1958382-8	L1958382-9	L1958382-10
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	13-JUL-17	13-JUL-17	13-JUL-17	13-JUL-17	13-JUL-17
Sampled Time	13:46	13:58	14:05	14:10	14:18
Client ID	WSA-2	WSA-3	WSA-4	WSA-5	WSA-6
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	25.9	21.0	23.0	24.2	19.7
pH (1:2 soil:water) (pH)	7.23	6.96	7.14	7.49	8.48
Metals Antimony (Sb) (mg/kg)	0.28	0.28	0.20	0.21	0.21
Arsenic (As) (mg/kg)	2.53	3.01	5.02	3.83	3.09
Barium (Ba) (mg/kg)	28.7	24.8	31.9	38.6	21.9
Beryllium (Be) (mg/kg)	0.21	0.15	0.21	0.31	0.19
Cadmium (Cd) (mg/kg)	0.062	0.094	0.052	0.059	0.077
Chromium (Cr) (mg/kg)	13.6	13.8	13.8	10.8	11.2
Cobalt (Co) (mg/kg)	6.40	6.45	8.69	7.43	8.40
Copper (Cu) (mg/kg)	15.7	13.1	20.4	20.5	20.8
Lead (Pb) (mg/kg)	12.7	28.0	16.2	21.9	16.7
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo) (mg/kg)	1.22	1.79	1.56	1.38	0.90
Nickel (Ni) (mg/kg)	8.38	8.13	8.58	7.67	9.11
Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (Tl) (mg/kg)	0.060	<0.050	<0.050	<0.050	<0.050
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	19.7	<2.0
Uranium (U) (mg/kg)	3.73	3.80	3.47	2.92	0.363
Vanadium (V) (mg/kg)	54.1	56.3	60.2	41.9	50.8
Zinc (Zn) (mg/kg)	44.3	41.6	43.5	50.6	63.5
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
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
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) (%)	106.4	105.7	83.9	84.8	80.9
Surrogate: 1,4-Difluorobenzene (SS) (%)	91.6	88.4	85.4	93.2	88.6
Hydrocarbons EPH10-19 (mg/kg)	2250	1290	<200	<200	<200
EPH10-19 (sg) (mg/kg)	2770	1610			
EPH19-32 (mg/kg)	420	200	490	590	<200
EPH19-32 (sg) (mg/kg)	490	260			
LEPH (mg/kg)	2250	1290	<200	<200	<200

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1958382-11	L1958382-12	L1958382-13		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	13-JUL-17	13-JUL-17	13-JUL-17		
	Sampled Time	14:29	14:40	14:47		
	Client ID	WSA-7	WSA-8	WSA-9		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	24.1	18.4	19.1		
	pH (1:2 soil:water) (pH)	8.47	8.34	7.95		
Metals	Antimony (Sb) (mg/kg)	0.36	0.22	0.19		
	Arsenic (As) (mg/kg)	4.74	2.63	1.93		
	Barium (Ba) (mg/kg)	38.2	35.8	36.3		
	Beryllium (Be) (mg/kg)	0.24	0.24	0.24		
	Cadmium (Cd) (mg/kg)	0.188	<0.050	0.071		
	Chromium (Cr) (mg/kg)	15.9	15.3	19.3		
	Cobalt (Co) (mg/kg)	9.29	7.49	9.89		
	Copper (Cu) (mg/kg)	23.5	26.4	31.9		
	Lead (Pb) (mg/kg)	10.9	7.47	5.60		
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050		
	Molybdenum (Mo) (mg/kg)	1.89	0.39	0.25		
	Nickel (Ni) (mg/kg)	12.6	7.80	8.95		
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20		
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		
	Thallium (Tl) (mg/kg)	0.091	<0.050	0.061		
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
	Uranium (U) (mg/kg)	1.11	2.07	1.36		
	Vanadium (V) (mg/kg)	58.8	70.2	74.2		
	Zinc (Zn) (mg/kg)	55.9	53.0	55.9		
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH		
	Benzene (mg/kg)	<0.0050	<0.0050	<0.0050		
	Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015		
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20		
	Styrene (mg/kg)	<0.050	<0.050	<0.050		
	Toluene (mg/kg)	<0.050	<0.050	<0.050		
	ortho-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	meta- & para-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	Xylenes (mg/kg)	<0.075	<0.075	<0.075		
	Surrogate: 4-Bromofluorobenzene (SS) (%)	98.6	89.4	88.2		
	Surrogate: 1,4-Difluorobenzene (SS) (%)	90.1	88.5	95.6		
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200		
	EPH10-19 (sg) (mg/kg)					
	EPH19-32 (mg/kg)	<200	<200	<200		
	EPH19-32 (sg) (mg/kg)					
	LEPH (mg/kg)	<200	<200	<200		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1958382-1	L1958382-2	L1958382-3	L1958382-4	L1958382-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	13-JUL-17	13-JUL-17	13-JUL-17	13-JUL-17	13-JUL-17
Sampled Time	12:50	13:09	12:00	13:49	13:35
Client ID	BF-SG2-1	BF-SG2-2	WIRA-1	WIRA-2	WSA-1
Grouping / **Analyte**					
SOIL					
Hydrocarbons HEPH (mg/kg)	<200	<200	930	680	<200
Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	<100	130
VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	130
Surrogate: 2-Bromobenzotrifluoride (%)	99.0	101.3	107.3	98.8	107.0
Surrogate: 2-Bromobenzotrifluoride, EPH-sg (%)					
Surrogate: 3,4-Dichlorotoluene (SS) (%)	98.1	111.8	87.7	68.6 SURR-ND	196.6 SMI
Polycyclic Aromatic Hydrocarbons Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene (mg/kg)	<0.050	<0.050	0.067	<0.050	<0.050
Anthracene (mg/kg)	<0.050	<0.050	0.055	<0.050	<0.050
Benz(a)anthracene (mg/kg)	0.062	<0.050	0.313	<0.050	<0.050
Benzo(a)pyrene (mg/kg)	0.056	<0.050	0.346	<0.060 DLCI	<0.050
Benzo(b)fluoranthene (mg/kg)	0.073	<0.050	0.418	<0.050	<0.050
Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	0.215	<0.050	<0.050
Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	0.172	<0.050	<0.050
Chrysene (mg/kg)	0.074	<0.050	0.328	<0.050	<0.050
Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene (mg/kg)	0.099	<0.050	0.348	<0.050	<0.050
Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	0.212	<0.050	<0.050
2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene (mg/kg)	0.051	<0.050	0.085	<0.050	<0.050
Pyrene (mg/kg)	0.111	<0.050	0.333	<0.050	0.061
Surrogate: Acenaphthene d10 (%)	97.4	100.2	127.9	120.6	96.2
Surrogate: Chrysene d12 (%)	92.8	101.9	111.7	112.6	109.5
Surrogate: Naphthalene d8 (%)	96.6	99.1	106.2	114.3	99.0
Surrogate: Phenanthrene d10 (%)	98.0	102.9	111.6	118.2	101.3

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1958382-6 Sediment 13-JUL-17 13:46 WSA-2	L1958382-7 Sediment 13-JUL-17 13:58 WSA-3	L1958382-8 Sediment 13-JUL-17 14:05 WSA-4	L1958382-9 Sediment 13-JUL-17 14:10 WSA-5	L1958382-10 Sediment 13-JUL-17 14:18 WSA-6
SOIL						
Hydrocarbons	HEPH (mg/kg)	420	200	490	590	<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 (%)	101.4	110.2	90.0	103.0	98.3
	Surrogate: 2-Bromobenzotrifluoride, EPH-sg (%)	110.0	113.3			
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	123.1	Not Reportable SMI	91.2	105.8	113.5
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Anthracene (mg/kg)	<0.060 DLCI	<0.050	0.087	0.071	<0.050
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	0.051	<0.050
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.080 DLCI	<0.050
	Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Pyrene (mg/kg)	0.089	0.078	<0.050	0.064	<0.050
	Surrogate: Acenaphthene d10 (%)	89.5	95.5	98.9	109.5	104.0
	Surrogate: Chrysene d12 (%)	84.2	94.6	95.3	106.2	105.2
	Surrogate: Naphthalene d8 (%)	97.9	100.9	92.7	102.9	101.1
	Surrogate: Phenanthrene d10 (%)	94.2	100.7	94.7	108.4	104.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1958382-11	L1958382-12	L1958382-13		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	13-JUL-17	13-JUL-17	13-JUL-17		
	Sampled Time	14:29	14:40	14:47		
	Client ID	WSA-7	WSA-8	WSA-9		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	HEPH (mg/kg)	<200	<200	<200		
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100		
	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	102.3	103.2	100.2		
	Surrogate: 2-Bromobenzotrifluoride, EPH-sg (%)					
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	110.7	118.2	113.7		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	109.0	112.6	103.6		
	Surrogate: Chrysene d12 (%)	109.6	112.4	104.2		
	Surrogate: Naphthalene d8 (%)	104.3	106.0	98.5		
	Surrogate: Phenanthrene d10 (%)	109.2	114.4	105.9		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
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).

EPH-TUMB-SG-FID-VA Soil EPH with Silica Gel by Tumbler and GCFID BCMOE EPH GCFID

EPH in Sediment/Soil with Silica Gel Cleanup - EPH(sg)

This analysis is carried out using British Columbia Ministry of Water, Land and Air Protection (BC WLAP) methods. Sediment/Soil samples are extracted and analzyed in accordance with the BC WLAP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID, Version 2.1 July 1999". The procedure, based on EPA 3570, uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone.

Prior to analysis by capillary gas chromatography with flame ionization detection (GC/FID), a silica gel cleanup procedure is applied. The cleanup, which is intended to selectively remove most naturally occurring organics, follows the BC WLAP method "Silica Gel Cleanup of Extractable Petroleum Hydrocarbons" (Draft, October 23, 2003).

Note that EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH). This analysis is sometimes also referred to as Total Petroleum Hydrocarbons.

Accuracy target values for Reference Materials used in this method are derived from averages of long-term method performance, as certified values do not exist for the reported parameters.

HG-200.2-CVAF-VA Soil Mercury in Soil by CVAFS EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA Soil LEPHs and HEPHs BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA Soil Metals in Soil by CRC ICPMS EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA Soil Moisture content CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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.

Reference Information

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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-608375 15-608376

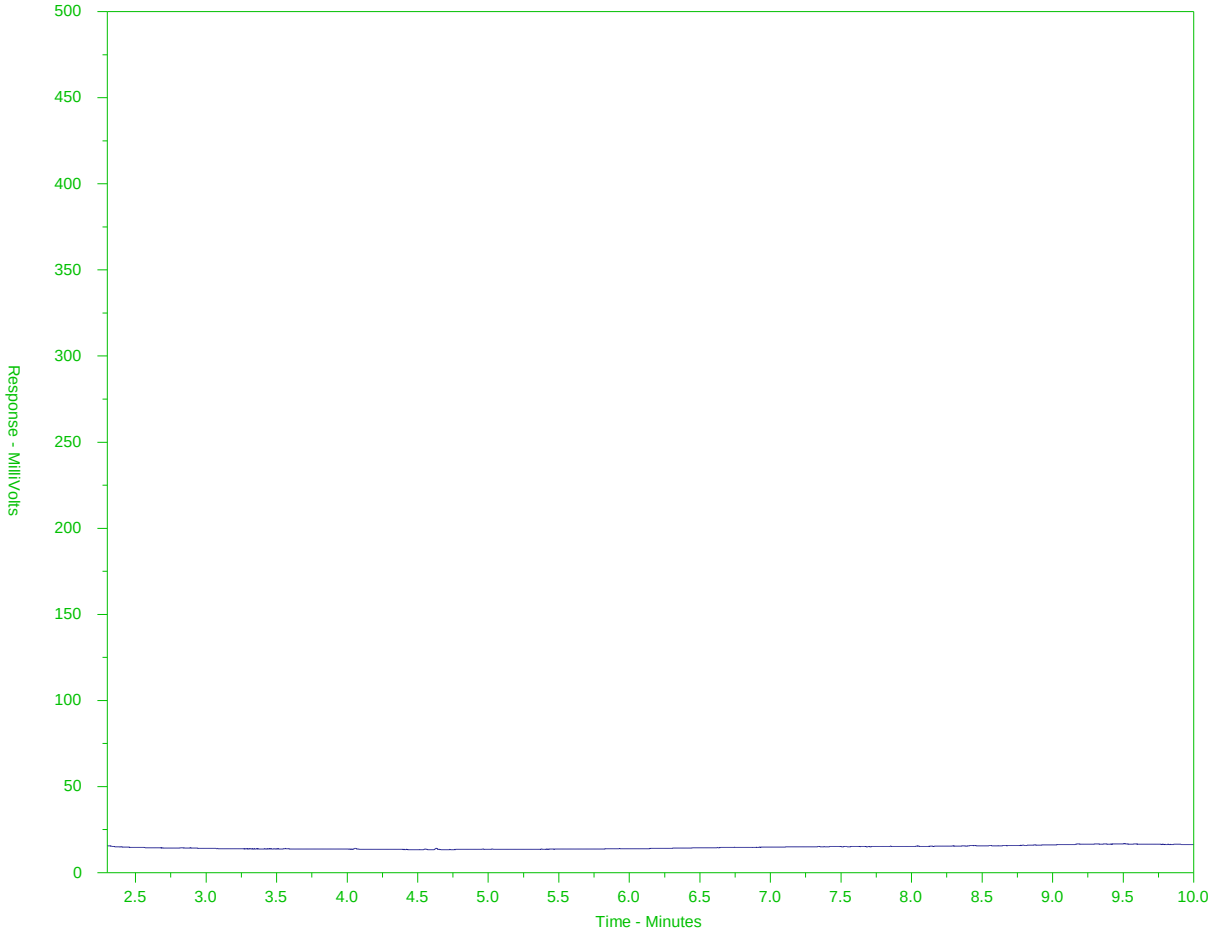
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1958382-1
Client Sample ID: BF-SG2-1



← 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.

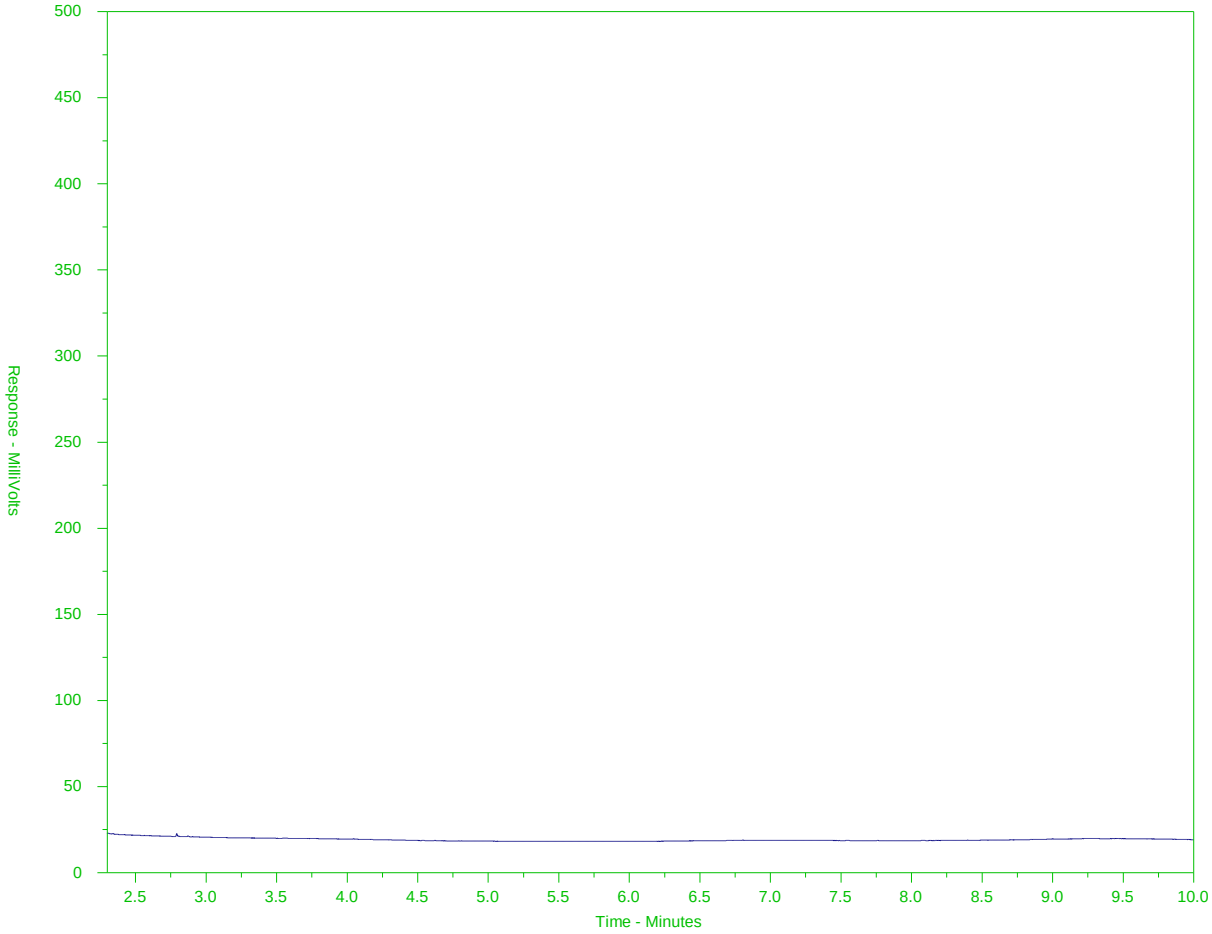
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-2
Client Sample ID: BF-SG2-2



← 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 →		

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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.

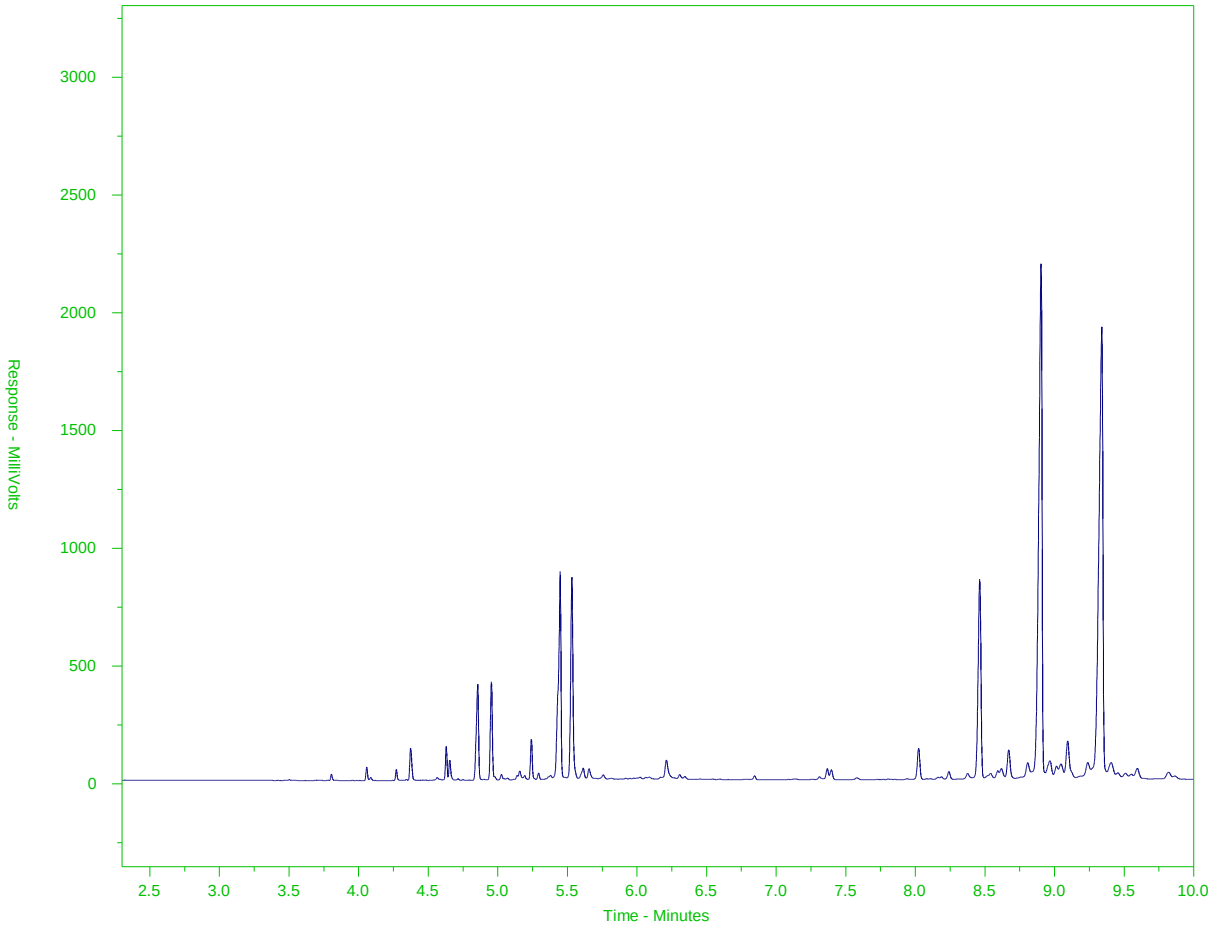
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-3
Client Sample ID: WIRA-1



← 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.

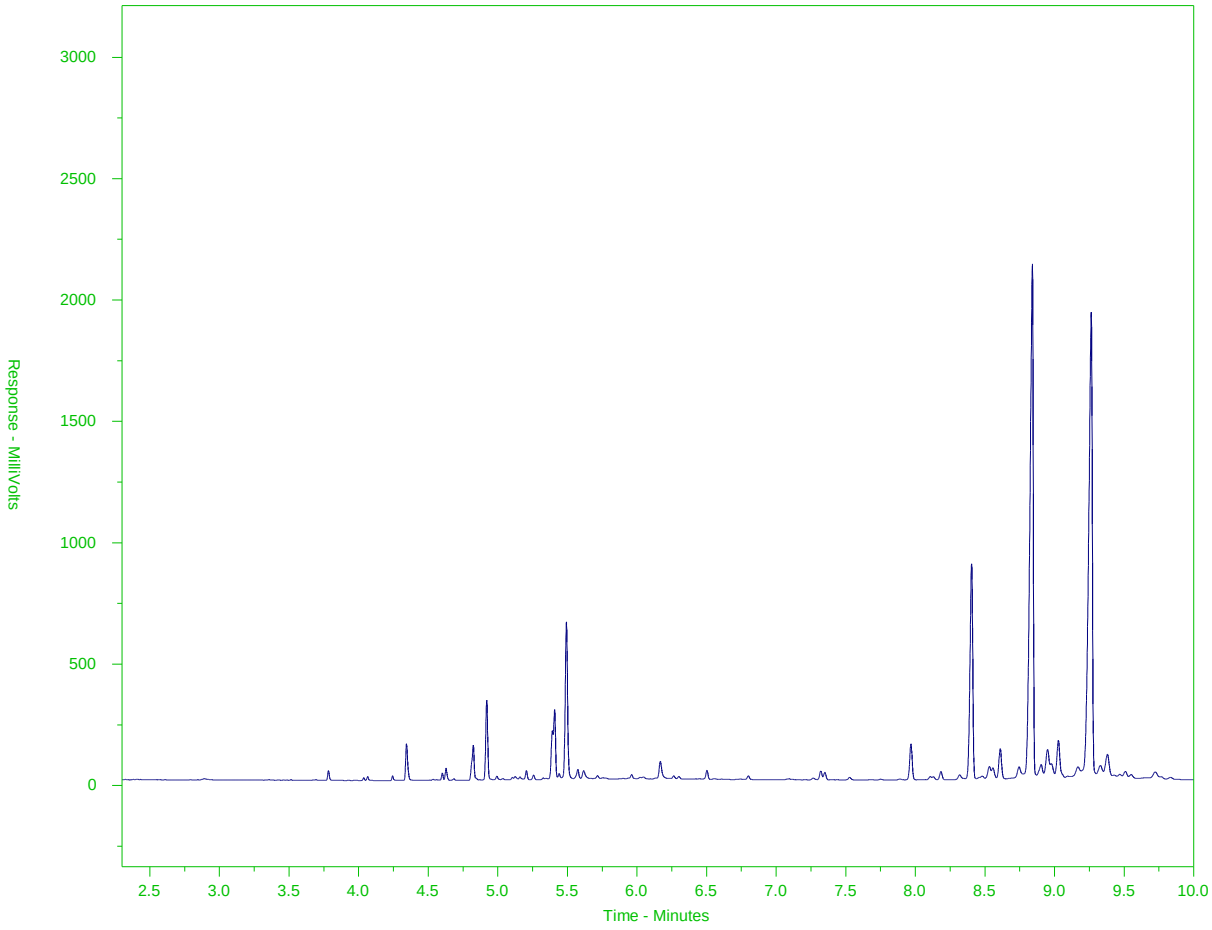
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-4
Client Sample ID: WIRA-2



← 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 →		

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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.

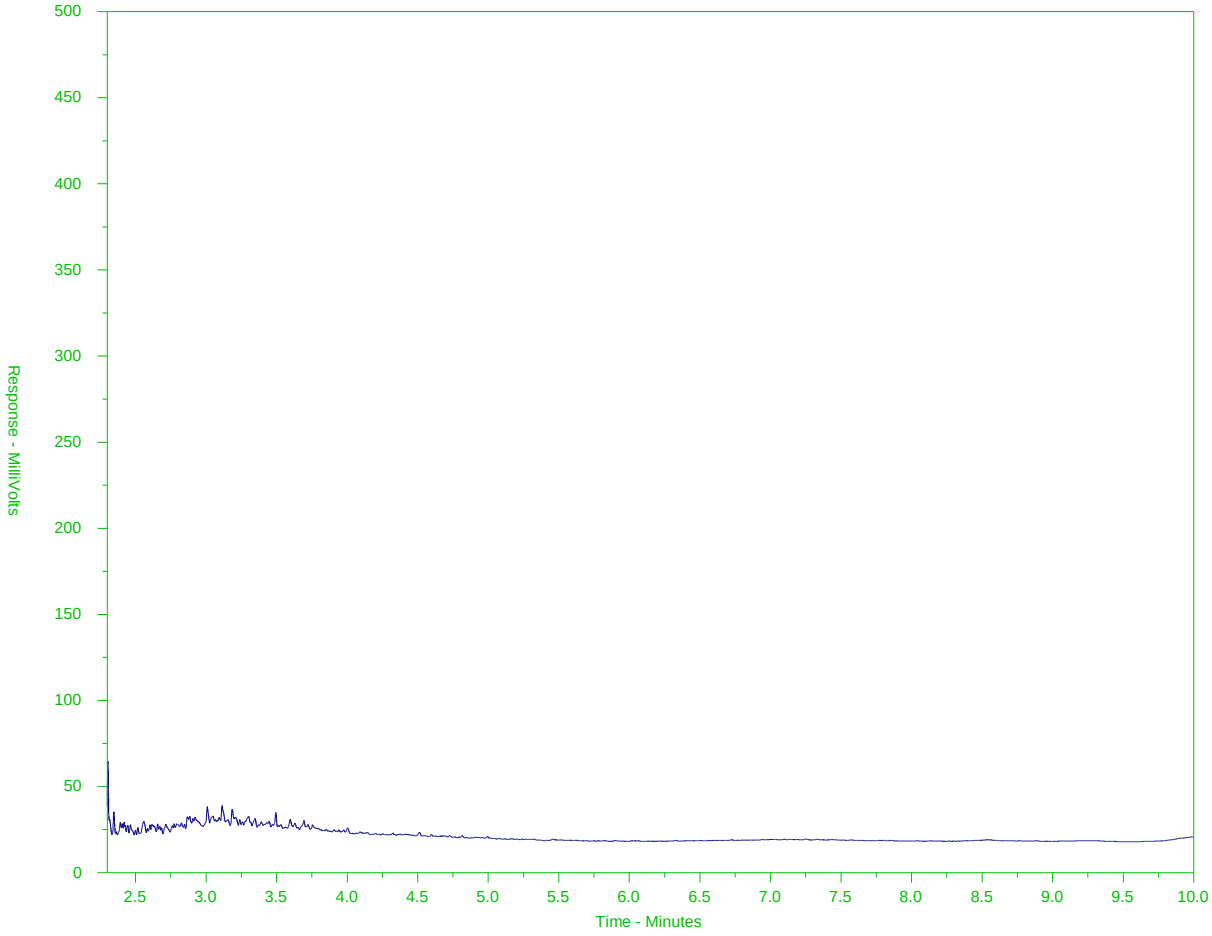
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-5
Client Sample ID: WSA-1



← 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 →		

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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.

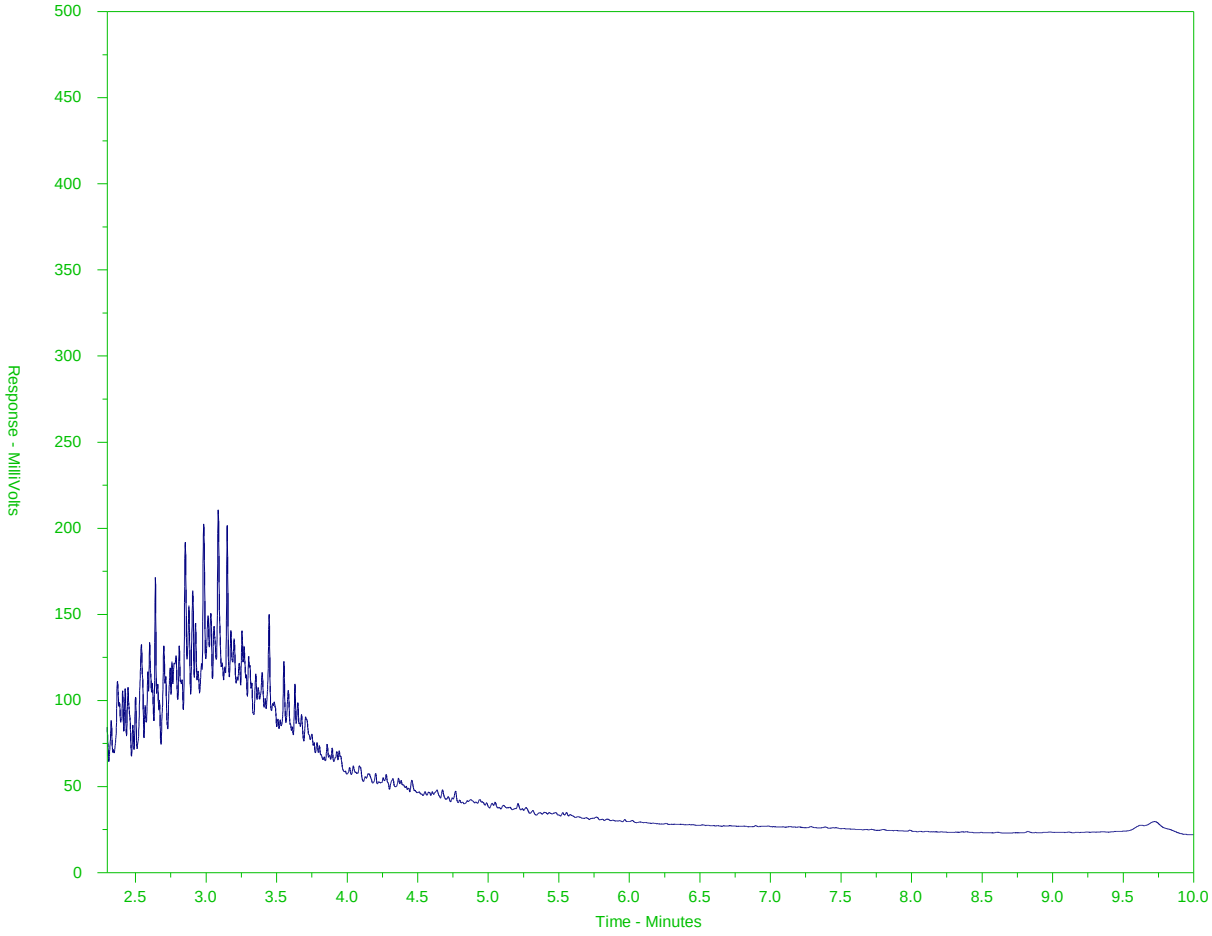
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-6
Client Sample ID: WSA-2



← 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.

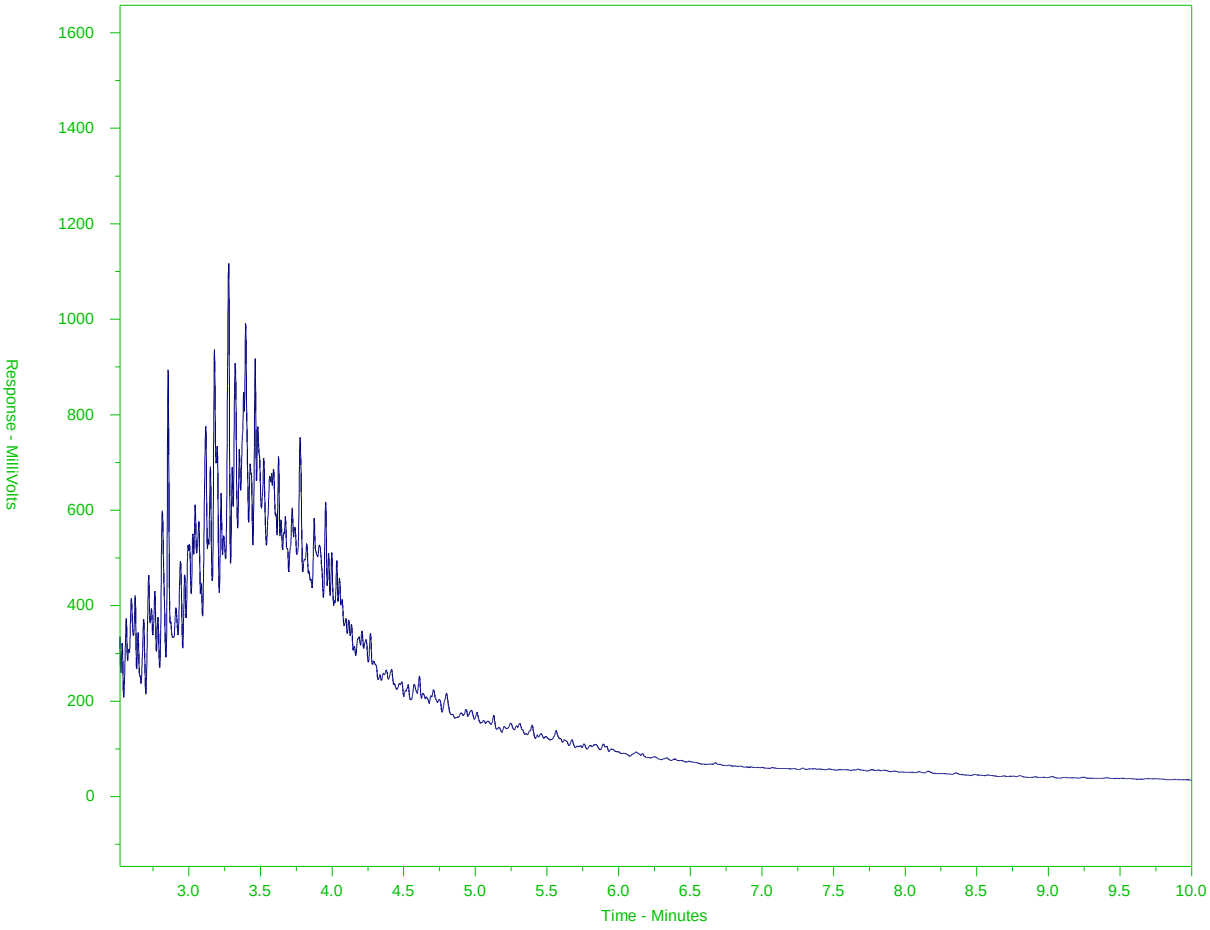
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-S-6
Client Sample ID: WSA-2



← 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.

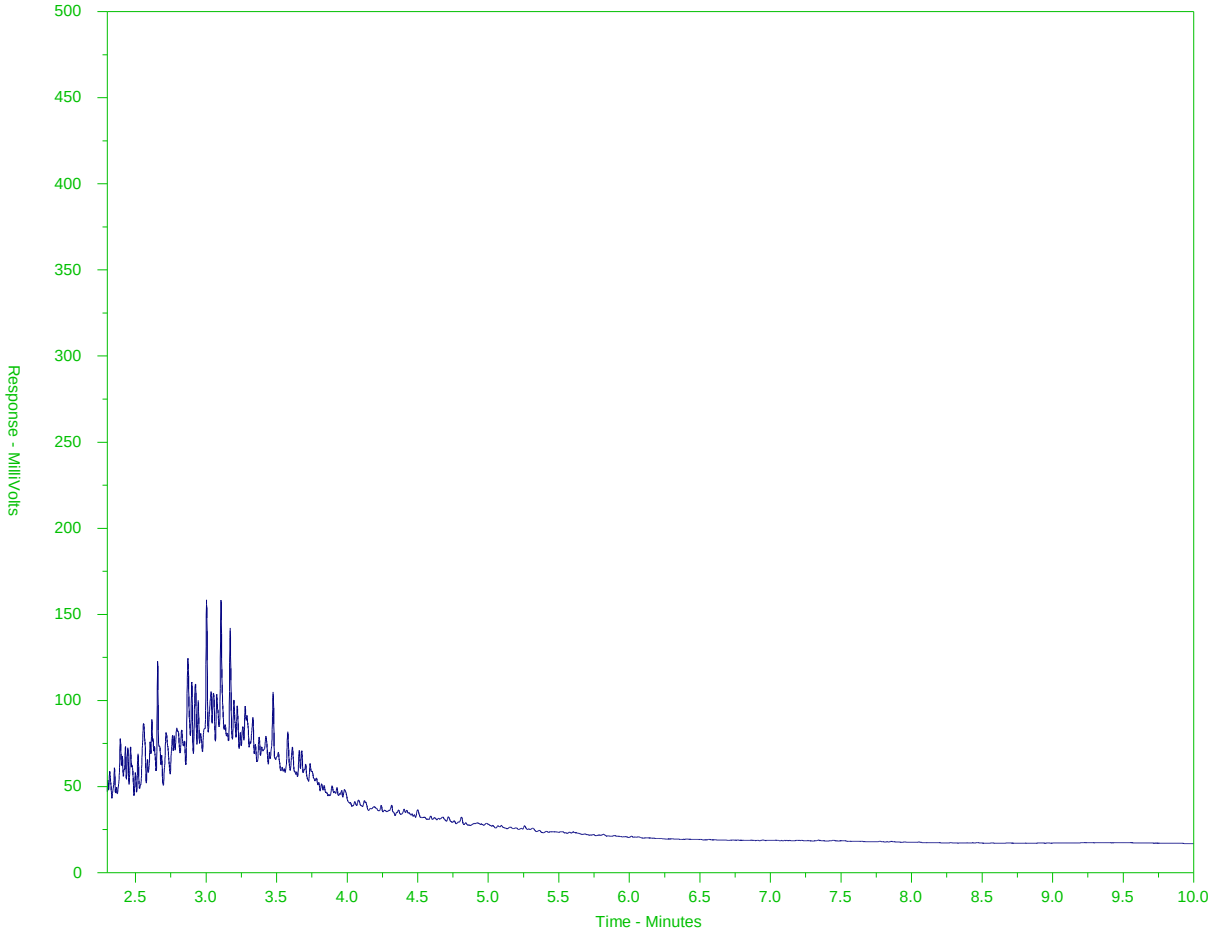
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-7
Client Sample ID: WSA-3



← 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.

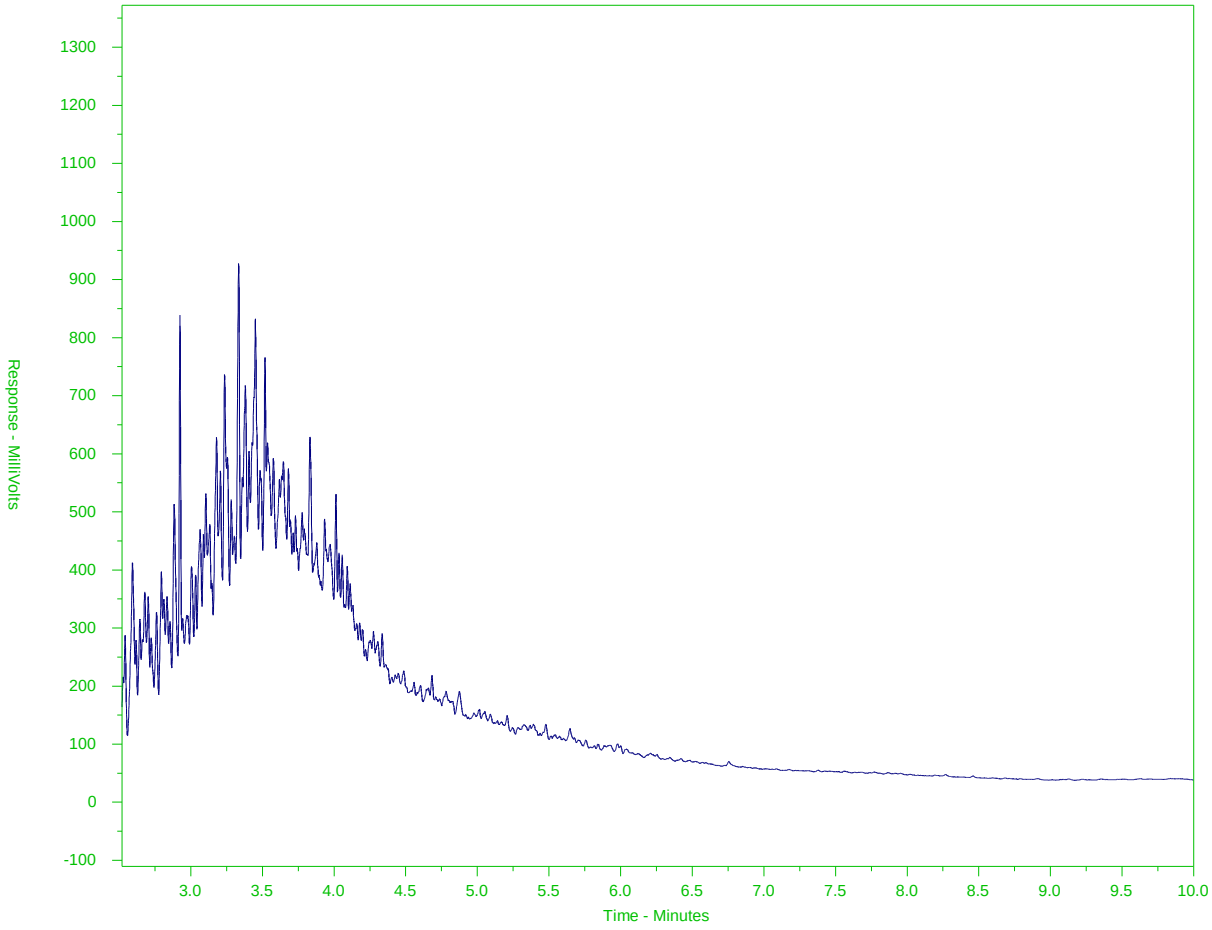
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-S-7
Client Sample ID: WSA-3



← 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 →		

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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.

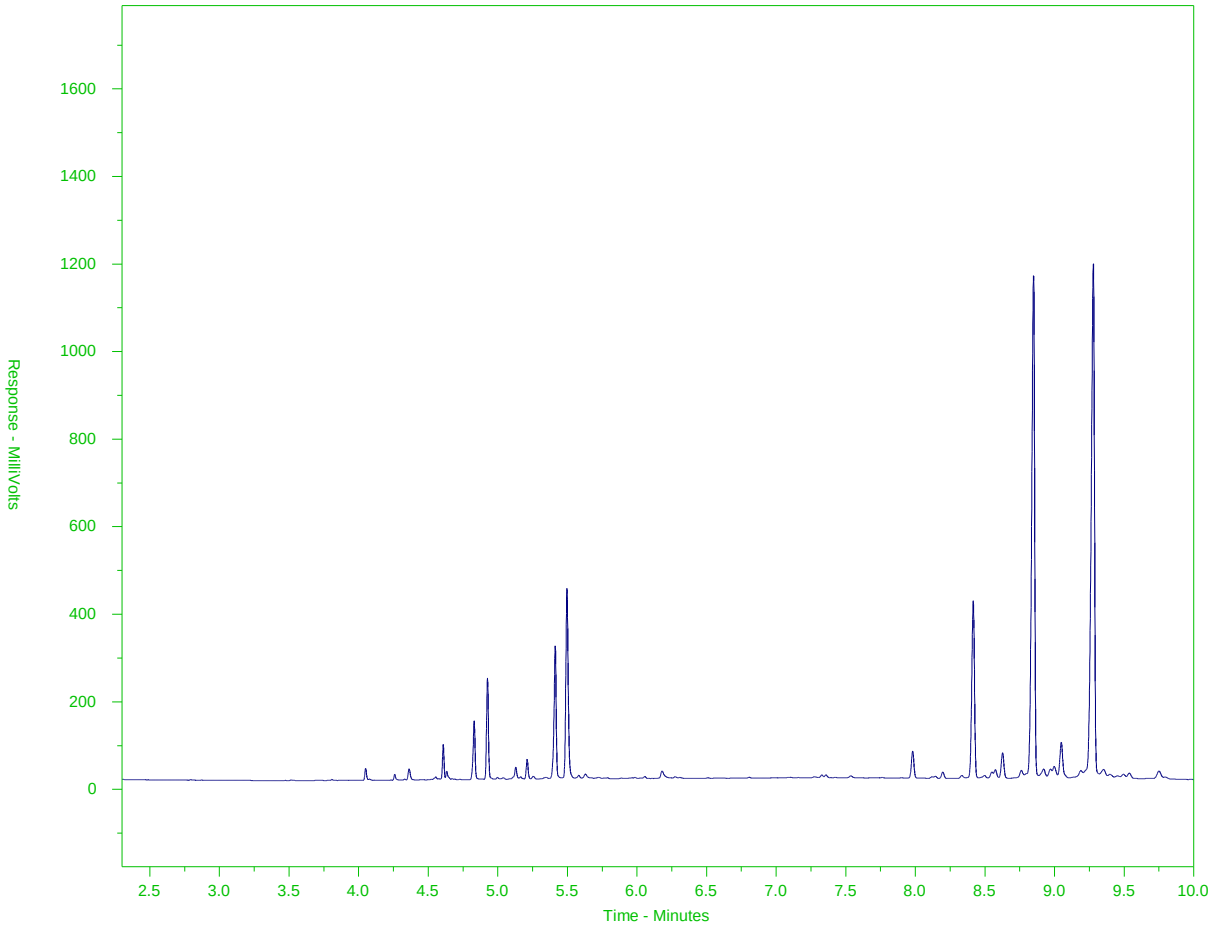
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-8
Client Sample ID: WSA-4



← 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.

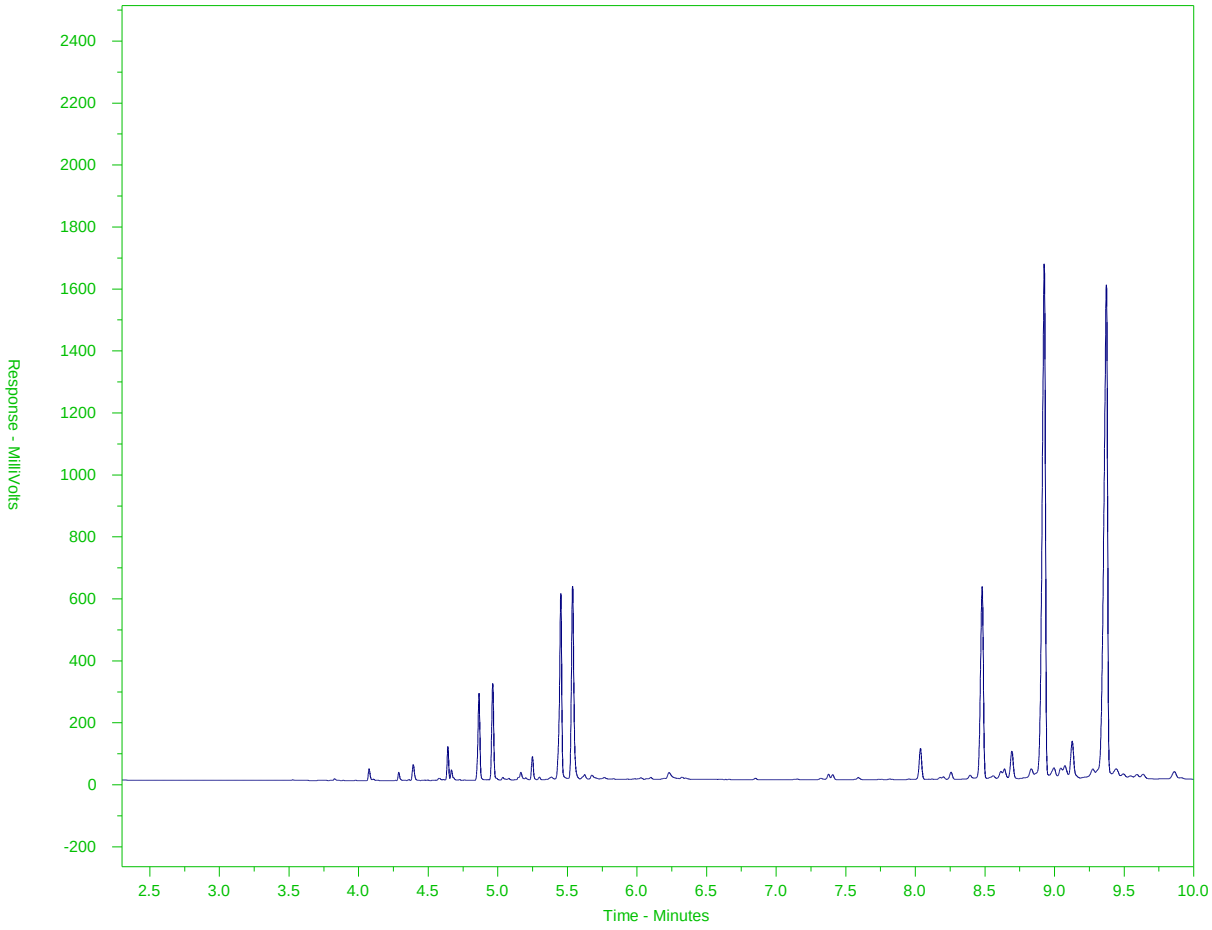
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-9
Client Sample ID: WSA-5



← 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.

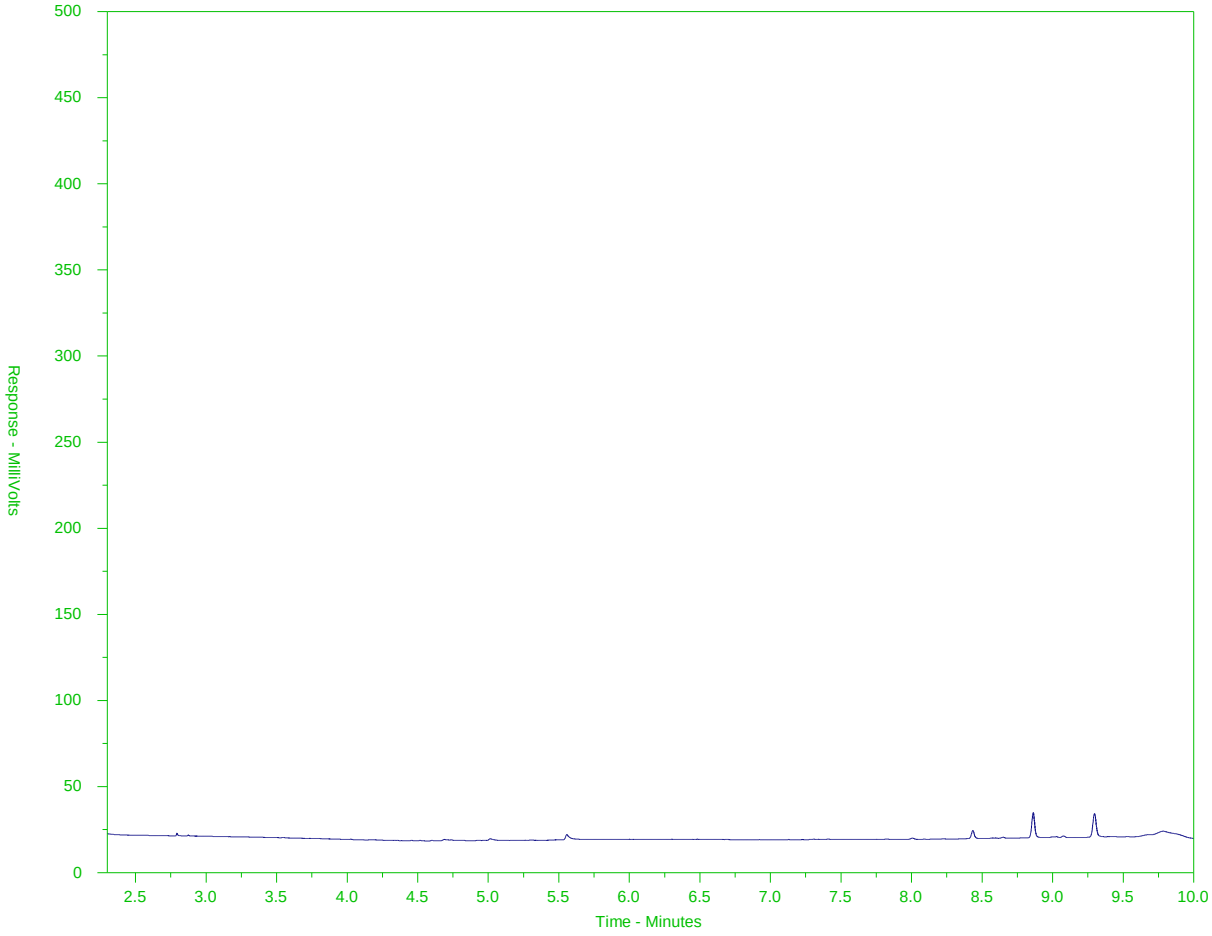
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-10
Client Sample ID: WSA-6



← 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 →		

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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.

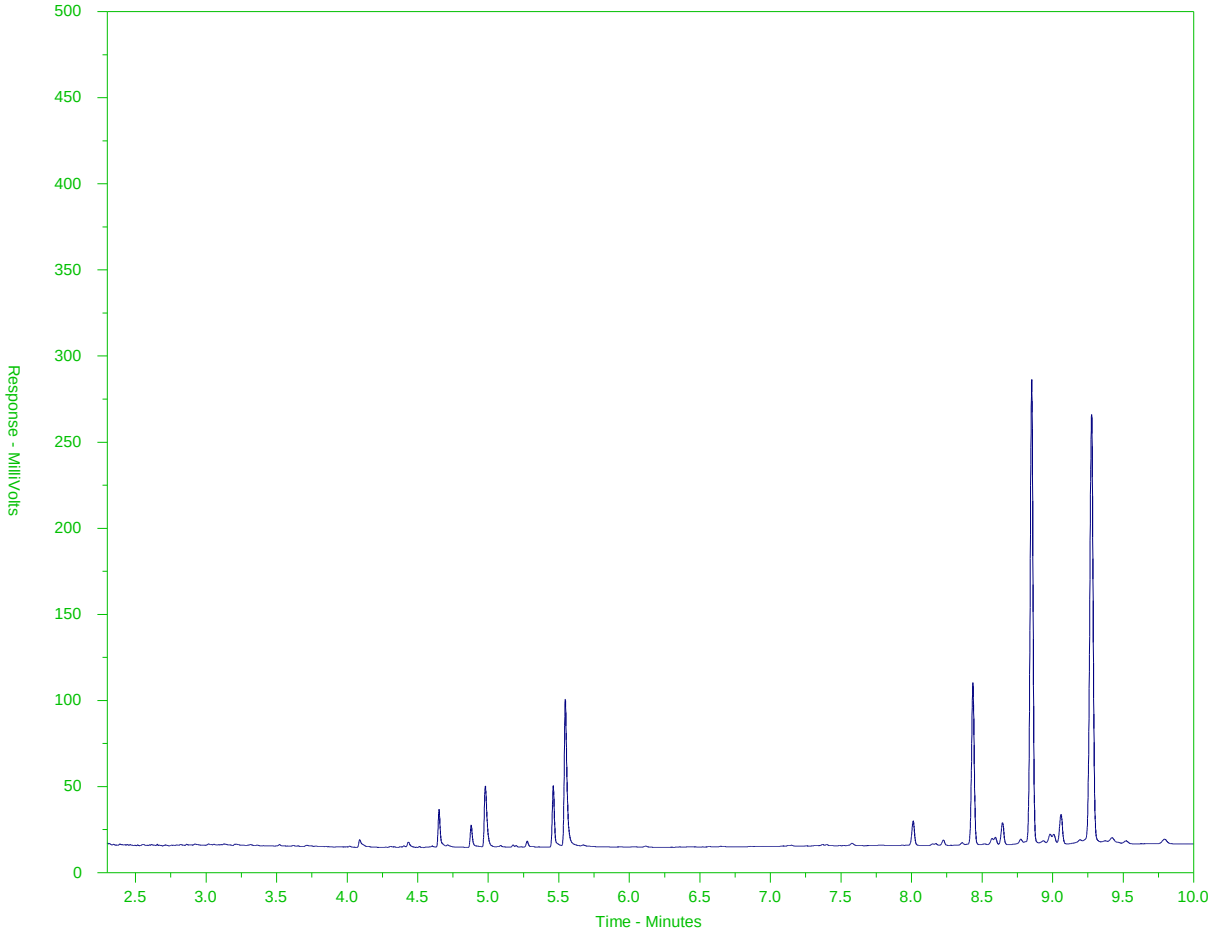
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-11
Client Sample ID: WSA-7



← 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.

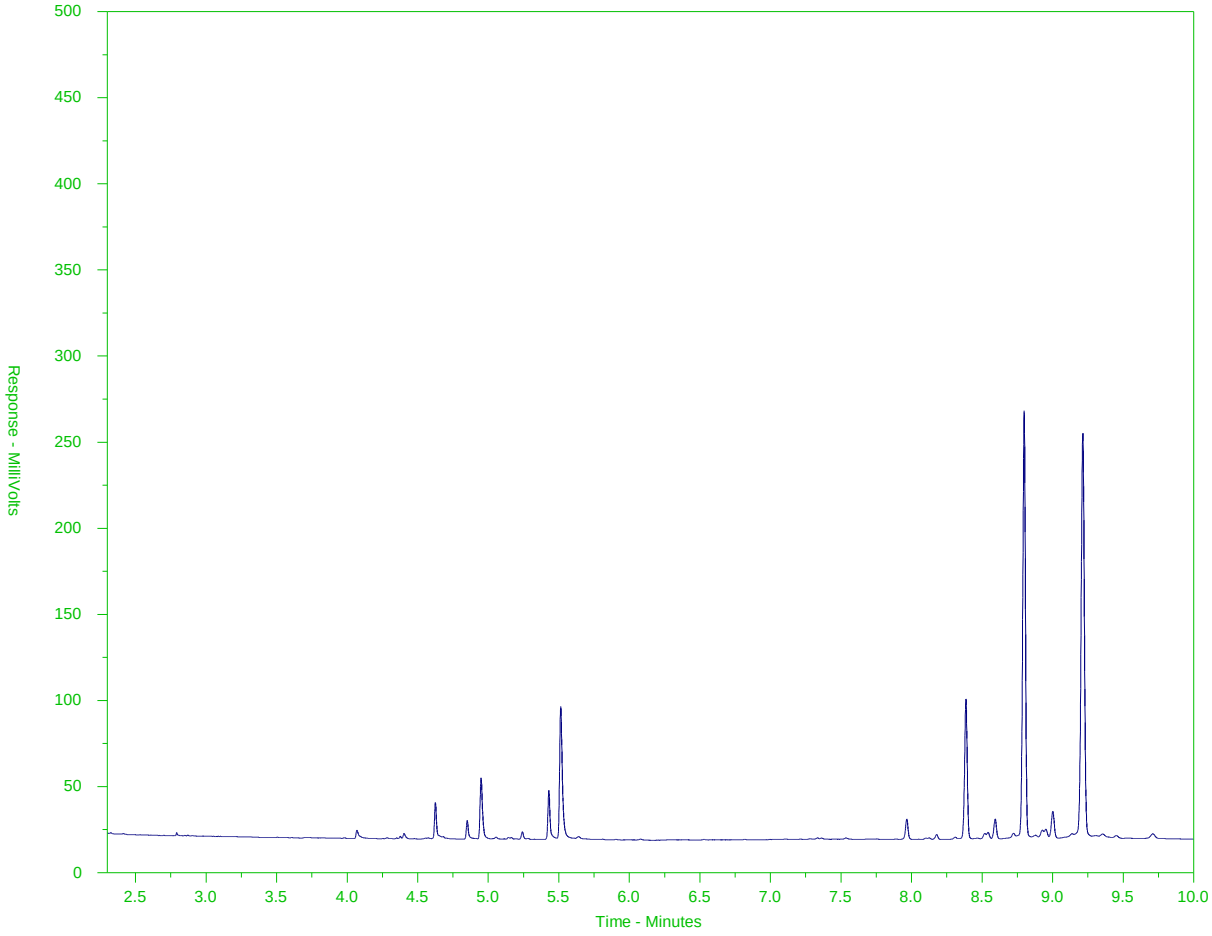
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-12
Client Sample ID: WSA-8



← 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.

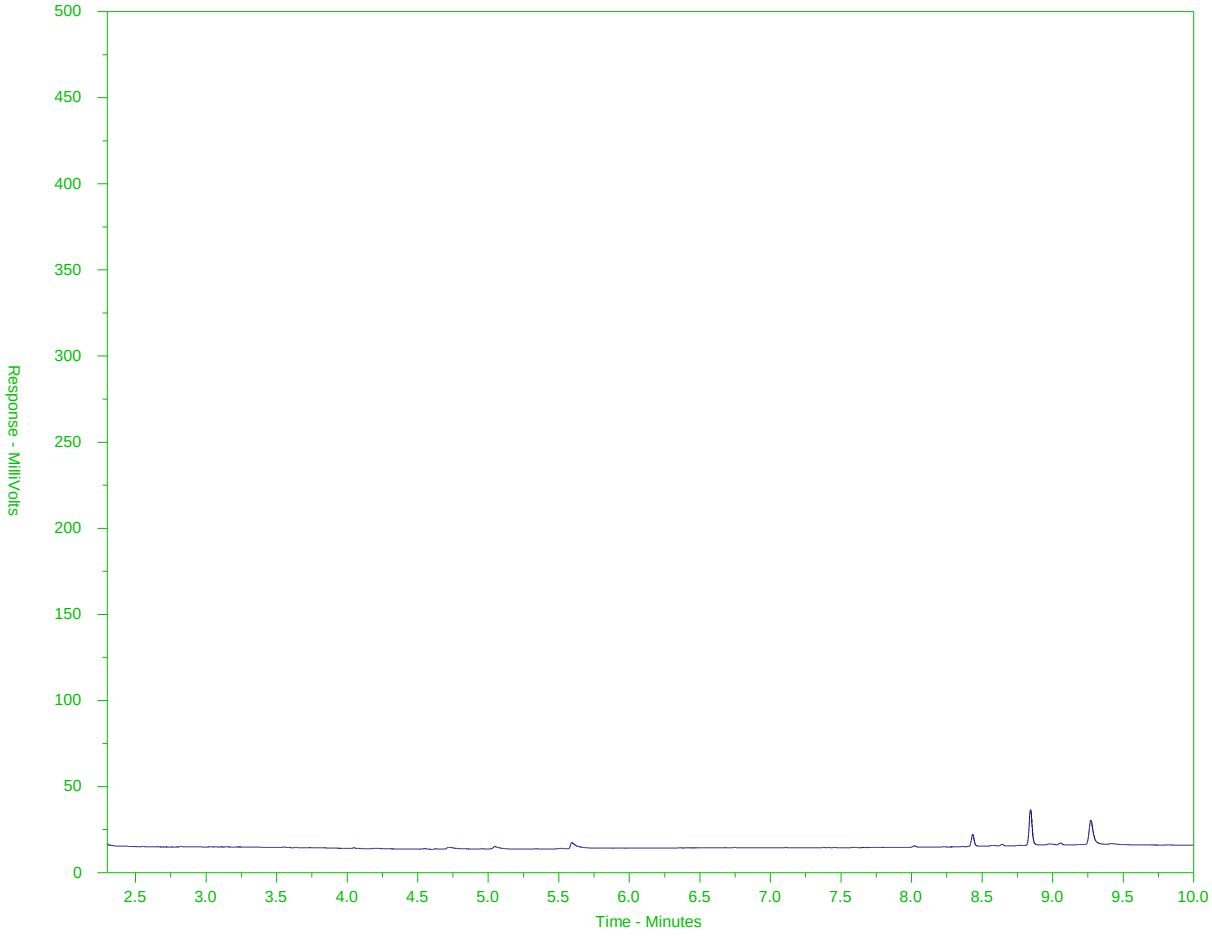
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1958382-13
Client Sample ID: WSA-9



← 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.

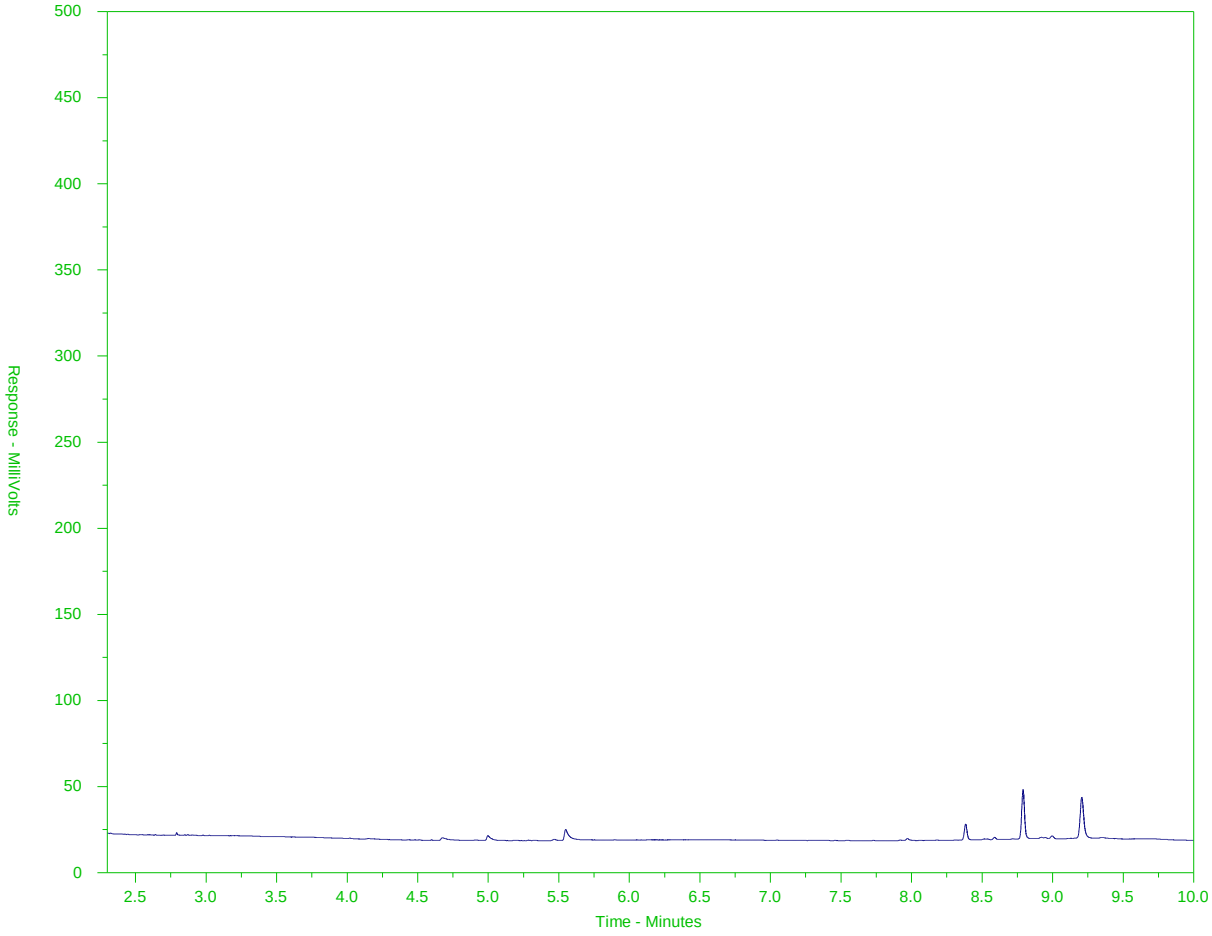
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2569795-4#L1958382-13
Client Sample ID: WSA-9



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1958382-COFC

COC Number: 15 - 608376

Page 1 of 2

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604.444.6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby B.C.
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Michael.gill@aecom.com
Email 2	
Email 3	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply			
Regular [R]	[ ]	Standard TAT if received by 3 pm - business days - no surcharges apply	
PRIORITY (Business Days) 4 day [P4]	[ ]	EMERGENCY 1 Business day [E1]	[ ]
3 day [P3]	[ ]	Same Day, Weekend or Statutory holiday [E0]	[X]
2 day [P2]	[ ]		
Date and Time Required for all E&P TATs:		ASAP	
For tests that can not be performed according to the service level selected, you will be contacted.			

Invoice To	Same as Report To [ ] YES [X] NO
	Copy of Invoice with Report [X] YES [ ] NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Same as above
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt

Sampler: EAP/JB

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VOA	LEPH/HEPH	Metals	Number of Containers
	BF-SG2-1	13-Jul-17	12:50	Sediment		X	X	X	4
	BF-SG2-2		13:09						
	WIRA-1		12:05						
	WIRA-2		13:49						
	WSA-1		13:35						
	WSA-2		13:46						
	WSA-3		13:58						
	WSA-4		14:05						
	WSA-5		14:10						
	WSA-6		14:18						
	WSA-7		14:29						
	WSA-8		14:40						

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human drinking water use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [X] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			27		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Justin Beckler	July 13, 2017	6:45p					7/13/17	18:45

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1958382-COFC

COC Number: 15 - 608375

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604.444.6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1	michael.gill@aecom.com
Email 2	
Email 3	

Invoice To		
	Same as Report To	[ ] YES [X] NO
	Copy of Invoice with Report	[X] YES [ ] NO
Company:	Chevron Canada Ltd.	
Contact:	Chris Boys	

Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Same as above
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	[illegible]
LSD:	Foreshore
ALS Lab Work Order # (lab use only)	

Oil and Gas Required Fields (client use)		
AFE/Cost Center:	PO#	
Major/Minor Code:	Routing Code:	
Requisitioner:		
Location:		
ALS Contact: Dean Watt	Sampler: EAP/JB	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] [ ] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [X]

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	WSA-9	13-Jul-17	14:47	Sediment	X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? [ ] YES [X] NO	BC CSR
Are samples for human drinking water use? [ ] YES [X] NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	[ ]	SIF Observations	Yes [ ]	No [ ]	
Ice Packs	[X]	Ice Cubes [ ]	Custody seal intact	Yes [ ]	No [ ]
Cooling Initiated	[ ]				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			22		

SHIPMENT RELEASE (client use)		
Released by: Justin Becker	Date: July 13, 2017	Time: 18:45

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by: [illegible]	Date: 7/13/17	Time: 18:45

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 14-JUL-17
Report Date: 17-JUL-17 16:47 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1959111

Project P.O. #:	NOT SUBMITTED
Job Reference:	60542455
C of C Numbers:	608560
Legal Site Desc:	FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1959111-1 SEDIMENT 14-JUL-17 12:30 EIRA-1	L1959111-2 SEDIMENT 14-JUL-17 12:45 EIRA-2	L1959111-3 SEDIMENT 14-JUL-17 14:20 EIRA-3	L1959111-4 SEDIMENT 14-JUL-17 14:10 EIRA-4	L1959111-5 SEDIMENT 14-JUL-17 14:30 EIRA-5
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
SOIL						
Physical Tests	Moisture (%)	21.4	22.6	16.8	16.6	23.3
	pH (1:2 soil:water) (pH)	8.83	8.92	9.13	8.54	8.71
Metals	Antimony (Sb) (mg/kg)	0.17	0.23	0.15	0.14	0.19
	Arsenic (As) (mg/kg)	3.39	3.72	2.42	2.57	3.34
	Barium (Ba) (mg/kg)	56.1	41.5	39.4	28.5	88.5
	Beryllium (Be) (mg/kg)	0.27	0.25	0.29	0.23	0.28
	Cadmium (Cd) (mg/kg)	0.119	0.115	0.066	0.068	0.104
	Chromium (Cr) (mg/kg)	24.3	20.3	7.62	8.24	20.6
	Cobalt (Co) (mg/kg)	5.19	5.48	4.07	4.59	6.29
	Copper (Cu) (mg/kg)	17.4	17.5	12.3	13.9	17.0
	Lead (Pb) (mg/kg)	6.42	6.09	11.8	10.6	6.21
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Molybdenum (Mo) (mg/kg)	0.31	0.41	0.28	0.22	0.35
	Nickel (Ni) (mg/kg)	20.7	19.2	6.05	6.85	19.9
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Uranium (U) (mg/kg)	0.846	0.756	1.01	0.783	0.831
	Vanadium (V) (mg/kg)	38.2	40.9	29.9	35.0	46.5
	Zinc (Zn) (mg/kg)	38.1	35.2	42.0	41.3	41.6
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	Field MeOH	Field MeOH
	Benzene (mg/kg)	0.100	0.411	0.327	0.297	0.0155
	Ethylbenzene (mg/kg)	<0.015	<0.015	0.049	0.051	<0.015
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Styrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Toluene (mg/kg)	<0.050	<0.050	0.086	<0.050	<0.050
	ortho-Xylene (mg/kg)	<0.050	<0.050	0.054	<0.050	<0.050
	meta- & para-Xylene (mg/kg)	<0.050	<0.050	0.132	<0.050	<0.050
	Xylenes (mg/kg)	<0.075	<0.075	0.186	<0.075	<0.075
	Surrogate: 4-Bromofluorobenzene (SS) (%)	70.4	74.3	92.5	88.2	79.2
	Surrogate: 1,4-Difluorobenzene (SS) (%)	79.6	78.6	91.5	90.0	84.3
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200	<200	<200
	EPH19-32 (mg/kg)	810	730	460	540	700
	LEPH (mg/kg)	<200	<200	<200	<200	<200
	HEPH (mg/kg)	810	730	460	540	700
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	<100	<100

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1959111-6				
	Description	SEDIMENT				
	Sampled Date	14-JUL-17				
	Sampled Time	14:45				
	Client ID	EIRA-6				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	21.1				
	pH (1:2 soil:water) (pH)	8.68				
Metals	Antimony (Sb) (mg/kg)	0.22				
	Arsenic (As) (mg/kg)	3.50				
	Barium (Ba) (mg/kg)	83.2				
	Beryllium (Be) (mg/kg)	0.27				
	Cadmium (Cd) (mg/kg)	0.101				
	Chromium (Cr) (mg/kg)	20.2				
	Cobalt (Co) (mg/kg)	6.53				
	Copper (Cu) (mg/kg)	17.6				
	Lead (Pb) (mg/kg)	6.65				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.46				
	Nickel (Ni) (mg/kg)	19.2				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.802				
	Vanadium (V) (mg/kg)	45.6				
	Zinc (Zn) (mg/kg)	44.0				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	0.0185				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	82.2				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	87.0				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	630				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	630				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1959111-1 SEDIMENT 14-JUL-17 12:30 EIRA-1	L1959111-2 SEDIMENT 14-JUL-17 12:45 EIRA-2	L1959111-3 SEDIMENT 14-JUL-17 14:20 EIRA-3	L1959111-4 SEDIMENT 14-JUL-17 14:10 EIRA-4	L1959111-5 SEDIMENT 14-JUL-17 14:30 EIRA-5
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
	Surrogate: 2-Bromobenzotrifluoride (%)	95.9	94.7	87.2	87.4	92.2
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	74.8	85.7	103.0	97.9	63.6 SURR-ND
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	0.066	0.061	<0.050
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: Acenaphthene d10 (%)	102.2	101.6	91.8	94.5	97.0
	Surrogate: Chrysene d12 (%)	108.1	112.1	96.6	96.1	108.6
	Surrogate: Naphthalene d8 (%)	97.2	89.8	85.1	85.4	87.0
	Surrogate: Phenanthrene d10 (%)	100.8	104.5	91.7	96.8	98.3

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1959111-6				
	Description	SEDIMENT				
	Sampled Date	14-JUL-17				
	Sampled Time	14:45				
	Client ID	EIRA-6				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	90.4				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	86.0				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	0.121				
	Naphthalene (mg/kg)	0.068				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	98.7				
	Surrogate: Chrysene d12 (%)	99.6				
	Surrogate: Naphthalene d8 (%)	92.3				
	Surrogate: Phenanthrene d10 (%)	98.3				

* 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	Selenium (Se)	LCS-H	L1959111-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

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.
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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

Reference Information

VPH-CALC-VA	Soil	VPH is VH minus select aromatics	BC MOE LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

608560

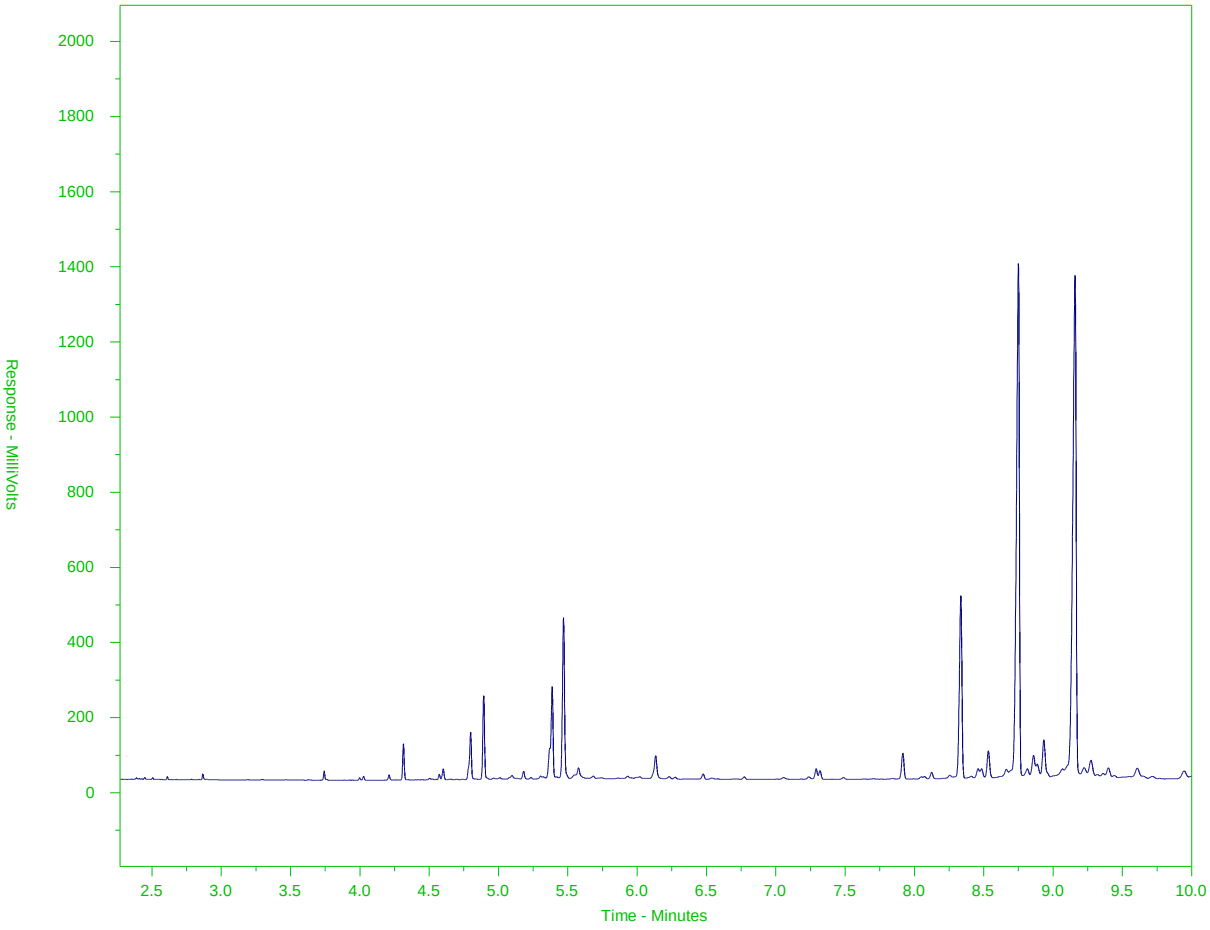
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1959111-1
Client Sample ID: EIRA-1



← 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.

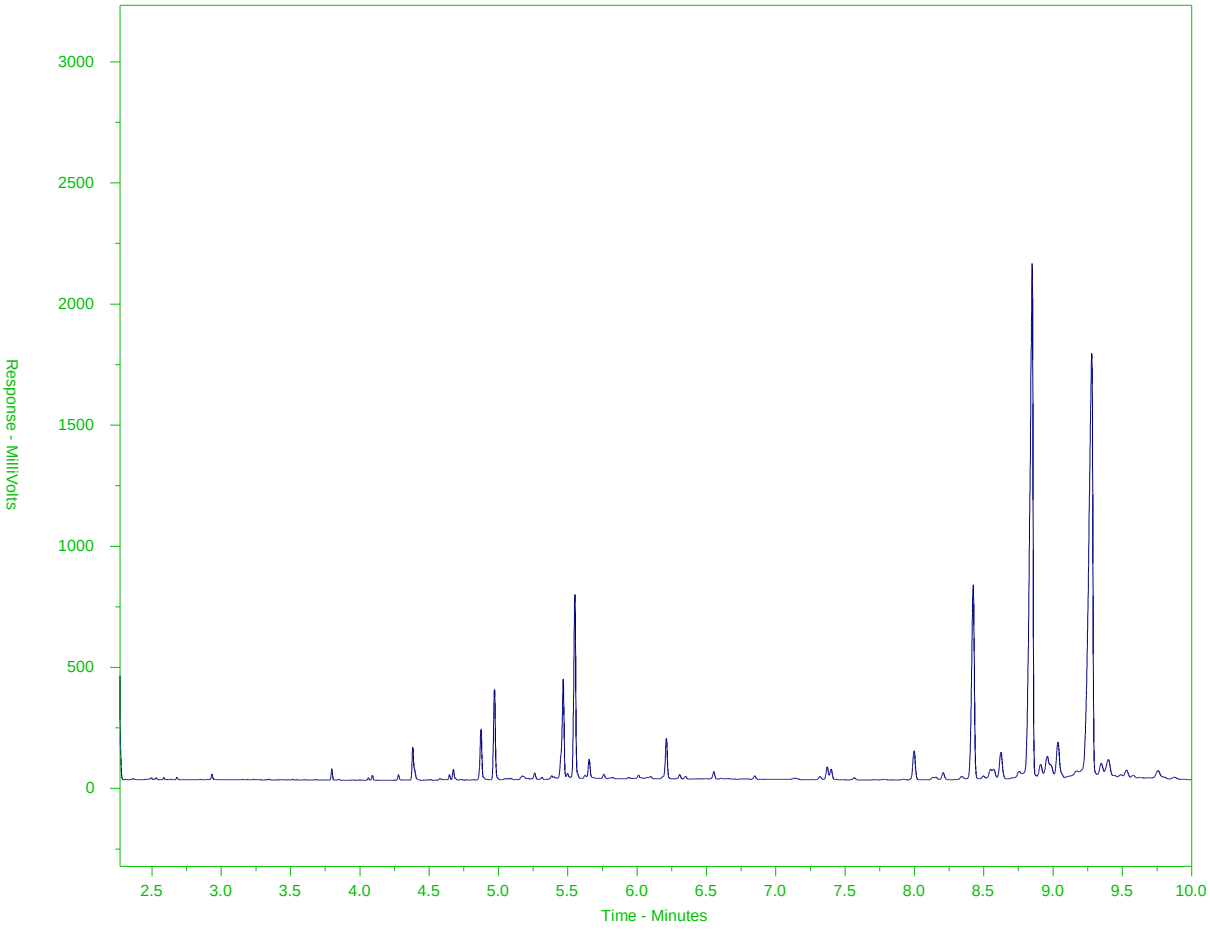
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959111-2
Client Sample ID: EIRA-2



← 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 →		

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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.

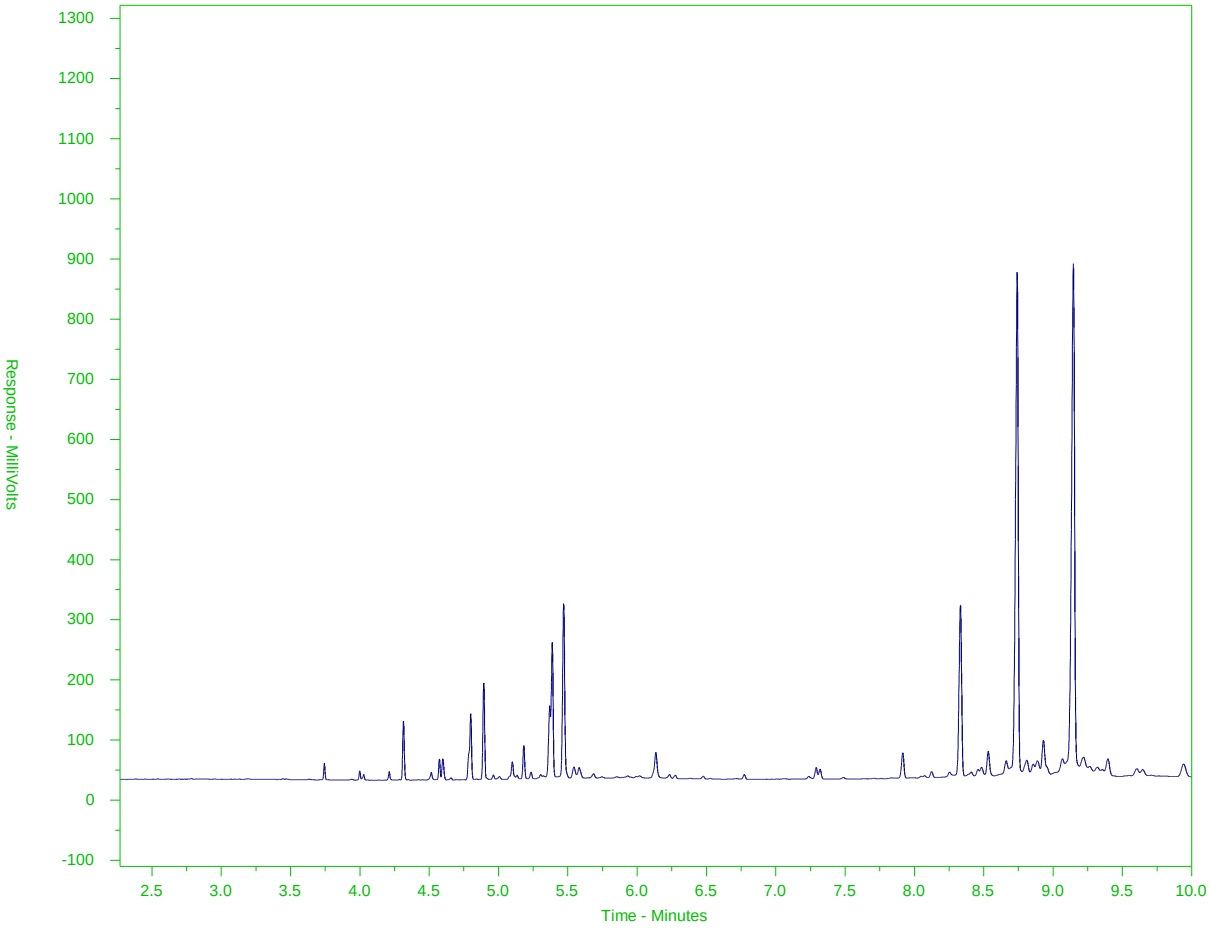
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959111-3
Client Sample ID: EIRA-3



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.

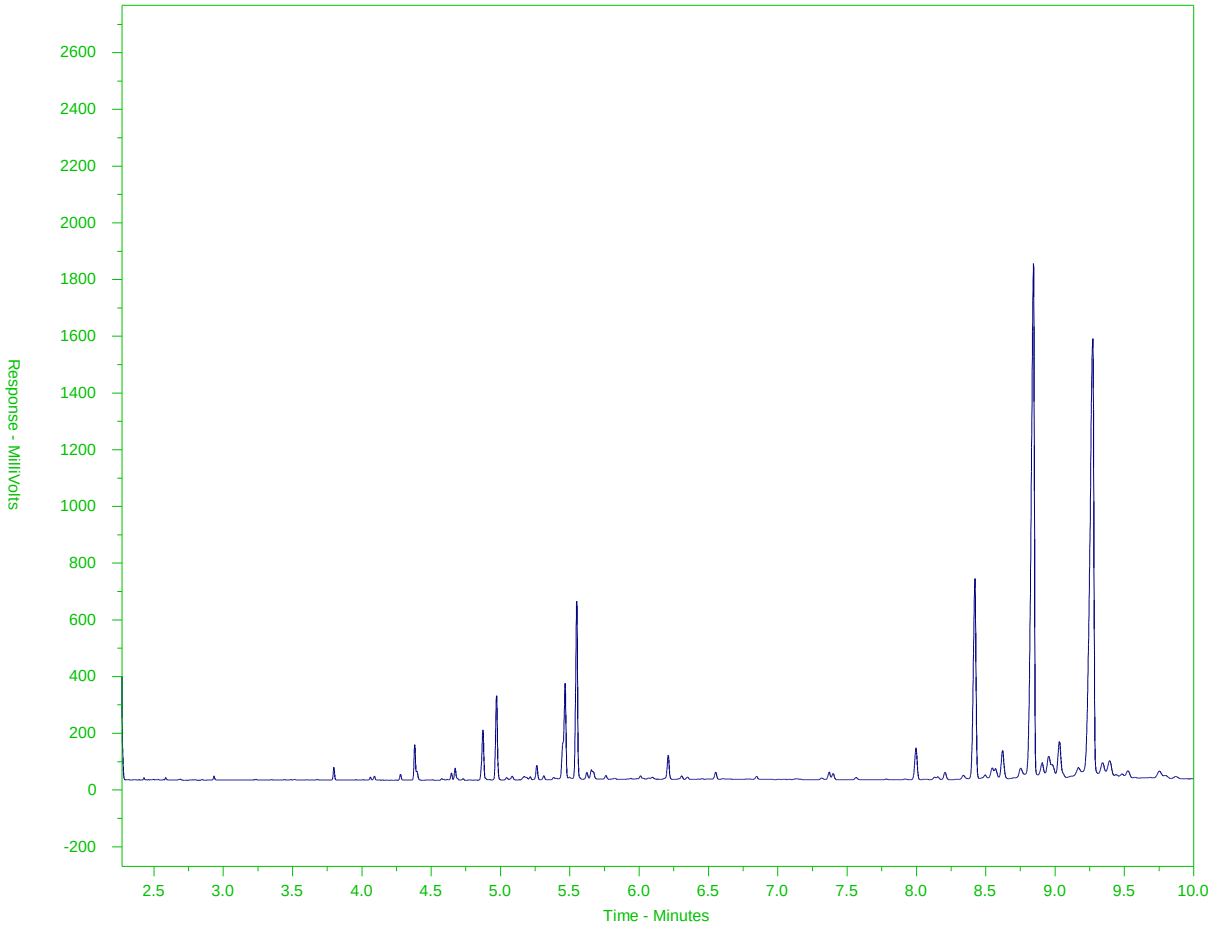
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959111-4
Client Sample ID: EIRA-4



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.

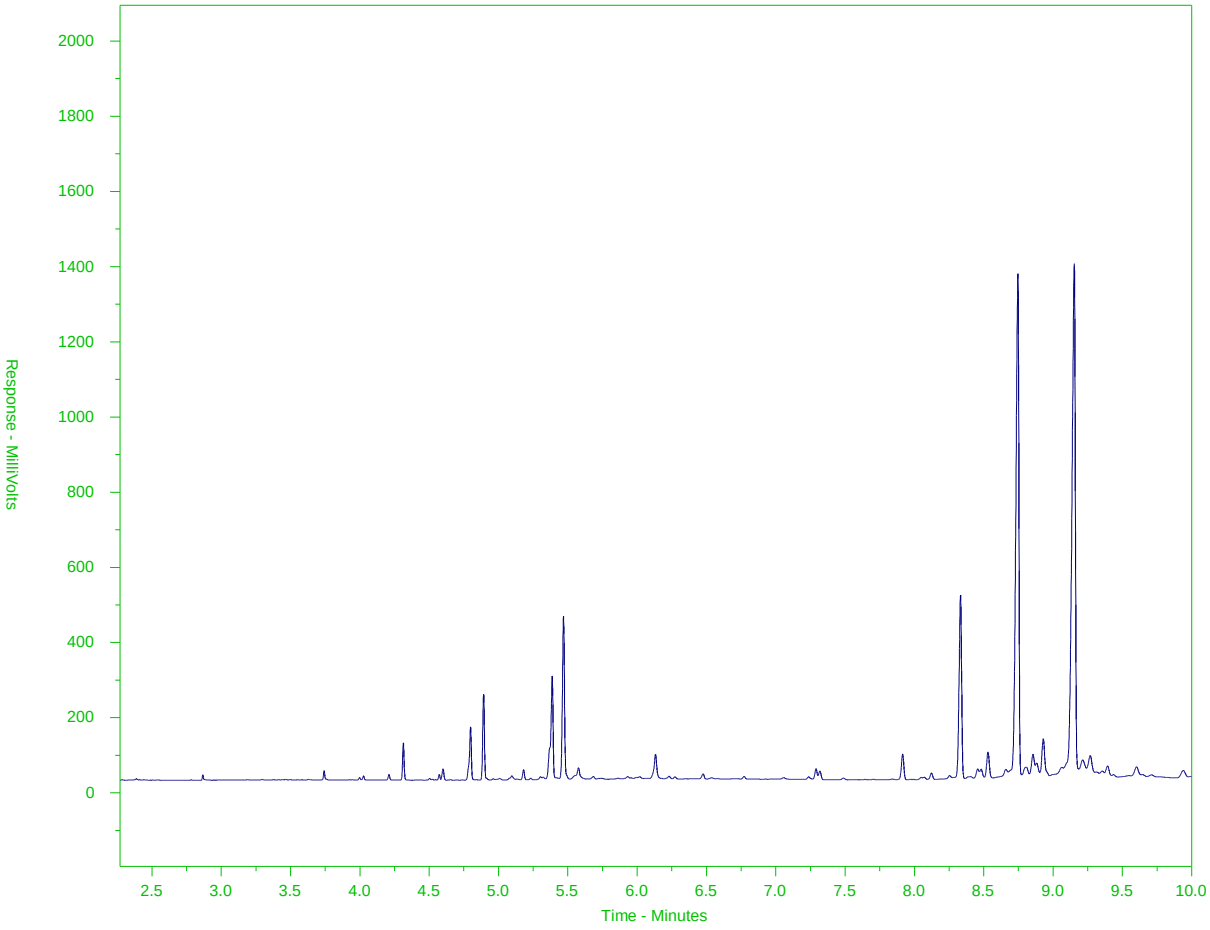
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959111-5
Client Sample ID: EIRA-5



← 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.

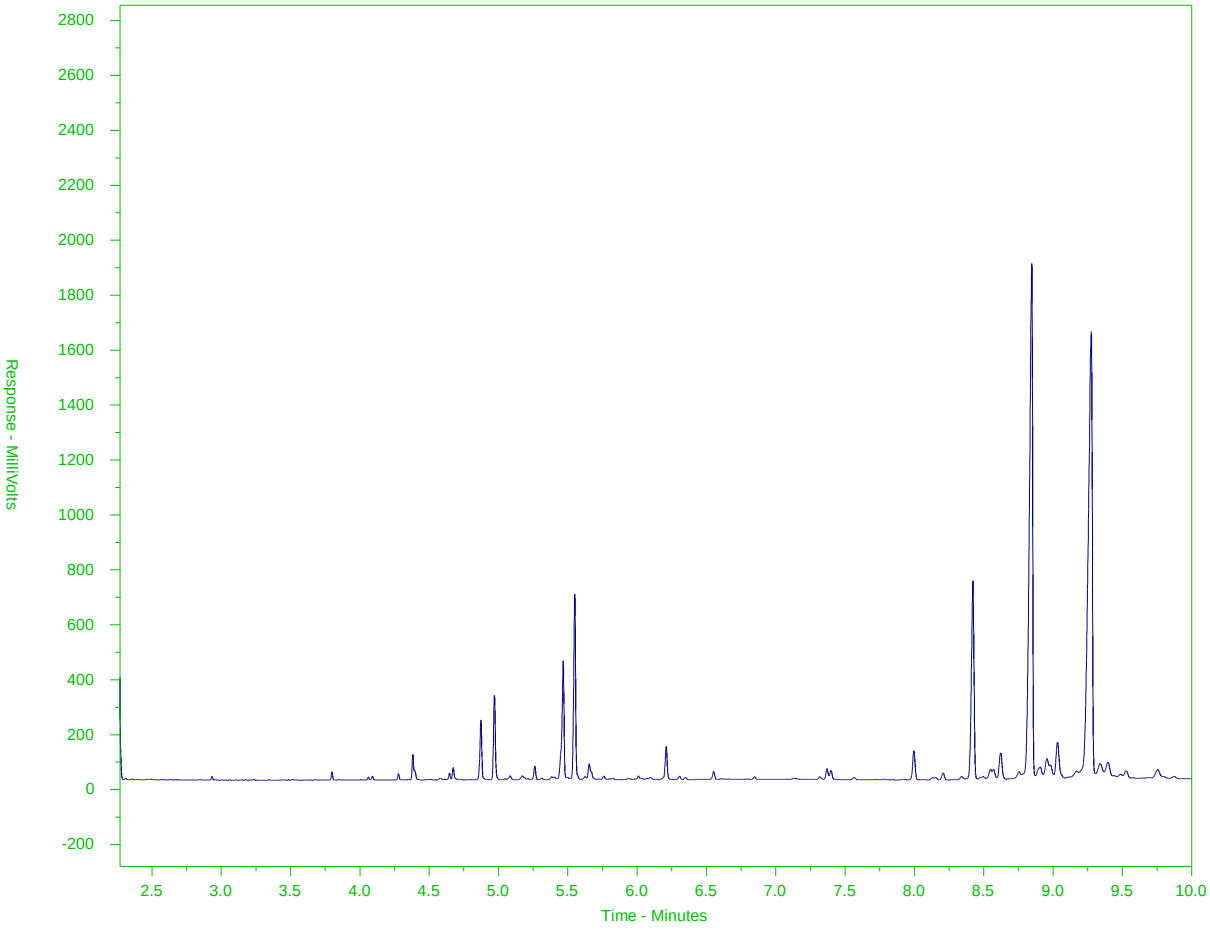
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959111-6
Client Sample ID: EIRA-6



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1959111-COFC

COC Number: 15 - 608561

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution		Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply	
Company:	AECOM	Select Report Format:	PDF EXCEL EDD (DIGITAL)	Regular [R]	Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report	YES NO	PRIORITY (Business Days) 4 day [P4]	EMERGENCY 1 Business day [E1]
Phone:	604 444 6400	Compare Results to Criteria on Report - provide details below if box checked		3 day [P3]	Same Day, Weekend or Statutory holiday [E0]
	Company address below will appear on the final report	Select Distribution:	EMAIL MAIL FAX	2 day [P2]	
Street:	3292 Production Way	Email 1 or Fax	michael.gill@aecom.com	Date and Time Required for all E&P TATs:	ASAP
City/Province:	Burnaby B.C.	Email 2	leslie.southern@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.	
Postal Code:		Email 3		Analysis Request	

Invoice To		Invoice Distribution	
	Same as Report To YES NO		
	Copy of Invoice with Report YES NO	Select Invoice Distribution:	EMAIL MAIL FAX
Company:	Chevron Canada	Email 1 or Fax	Same as above
Contact:	Chris Boyle	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Beam Wall	Sampler: EAP/JB

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals
	EIRA-1	14-Jul-17	12:30	Sediment	P	X	X	X
	EIRA-2		12:45					
	EIRA-3		14:20					
	EIRA-4		14:10					
	EIRA-5		14:30					
	EIRA-6		14:45					
	[redacted]							

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES NO	BC CSR
Are samples for human drinking water use? YES NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No
Ice Packs	Ice Cubes	Custody seal intact	Yes	No
Cooling Initiated				

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES			
29.2	29.6	28.2	29.4	29.7	29.9		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time
Justin Beeler	July 14, 2017	17:08	Alex	14/07/2017	17:10			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

White Paper Co. 604 951-3900

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 17-JUL-17
Report Date: 19-JUL-17 00:46 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1959524

Project P.O. #: 0015243589
Job Reference: 60542455 SOIL ANALYSIS
C of C Numbers: 15-609400
Legal Site Desc: Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1959524-1	L1959524-2	L1959524-3	L1959524-4	L1959524-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	15-JUL-17	15-JUL-17	15-JUL-17	15-JUL-17	15-JUL-17
Sampled Time	14:20	14:40	14:48	14:50	14:55
Client ID	WSA-10	WSA-11	WSA-12	WSA-13	WSA-14
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	14.7	24.9	22.5	19.8	17.8
pH (1:2 soil:water) (pH)	7.58	7.57	7.11	6.90	8.41
Metals Antimony (Sb) (mg/kg)	0.17	0.27	0.25	0.20	0.26
Arsenic (As) (mg/kg)	1.94	3.41	4.04	3.30	3.32
Barium (Ba) (mg/kg)	122	27.8	24.4	26.6	24.8
Beryllium (Be) (mg/kg)	0.26	0.25	0.21	0.18	0.21
Cadmium (Cd) (mg/kg)	<0.050	0.057	0.069	0.083	0.110
Chromium (Cr) (mg/kg)	12.6	14.9	15.0	19.3	11.8
Cobalt (Co) (mg/kg)	8.72	7.35	6.77	7.78	6.87
Copper (Cu) (mg/kg)	27.2	23.2	18.9	16.2	21.4
Lead (Pb) (mg/kg)	5.84	11.7	12.7	4.78	15.8
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.235
Molybdenum (Mo) (mg/kg)	0.32	0.94	1.07	1.13	0.64
Nickel (Ni) (mg/kg)	8.20	9.24	9.57	9.13	9.02
Selenium (Se) (mg/kg)	<0.20	<0.20	0.23	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	0.053	<0.050
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U) (mg/kg)	0.774	2.48	2.60	2.62	0.706
Vanadium (V) (mg/kg)	70.6	62.6	54.1	58.1	47.8
Zinc (Zn) (mg/kg)	52.2	47.3	39.6	35.9	62.9
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
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
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) (%)	90.5	84.4	89.7	89.7	92.2
Surrogate: 1,4-Difluorobenzene (SS) (%)	88.1	85.0	92.9	92.9	89.9
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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1959524-6	L1959524-7	L1959524-8		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	15-JUL-17	15-JUL-17	15-JUL-17		
	Sampled Time	15:05	15:10	15:30		
	Client ID	WSA-15	WSA-16	WSA-17		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	23.1	20.0	17.8		
	pH (1:2 soil:water) (pH)	7.49	7.61	7.31		
Metals	Antimony (Sb) (mg/kg)	0.33	0.22	0.20		
	Arsenic (As) (mg/kg)	2.66	2.14	3.70		
	Barium (Ba) (mg/kg)	33.5	28.0	32.3		
	Beryllium (Be) (mg/kg)	0.19	0.27	0.22		
	Cadmium (Cd) (mg/kg)	0.526	<0.050	<0.050		
	Chromium (Cr) (mg/kg)	20.0	14.2	18.3		
	Cobalt (Co) (mg/kg)	12.4	9.44	8.35		
	Copper (Cu) (mg/kg)	27.3	31.9	30.0		
	Lead (Pb) (mg/kg)	4.93	6.92	4.76		
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050		
	Molybdenum (Mo) (mg/kg)	0.64	0.31	0.67		
	Nickel (Ni) (mg/kg)	10.7	7.84	9.13		
	Selenium (Se) (mg/kg)	0.40	<0.20	<0.20		
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		
	Thallium (Tl) (mg/kg)	0.179	0.056	0.067		
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
	Uranium (U) (mg/kg)	4.04	2.55	1.69		
	Vanadium (V) (mg/kg)	73.5	84.5	75.6		
	Zinc (Zn) (mg/kg)	47.5	52.2	45.1		
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH		
	Benzene (mg/kg)	<0.0050	<0.0050	<0.0050		
	Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015		
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20		
	Styrene (mg/kg)	<0.050	<0.050	<0.050		
	Toluene (mg/kg)	<0.050	<0.050	<0.050		
	ortho-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	meta- & para-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	Xylenes (mg/kg)	<0.075	<0.075	<0.075		
	Surrogate: 4-Bromofluorobenzene (SS) (%)	94.6	83.7	98.5		
	Surrogate: 1,4-Difluorobenzene (SS) (%)	97.4	91.5	100.6		
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200		
	EPH19-32 (mg/kg)	<200	<200	<200		
	LEPH (mg/kg)	<200	<200	<200		
	HEPH (mg/kg)	<200	<200	<200		
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100		

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1959524-1	L1959524-2	L1959524-3	L1959524-4	L1959524-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	15-JUL-17	15-JUL-17	15-JUL-17	15-JUL-17	15-JUL-17
Sampled Time	14:20	14:40	14:48	14:50	14:55
Client ID	WSA-10	WSA-11	WSA-12	WSA-13	WSA-14
Grouping / **Analyte**					
SOIL					
Hydrocarbons VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
Surrogate: 2-Bromobenzotrifluoride (%)	81.3	81.3	81.1	85.8	88.6
Surrogate: 3,4-Dichlorotoluene (SS) (%)	94.9	124.5	124.3	108.8	123.0
Polycyclic Aromatic Hydrocarbons Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.053
Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.111
Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.097
Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.069
Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.129
Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.123
Surrogate: Acenaphthene d10 (%)	88.4	88.2	88.2	81.4	96.0
Surrogate: Chrysene d12 (%)	85.9	91.3	91.2	92.8	99.5
Surrogate: Naphthalene d8 (%)	61.1	73.6	64.9	68.2	86.3
Surrogate: Phenanthrene d10 (%)	89.7	90.6	92.1	89.4	101.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1959524-6	L1959524-7	L1959524-8		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	15-JUL-17	15-JUL-17	15-JUL-17		
	Sampled Time	15:05	15:10	15:30		
	Client ID	WSA-15	WSA-16	WSA-17		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	88.5	88.5	85.2		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	109.4	100.6	106.4		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	83.3	86.6	81.0		
	Surrogate: Chrysene d12 (%)	97.4	95.3	93.3		
	Surrogate: Naphthalene d8 (%)	76.8	76.3	66.9		
	Surrogate: Phenanthrene d10 (%)	91.1	88.9	84.8		

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

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:

15-609400

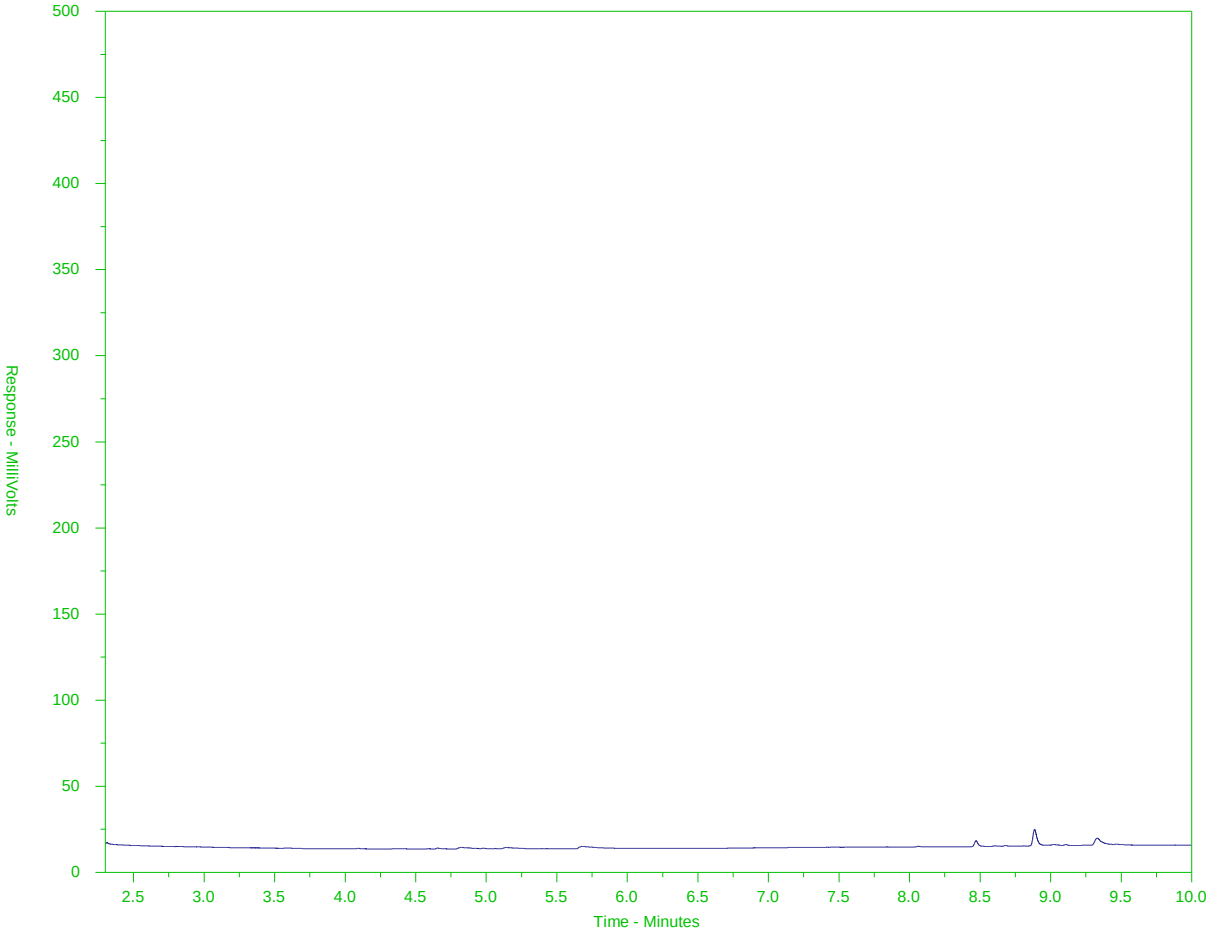
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1959524-1
Client Sample ID: WSA-10



← 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.

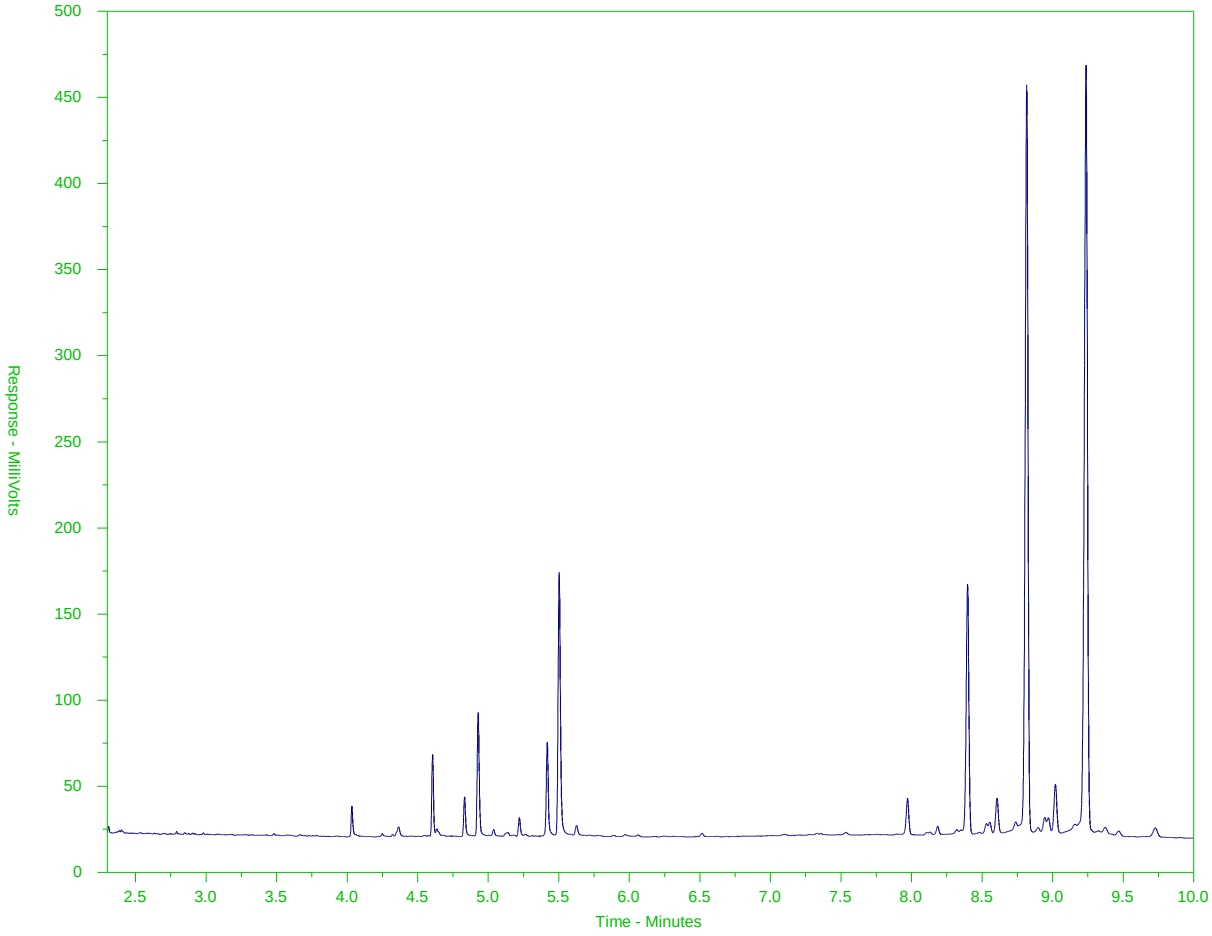
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-2
Client Sample ID: WSA-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 →		

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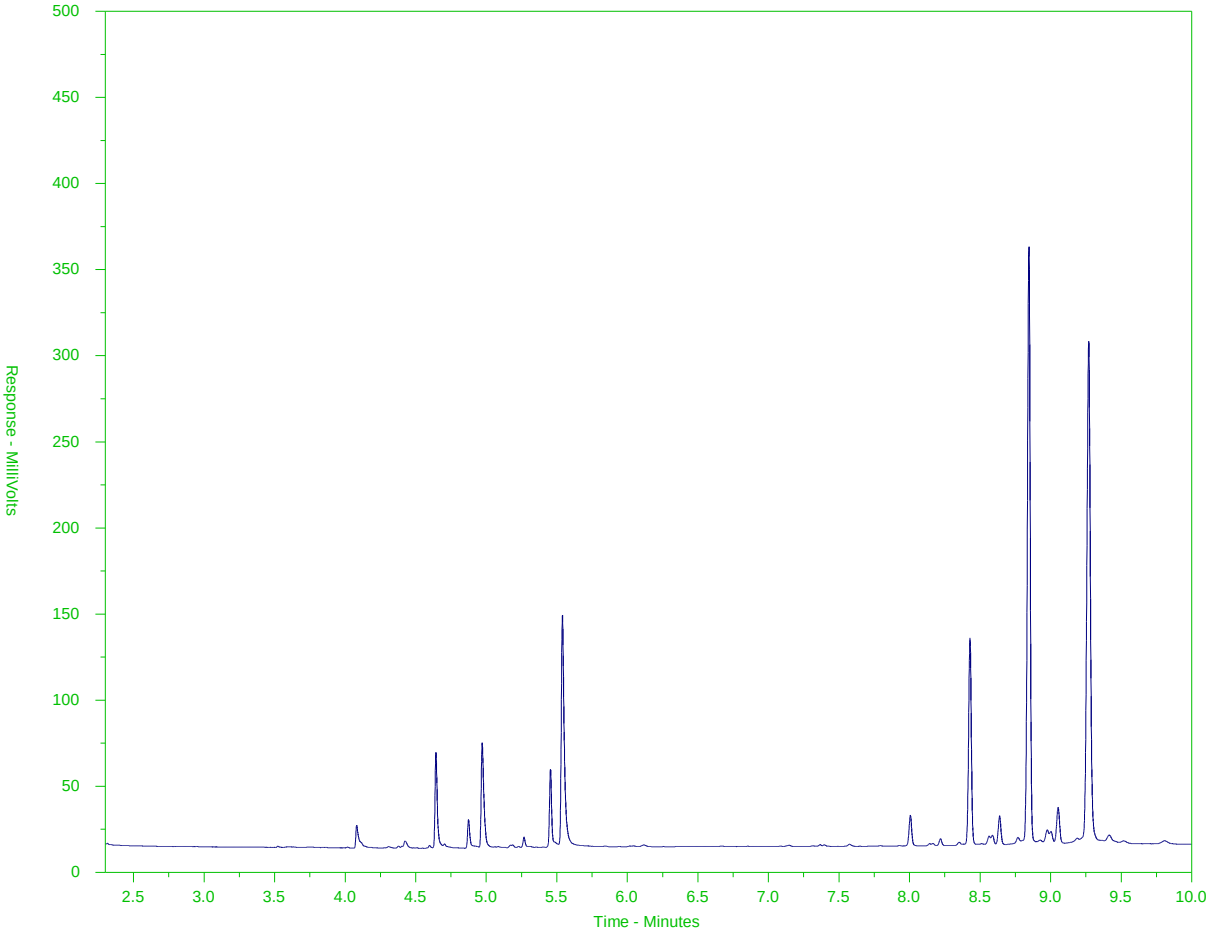
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-3
Client Sample ID: WSA-12



← 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 →		

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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.

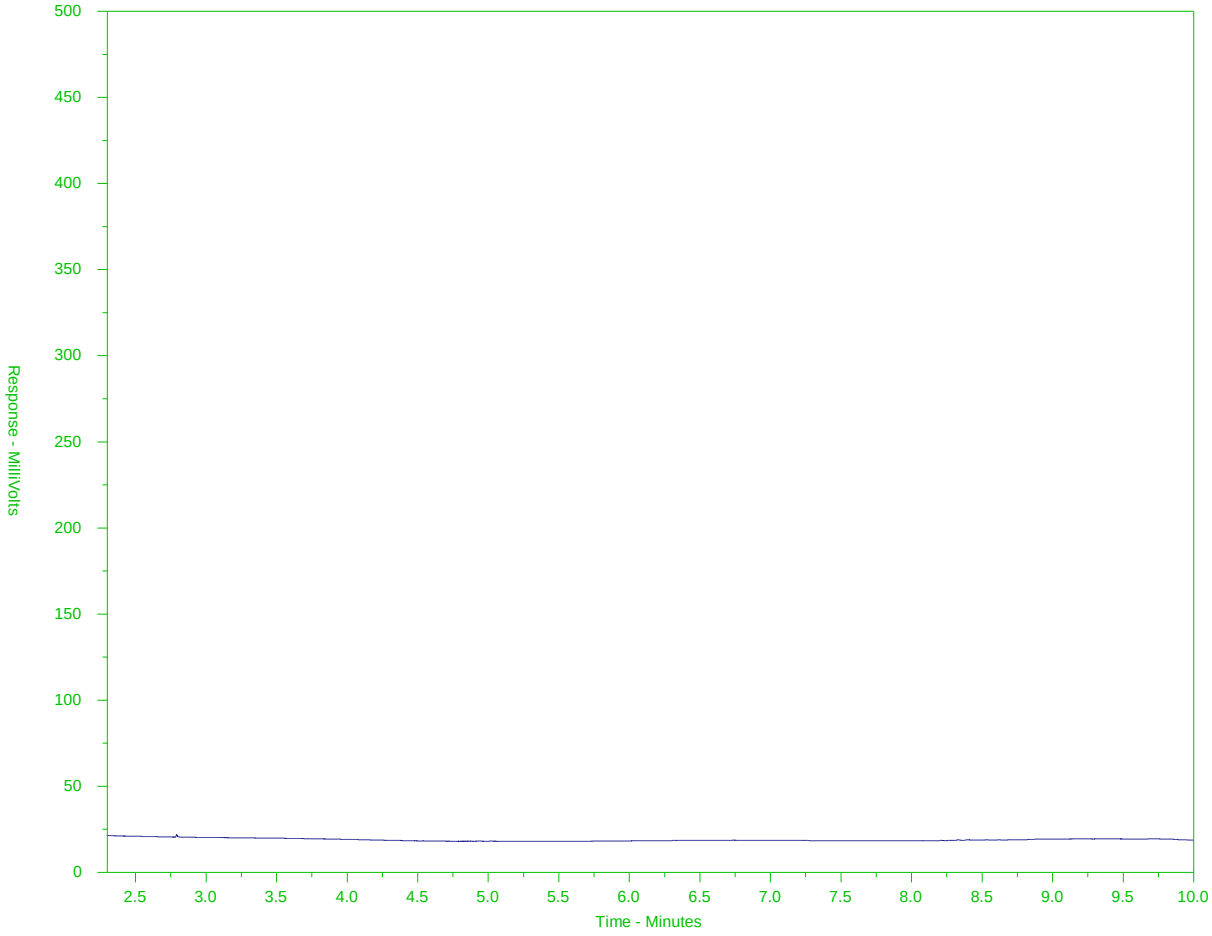
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-4
Client Sample ID: WSA-13



← 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 →		

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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.

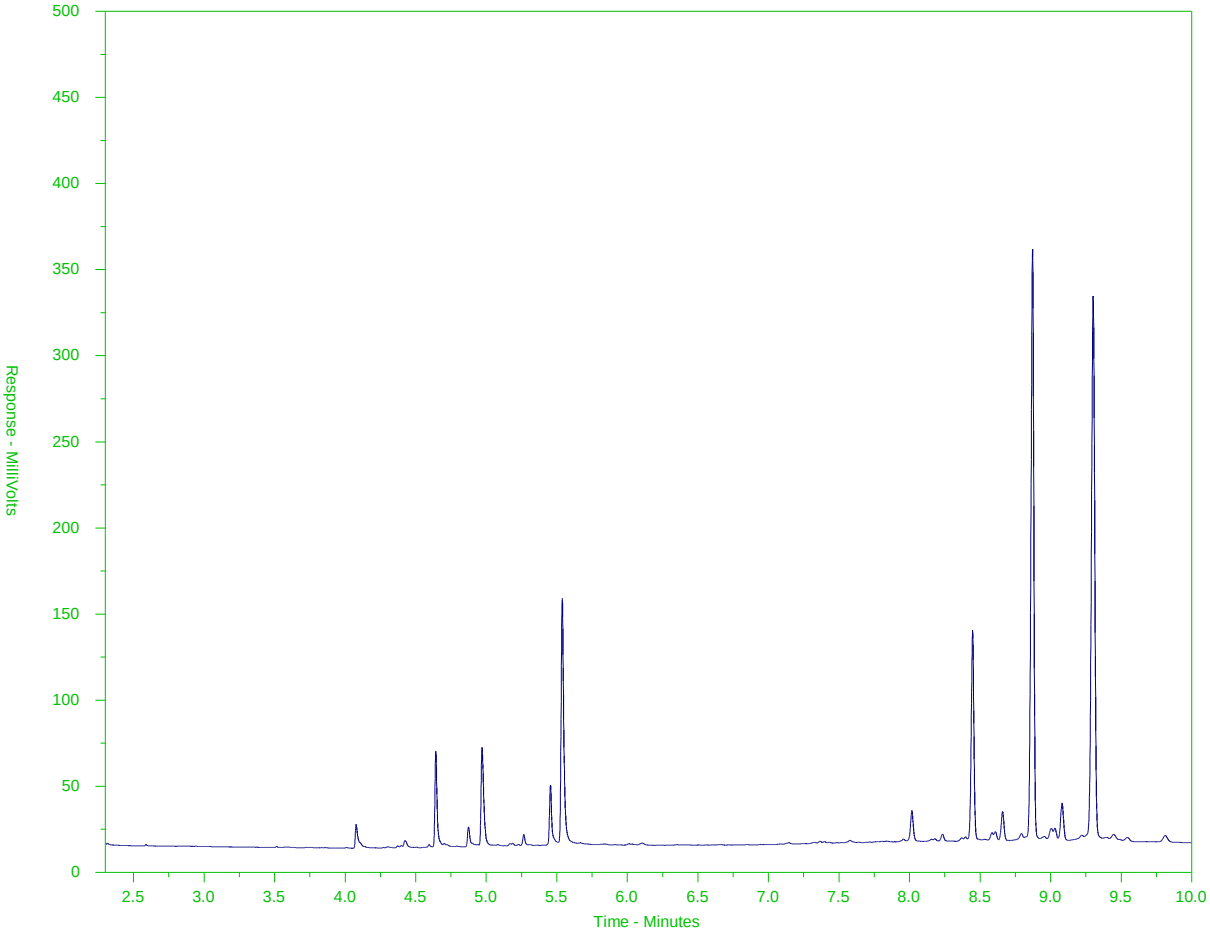
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-5
Client Sample ID: WSA-14



← 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 →		

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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.

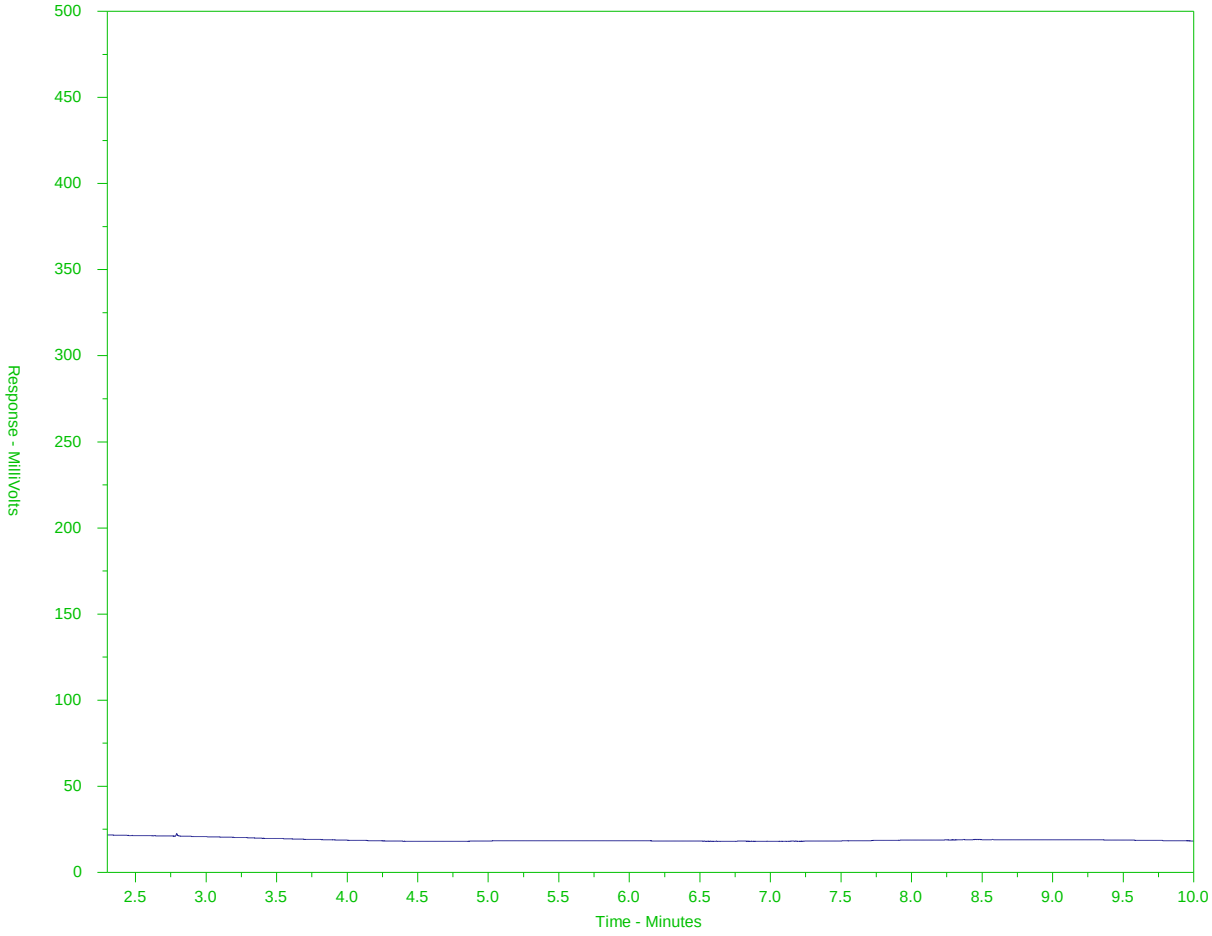
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-6
Client Sample ID: WSA-15



← 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.

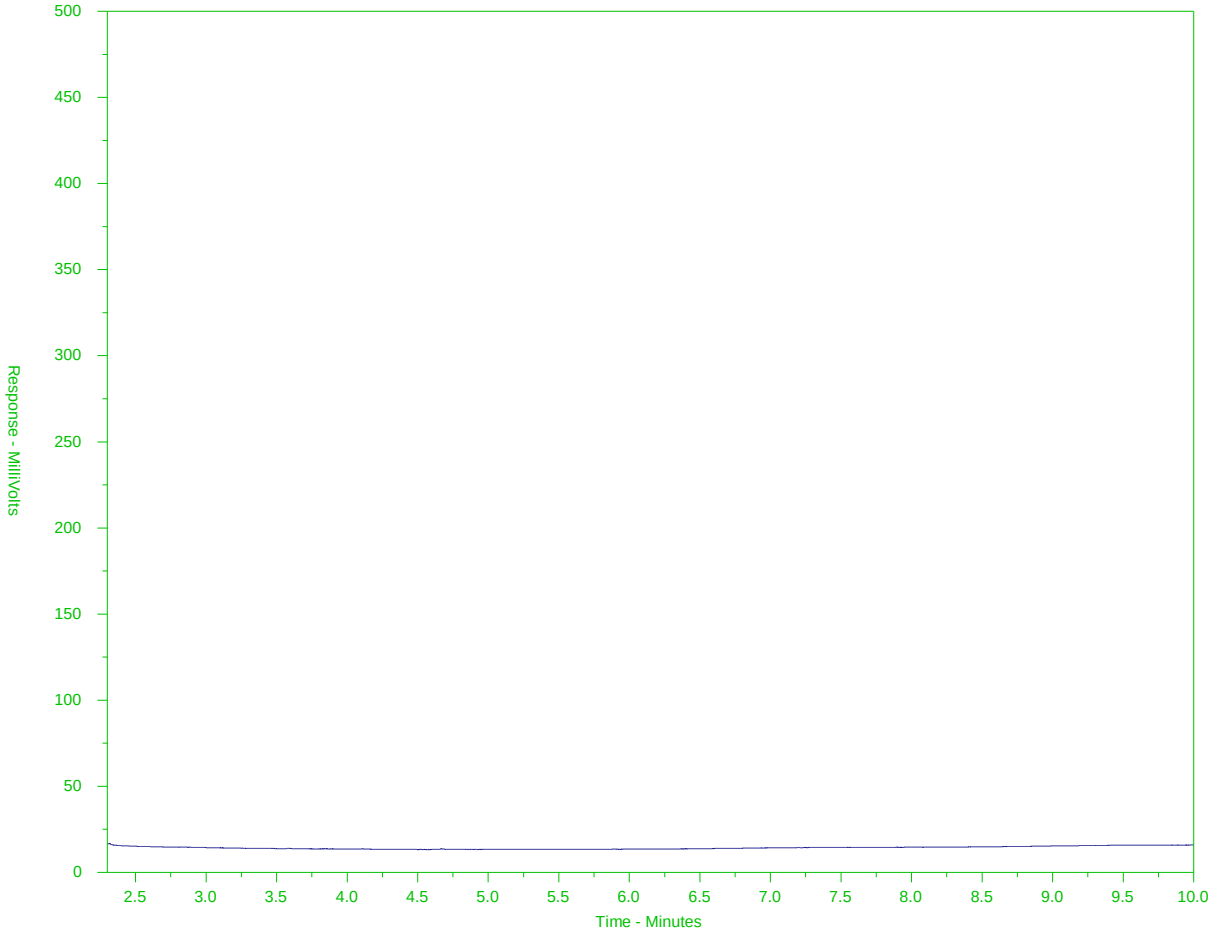
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-7
Client Sample ID: WSA-16



← 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.

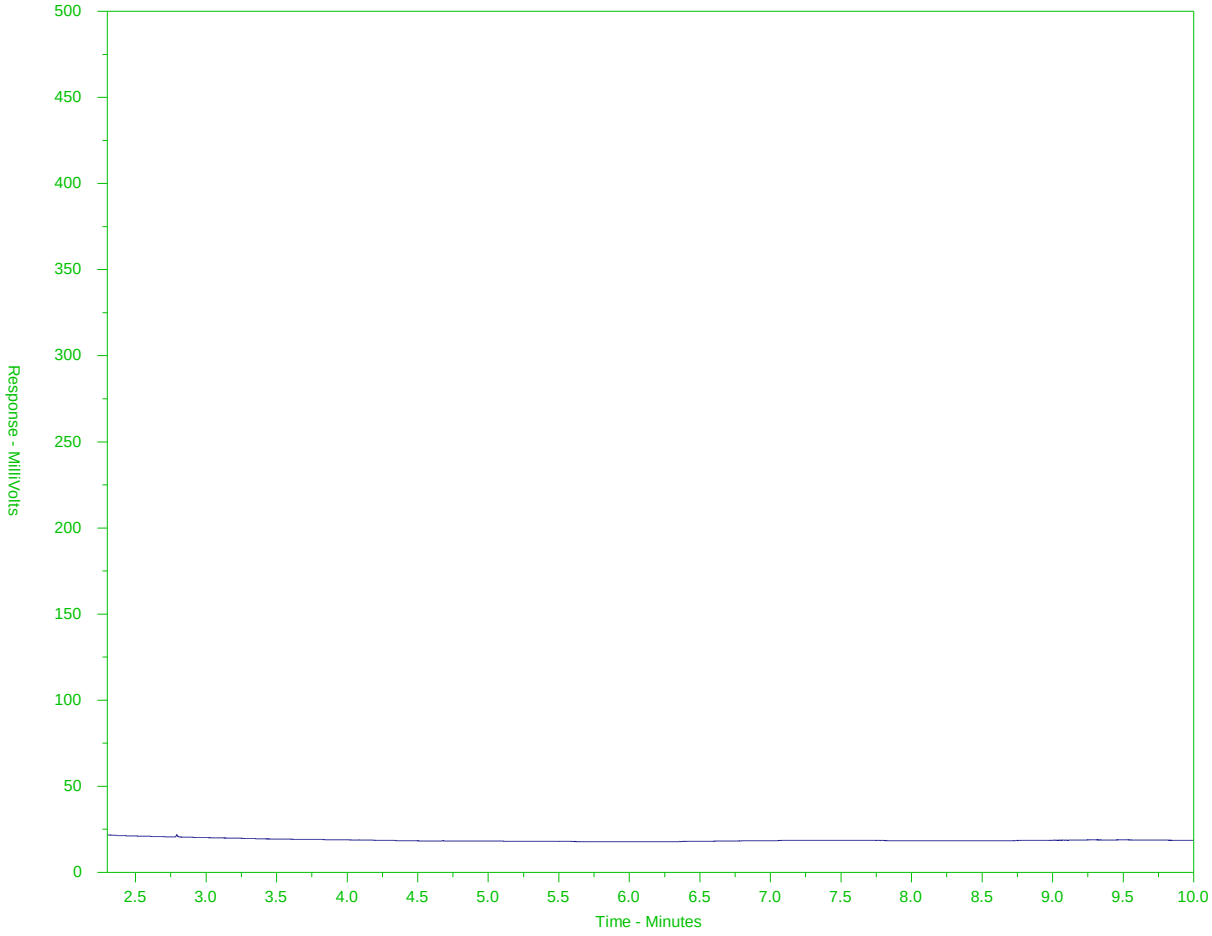
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959524-8
Client Sample ID: WSA-17



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1959524-COFC

COC Number: 15 - 609400

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	AECOM	Select Report Format: PDF, EXCEL, EDD (DIGITAL)	Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report: YES, NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☒
Phone:	604 444 6400	Compare Results to Criteria on Report - provide details below if box checked	
Company address below will appear on the final report		Select Distribution: EMAIL, MAIL, FAX	Date and Time Required for all E&P TATs: ASAP
Street:	3292 Production Way	Email 1: michael.gill@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Burnaby B.C.	Email 2: Leslie.Southern@aecom.com	
Postal Code:		Email 3	

Invoice To		Invoice Distribution	Analysis Request
	Same as Report To: YES, NO	Select Invoice Distribution: EMAIL, MAIL, FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report: YES, NO	Email 1 or Fax: Same as above	
Company:	Chevron Canada Ltd	Email 2	
Contact:	Chris Boys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: EAP + JB

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	WSA-10	15-Jul-17	14:20	Sediment	X	X	X	4
	WSA-11		14:40					
	WSA-12		14:48					
	WSA-13		14:50					
	WSA-14		14:55					
	WSA-15		15:05					
	WSA-16		15:10					
	WSA-17		15:30					

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES, NO	BC CSR
Are samples for human drinking water use? YES, NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			4	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JC	Date: 7/17/17	Time: 1138AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 17-JUL-17
Report Date: 19-JUL-17 00:55 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1959529

Project P.O. #: 0015243589
Job Reference: 60542455 SOIL ANALYSIS
C of C Numbers: 15-609401
Legal Site Desc: foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1959529-1	L1959529-2	L1959529-3	L1959529-4	L1959529-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	17-JUL-17	17-JUL-17	17-JUL-17	17-JUL-17	17-JUL-17
Sampled Time	07:35		09:10	09:14	05:00
Client ID	EIRA-7	DUP-1	ESA-1	ESA-2	ESA-3
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	22.0	23.4	17.8	19.6	21.2
pH (1:2 soil:water) (pH)	8.78	8.45	6.86	8.65	6.11
Metals Antimony (Sb) (mg/kg)	<0.10	<0.10	0.22	0.14	0.14
Arsenic (As) (mg/kg)	1.31	1.14	3.88	1.62	1.89
Barium (Ba) (mg/kg)	51.1	40.6	55.1	52.2	67.1
Beryllium (Be) (mg/kg)	0.18	0.18	0.27	0.23	0.42
Cadmium (Cd) (mg/kg)	0.051	<0.050	<0.050	<0.050	<0.050
Chromium (Cr) (mg/kg)	7.20	6.68	17.9	12.6	16.2
Cobalt (Co) (mg/kg)	3.03	2.80	8.77	4.31	10.8
Copper (Cu) (mg/kg)	7.08	6.61	17.9	14.3	35.4
Lead (Pb) (mg/kg)	4.23	3.85	7.73	5.58	7.17
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo) (mg/kg)	0.37	0.23	0.75	0.44	0.37
Nickel (Ni) (mg/kg)	5.40	4.77	7.64	6.29	11.9
Selenium (Se) (mg/kg)	<0.20	<0.20	0.29	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (Tl) (mg/kg)	<0.050	<0.050	0.056	<0.050	0.060
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U) (mg/kg)	0.875	0.669	0.917	0.855	0.498
Vanadium (V) (mg/kg)	28.1	29.5	83.0	54.5	65.5
Zinc (Zn) (mg/kg)	19.6	18.4	47.1	33.9	57.8
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
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
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) (%)	74.0	61.8 SURR-ND	80.2	72.2	81.3
Surrogate: 1,4-Difluorobenzene (SS) (%)	87.8	71.2	93.7	86.5	92.5
Hydrocarbons EPH10-19 (mg/kg)	<200	<200	<200	<200	<200
EPH19-32 (mg/kg)	550	750	<200	210	<200
LEPH (mg/kg)	<200	<200	<200	<200	<200
HEPH (mg/kg)	550	750	<200	210	<200

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1959529-6				
	Description	Sediment				
	Sampled Date	17-JUL-17				
	Sampled Time	09:20				
	Client ID	ESA-4				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	18.6				
	pH (1:2 soil:water) (pH)	7.79				
Metals	Antimony (Sb) (mg/kg)	0.18				
	Arsenic (As) (mg/kg)	1.55				
	Barium (Ba) (mg/kg)	27.0				
	Beryllium (Be) (mg/kg)	0.21				
	Cadmium (Cd) (mg/kg)	<0.050				
	Chromium (Cr) (mg/kg)	12.8				
	Cobalt (Co) (mg/kg)	5.75				
	Copper (Cu) (mg/kg)	21.0				
	Lead (Pb) (mg/kg)	6.93				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.43				
	Nickel (Ni) (mg/kg)	6.90				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	0.055				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.588				
	Vanadium (V) (mg/kg)	59.5				
	Zinc (Zn) (mg/kg)	46.0				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	78.3				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.5				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	<200				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1959529-1	L1959529-2	L1959529-3	L1959529-4	L1959529-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	17-JUL-17	17-JUL-17	17-JUL-17	17-JUL-17	17-JUL-17
Sampled Time	07:35		09:10	09:14	05:00
Client ID	EIRA-7	DUP-1	ESA-1	ESA-2	ESA-3
Grouping / **Analyte**					
SOIL					
Hydrocarbons Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	<100	<100
VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
Surrogate: 2-Bromobenzotrifluoride (%)	86.1	84.1	83.4	85.8	85.4
Surrogate: 3,4-Dichlorotoluene (SS) (%)	74.2	72.2	88.3	69.1 SURR-ND	81.7
Polycyclic Aromatic Hydrocarbons Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Surrogate: Acenaphthene d10 (%)	97.1	114.7	82.9	92.1	96.2
Surrogate: Chrysene d12 (%)	93.4	108.9	92.7	94.9	90.6
Surrogate: Naphthalene d8 (%)	93.4	108.6	79.9	88.0	94.9
Surrogate: Phenanthrene d10 (%)	96.2	114.7	88.2	95.1	96.6

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1959529-6				
	Description	Sediment				
	Sampled Date	17-JUL-17				
	Sampled Time	09:20				
	Client ID	ESA-4				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				
	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	93.0				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	82.8				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	92.7				
	Surrogate: Chrysene d12 (%)	99.6				
	Surrogate: Naphthalene d8 (%)	88.5				
	Surrogate: Phenanthrene d10 (%)	98.4				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

XYLENES-CALC-VA	Soil	Sum of Xylene Isomer Concentrations	EPA 8260B & 524.2

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:

15-609401

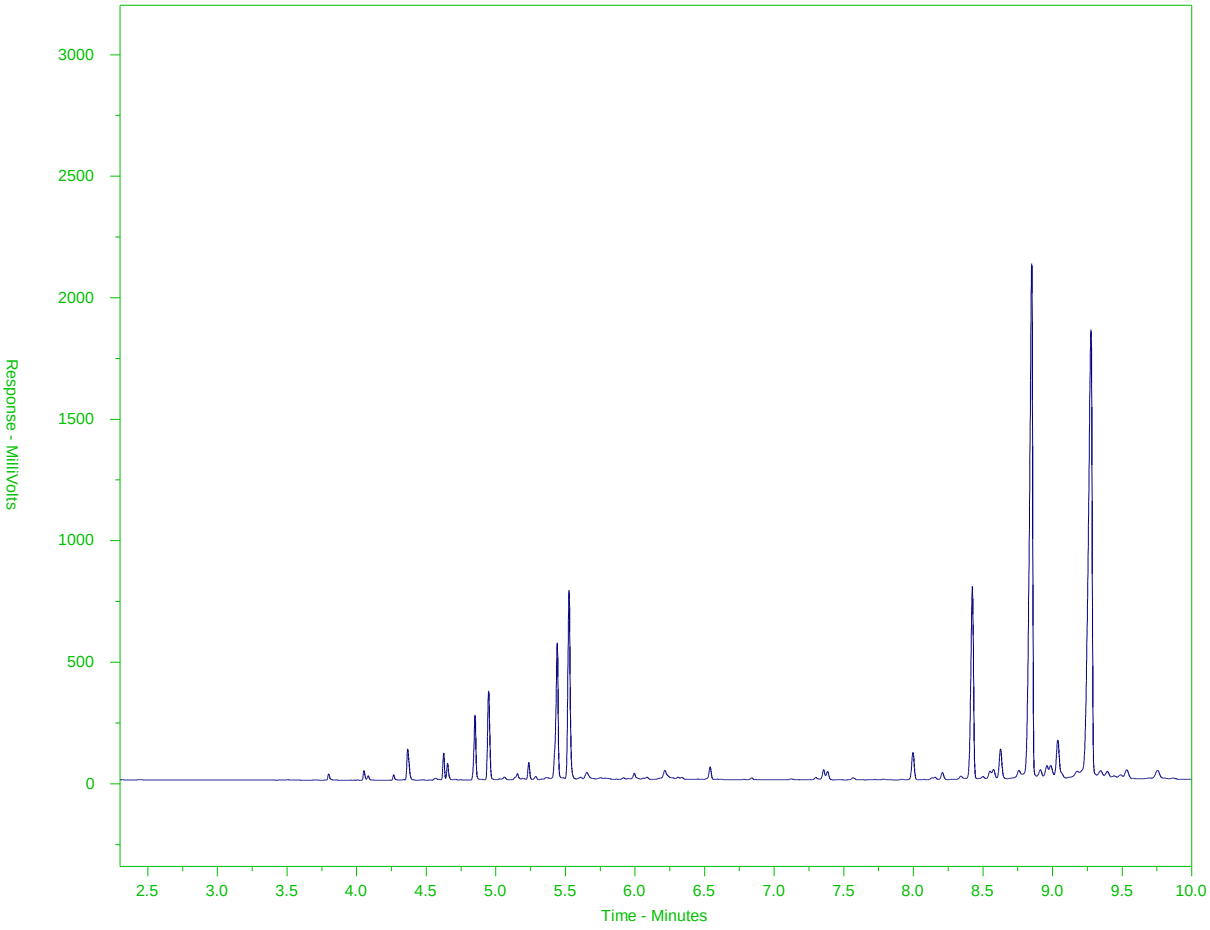
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1959529-1
Client Sample ID: EIRA-7



← 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.

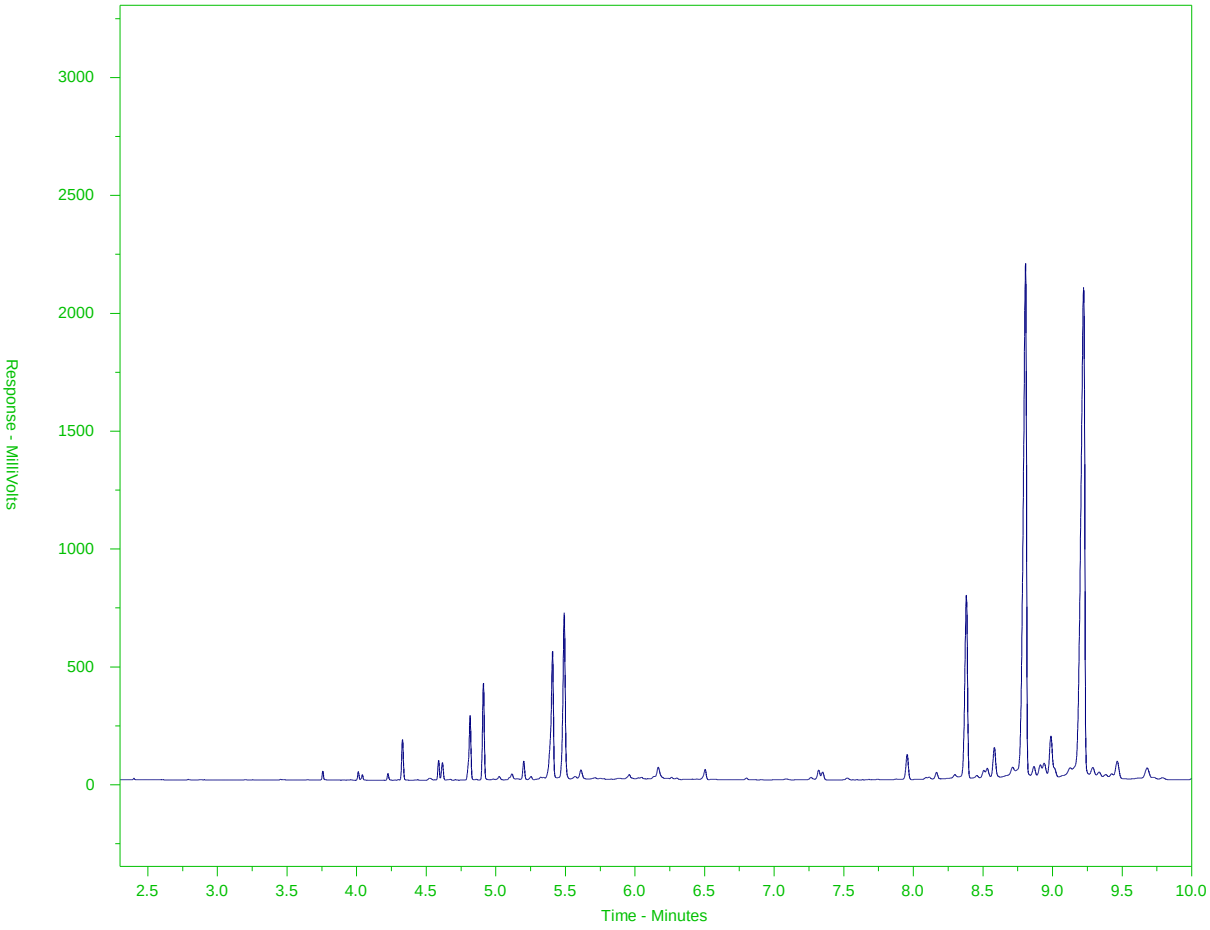
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2571988-6#L1959529-1
Client Sample ID: EIRA-7



← 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.

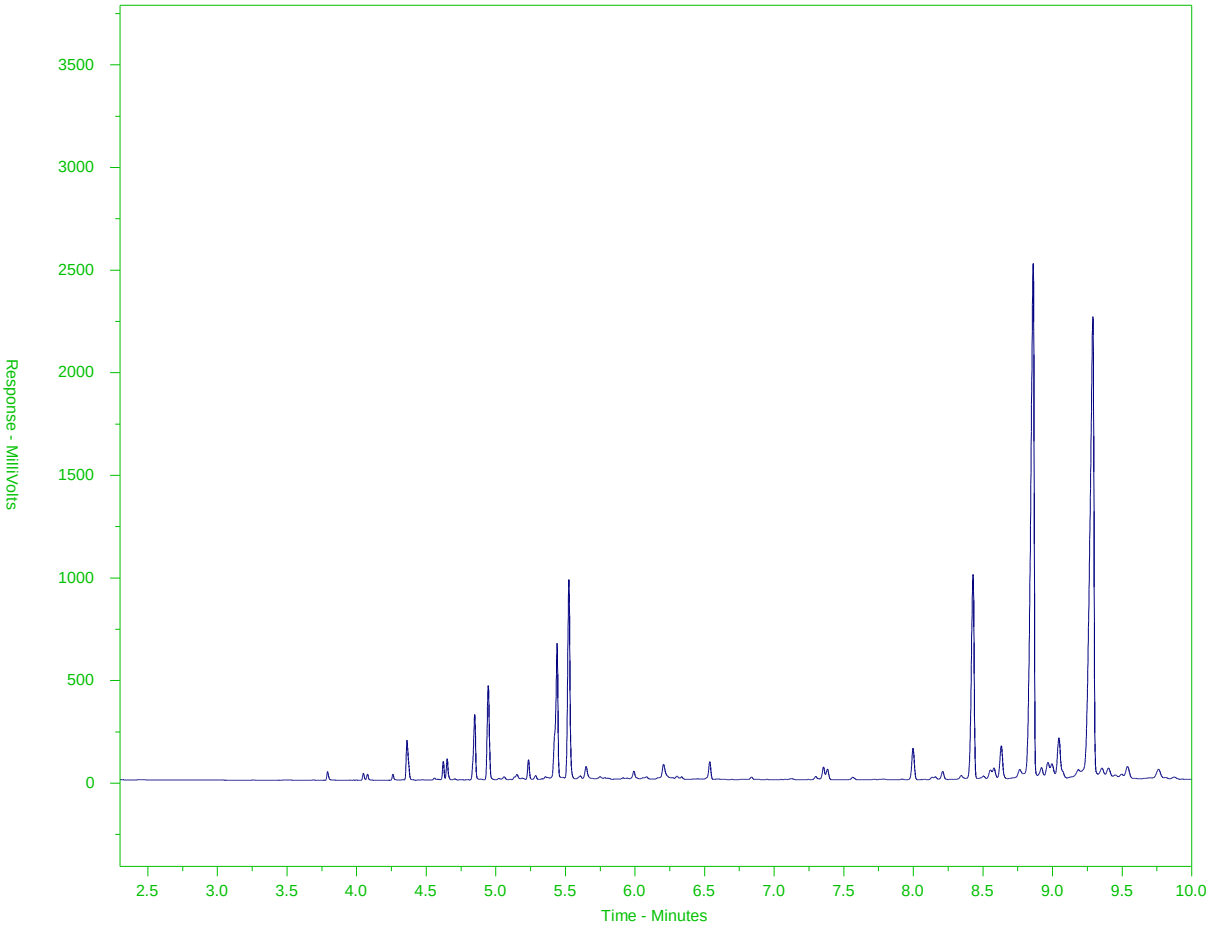
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959529-2
Client Sample ID: DUP-1



← 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.

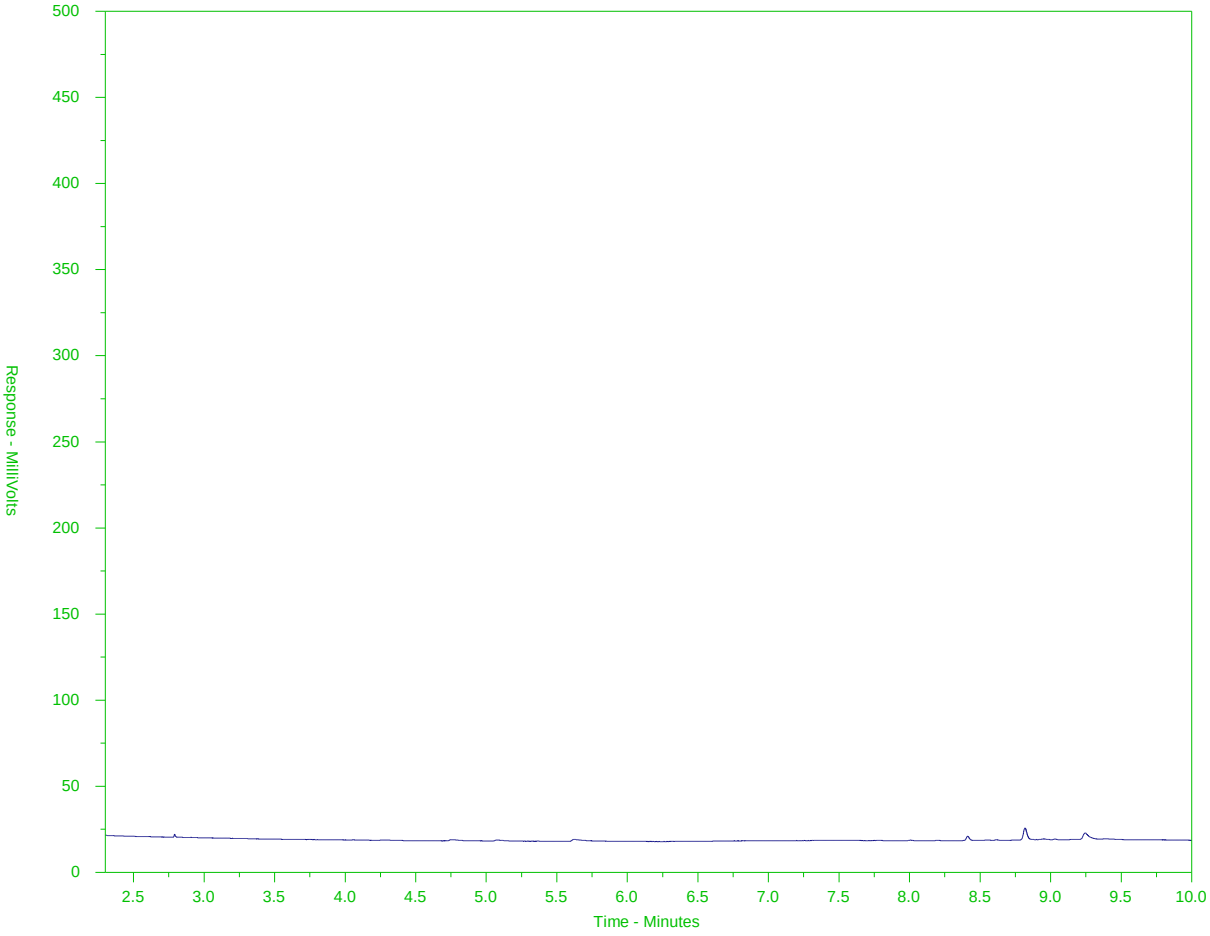
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959529-3
Client Sample ID: ESA-1



← 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 →		

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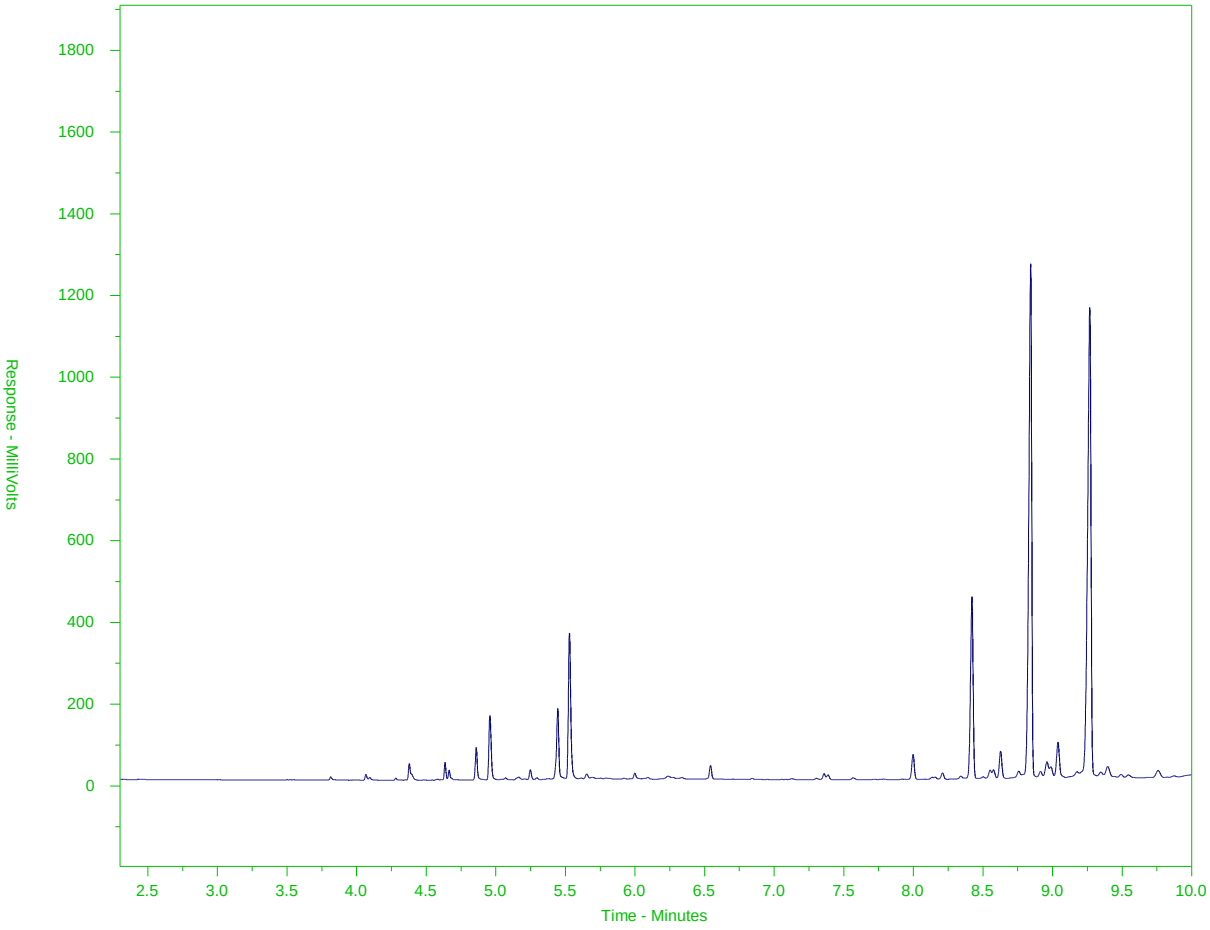
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1959529-4
Client Sample ID: ESA-2



← 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 →		

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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.

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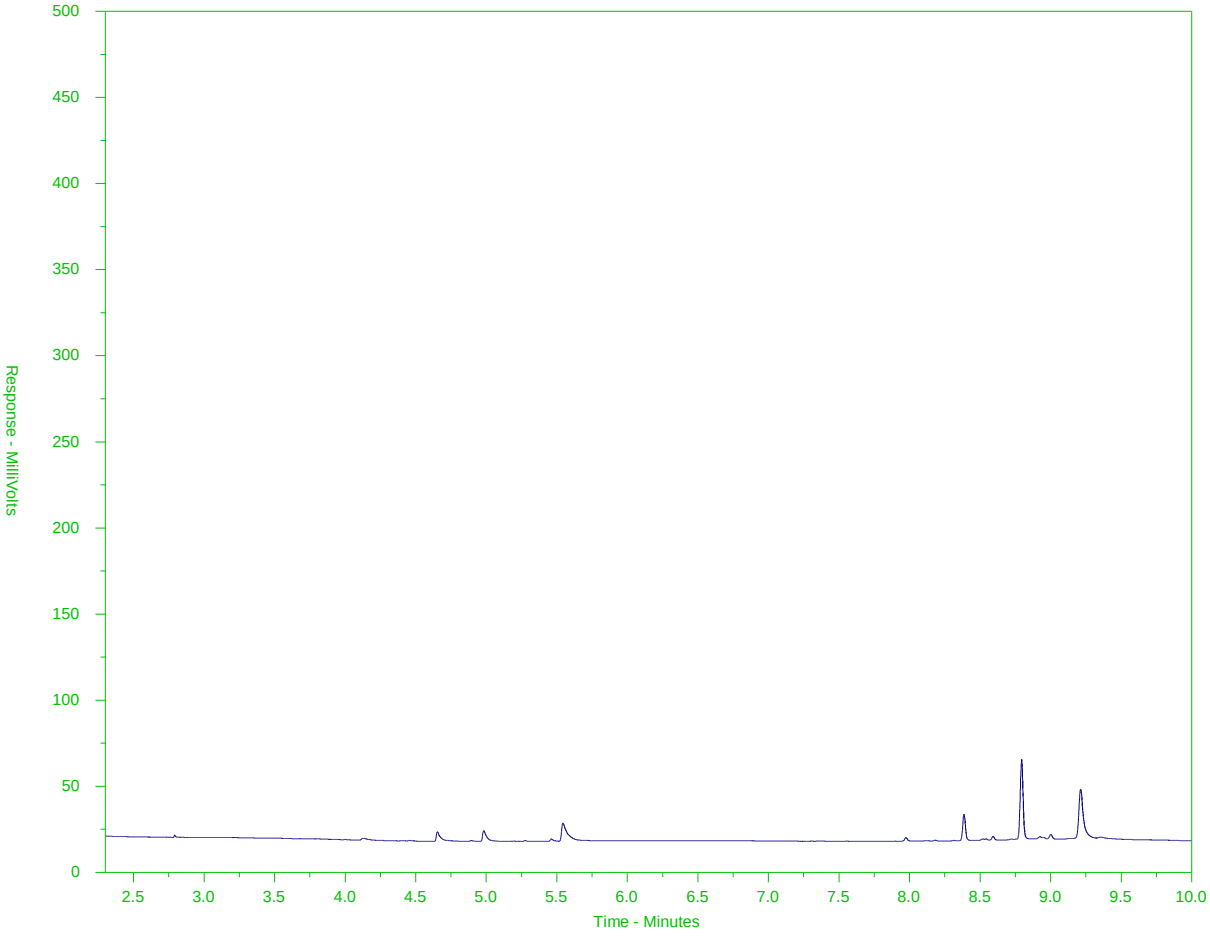
Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1959529-5
Client Sample ID: ESA-3



← 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 →		

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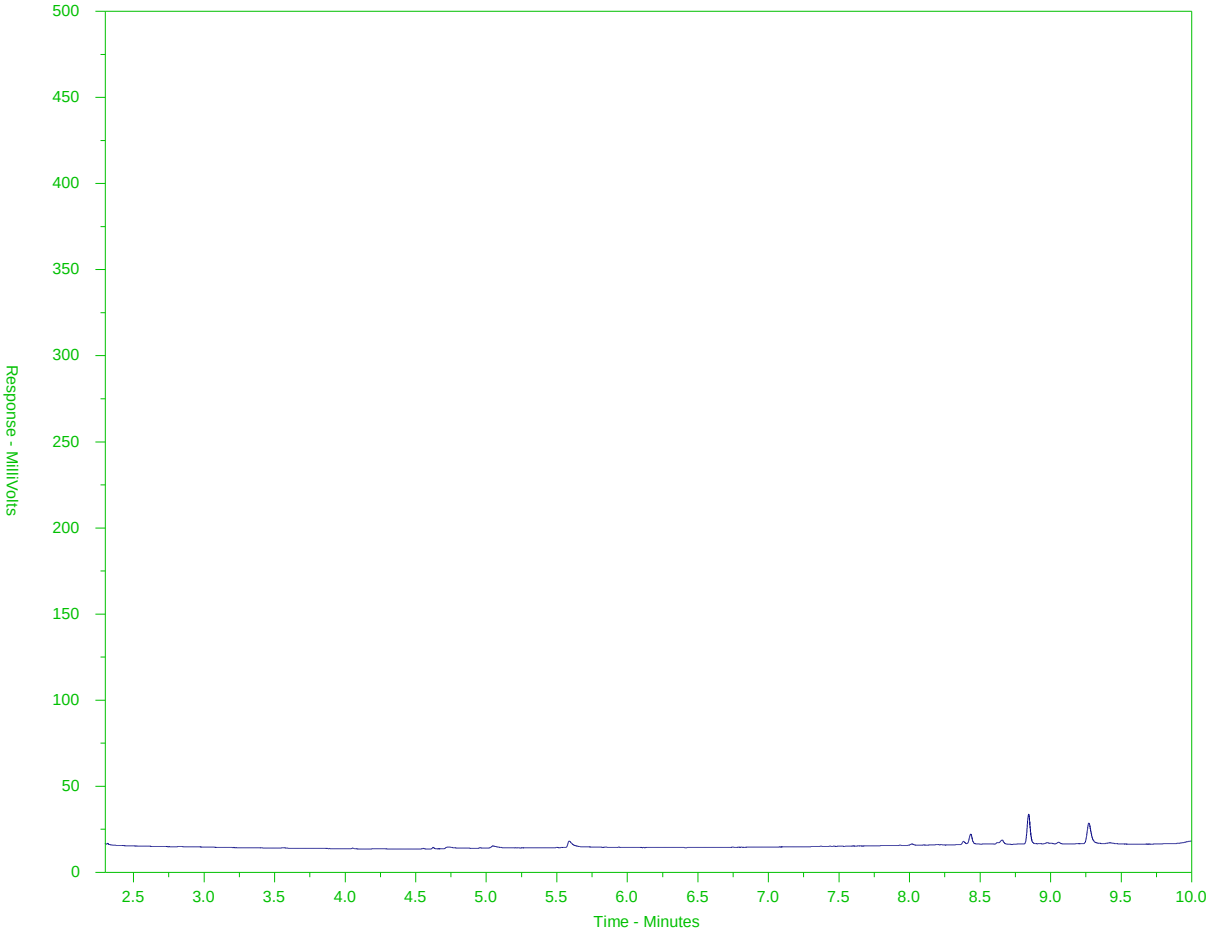
BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1959529-6
Client Sample ID: ESA-4



← 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 →		

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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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1959529-COFC

COC Number: 15 - 609401

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	

Invoice To		
	Same as Report To	YES ☒ NO
	Copy of Invoice with Report	☒ YES ☐ NO
Company:	Chevron Canada Ltd	
Contact:	Chris Boys	

Project Information

ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore
ALS Lab Work Order # (lab use only)	

Report Format / Distribution

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☒ YES ☐ NO

☒ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1: Michael.Gill@aecom.com

Email 2: Leslie.Southern@aecom.com

Email 3

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Same as above

Email 2

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Selin Watt	Sampler: EAP/JB

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☒

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX/VPH (P)	Lead/HEPH (P)	Metals (P)	Number of Containers
	EIRA-7	17-Jul-17	7:35 AM	Sediment	X	X	X	4
	DUP-1		9:10					
	ESA-1		9:14					
	ESA-2		9:17					
	ESA-3		9:20					
	ESA-4							

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			25.3		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Justin Becker	Date: July 17th, 2017	Time: 12:05	Received by:	Date:	Time:	Received by: PAUL	Date: JUL 17	Time: 12:05

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 18-JUL-17
Report Date: 01-AUG-17 17:06 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1960419

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609402
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1960419-1				
	Description	SEDIMENT				
	Sampled Date	18-JUL-17				
	Sampled Time	09:25				
	Client ID	ESA-5				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	19.6				
	pH (1:2 soil:water) (pH)	6.87				
Metals	Antimony (Sb) (mg/kg)	0.46				
	Arsenic (As) (mg/kg)	2.61				
	Barium (Ba) (mg/kg)	73.2				
	Beryllium (Be) (mg/kg)	0.31				
	Cadmium (Cd) (mg/kg)	<0.050				
	Chromium (Cr) (mg/kg)	13.5				
	Cobalt (Co) (mg/kg)	10.2				
	Copper (Cu) (mg/kg)	27.0				
	Lead (Pb) (mg/kg)	4.93				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.36				
	Nickel (Ni) (mg/kg)	7.95				
	Selenium (Se) (mg/kg)	0.21				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	0.078				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.499				
	Vanadium (V) (mg/kg)	68.3				
	Zinc (Zn) (mg/kg)	58.1				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	97.7				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.5				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	<200				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1960419-1				
	Description	SEDIMENT				
	Sampled Date	18-JUL-17				
	Sampled Time	09:25				
	Client ID	ESA-5				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	83.4				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	93.9				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	80.3				
	Surrogate: Chrysene d12 (%)	80.4				
	Surrogate: Naphthalene d8 (%)	76.5				
	Surrogate: Phenanthrene d10 (%)	77.8				

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

XYLENES-CALC-VA	Soil	Sum of Xylene Isomer Concentrations	EPA 8260B & 524.2

Calculation of Total Xylenes

Reference Information

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:

15-609402

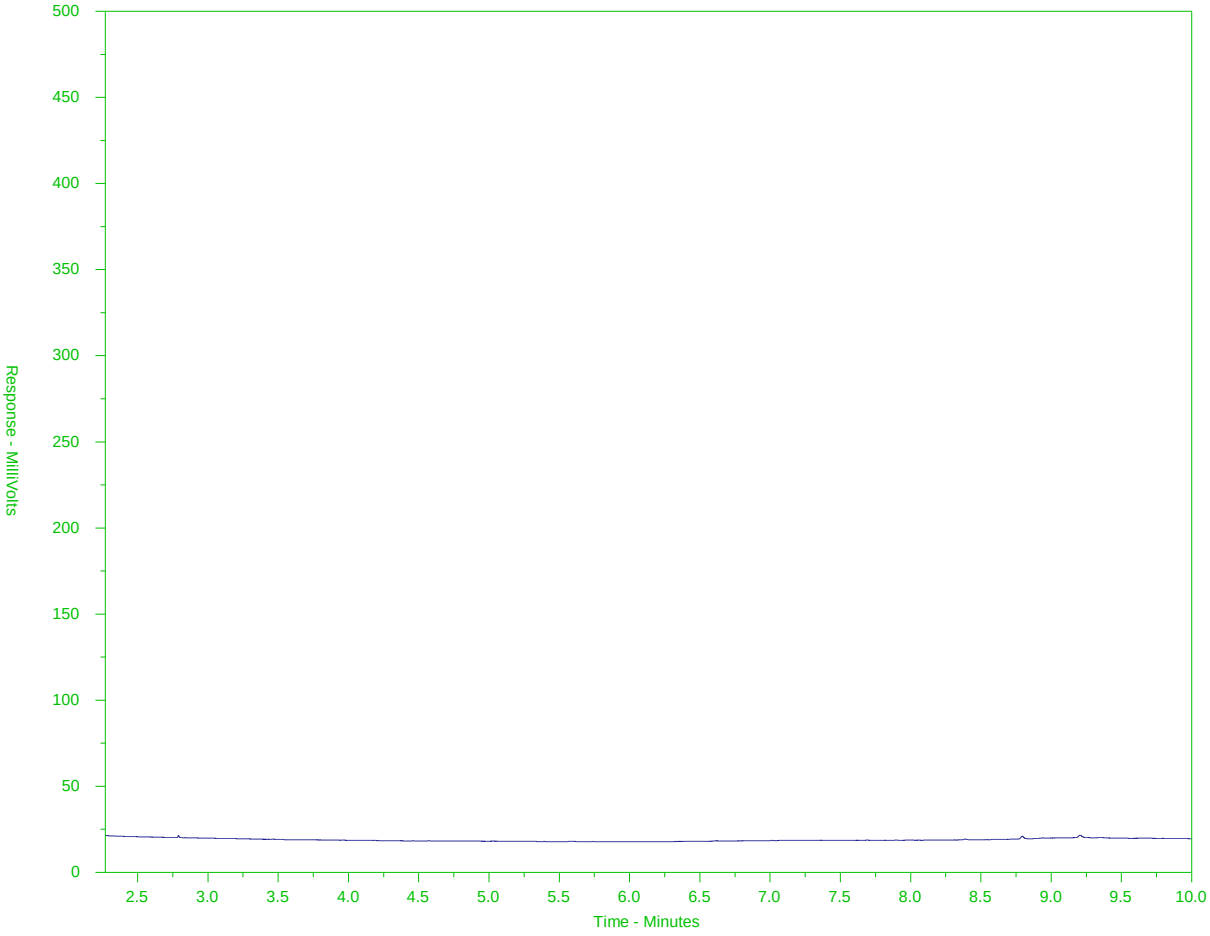
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1960419-1
Client Sample ID: ESA-5



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ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1960419-COFC

COC Number: 15 - 609402

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604-444-6400
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	

Report Format / Distribution	
Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☒ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	Michael.Gill@aecom.com
Email 2	Leslie.Southern@aecom.com
Email 3	

Select Service Level: ☐ with your AM - surcharges will apply

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☒ YES ☐ NO	Email 1 or Fax	Same as above
Company:	Chevron Canada Ltd	Email 2	
Contact:	Chris Boys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt Sampler: EAP/JUB

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX / VPH	LEPH / HEPH	Metals	Number of Containers
	ESA-5	18-Jul-17	9:25	Sediment	X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			27°C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Justin Becker	July 18th, 2017	13:40				Jody	July 18	1:40PM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 19-JUL-17
Report Date: 26-JUL-17 17:42 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1961328

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	15-609404
Legal Site Desc:	FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1961328-1	L1961328-2	L1961328-3		
	Description	SEDIMENT	SEDIMENT	SEDIMENT		
	Sampled Date	19-JUL-17	19-JUL-17	19-JUL-17		
	Sampled Time	09:15	09:30	10:00		
	Client ID	ESA-6	ESA-7	ESA-8		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	16.5	17.5	19.8		
	pH (1:2 soil:water) (pH)	5.90	7.53	7.75		
Metals	Antimony (Sb) (mg/kg)	0.17	0.22	0.19		
	Arsenic (As) (mg/kg)	1.91	2.12	2.45		
	Barium (Ba) (mg/kg)	45.0	38.8	83.7		
	Beryllium (Be) (mg/kg)	0.35	0.35	0.43		
	Cadmium (Cd) (mg/kg)	<0.050	<0.050	0.063		
	Chromium (Cr) (mg/kg)	16.5	20.7	14.8		
	Cobalt (Co) (mg/kg)	17.0	6.76	12.2		
	Copper (Cu) (mg/kg)	38.7	29.6	35.8		
	Lead (Pb) (mg/kg)	8.44	5.34	6.77		
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050		
	Molybdenum (Mo) (mg/kg)	0.30	0.35	0.34		
	Nickel (Ni) (mg/kg)	9.45	8.07	8.68		
	Selenium (Se) (mg/kg)	<0.20	0.31	<0.20		
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		
	Thallium (Tl) (mg/kg)	0.071	0.061	<0.050		
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
	Uranium (U) (mg/kg)	0.529	0.941	0.487		
	Vanadium (V) (mg/kg)	76.9	108	78.6		
	Zinc (Zn) (mg/kg)	56.8	49.8	58.4		
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH		
	Benzene (mg/kg)	<0.0050	<0.0050	0.0058		
	Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015		
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20		
	Styrene (mg/kg)	<0.050	<0.050	<0.050		
	Toluene (mg/kg)	<0.050	<0.050	<0.050		
	ortho-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	meta- & para-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	Xylenes (mg/kg)	<0.075	<0.075	<0.075		
	Surrogate: 4-Bromofluorobenzene (SS) (%)	93.2	83.9	83.5		
	Surrogate: 1,4-Difluorobenzene (SS) (%)	96.3	84.2	85.5		
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200		
	EPH19-32 (mg/kg)	<200	<200	<200		
	LEPH (mg/kg)	<200	<200	<200		
	HEPH (mg/kg)	<200	<200	<200		
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1961328-1	L1961328-2	L1961328-3		
	Description	SEDIMENT	SEDIMENT	SEDIMENT		
	Sampled Date	19-JUL-17	19-JUL-17	19-JUL-17		
	Sampled Time	09:15	09:30	10:00		
	Client ID	ESA-6	ESA-7	ESA-8		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	89.3	86.5	88.6		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	79.1	68.8 SURR-ND	71.8		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	92.6	85.9	96.0		
	Surrogate: Chrysene d12 (%)	89.4	89.5	95.5		
	Surrogate: Naphthalene d8 (%)	90.4	84.5	89.0		
	Surrogate: Phenanthrene d10 (%)	92.3	83.9	95.9		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
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).			
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.			
LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)
Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).			
MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
This method uses a heated strong acid digestion with HNO3 and HCl and 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.			
MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1
This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.			
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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)
These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).			
XYLENES-CALC-VA	Soil	Sum of Xylene Isomer Concentrations	EPA 8260B & 524.2

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:

15-609404

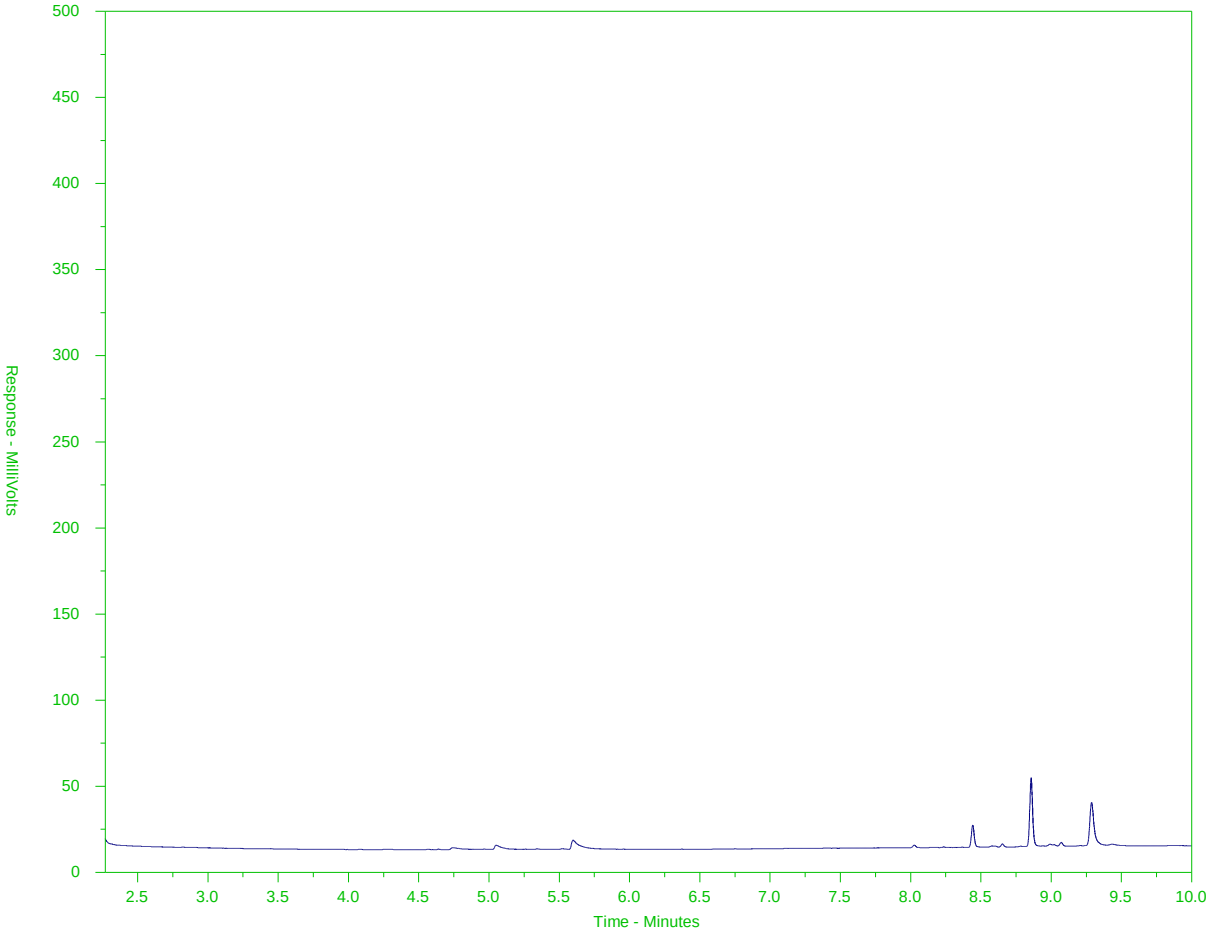
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1961328-1
Client Sample ID: ESA-6



← 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.

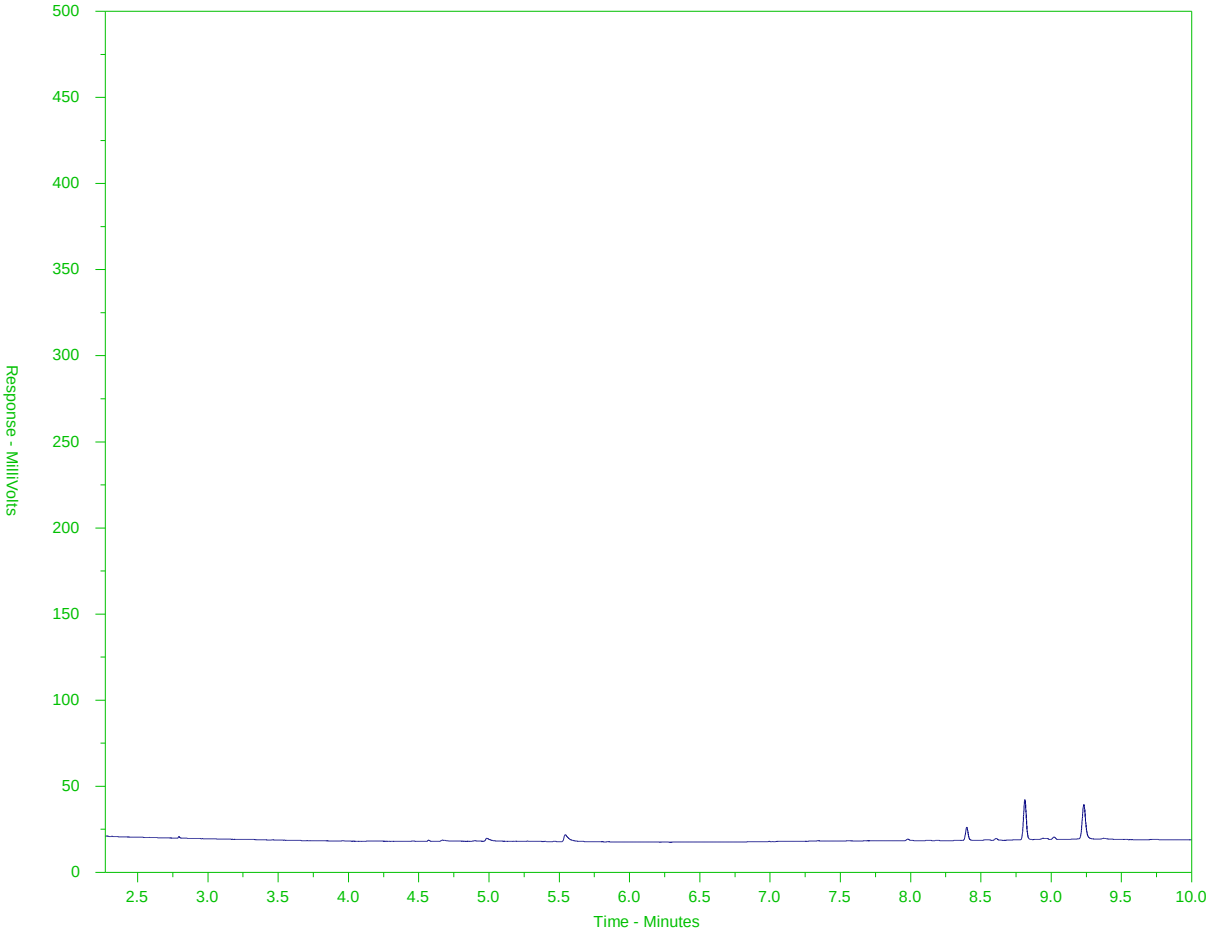
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2574976-4#L1961328-1
Client Sample ID: ESA-6



← 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 →		

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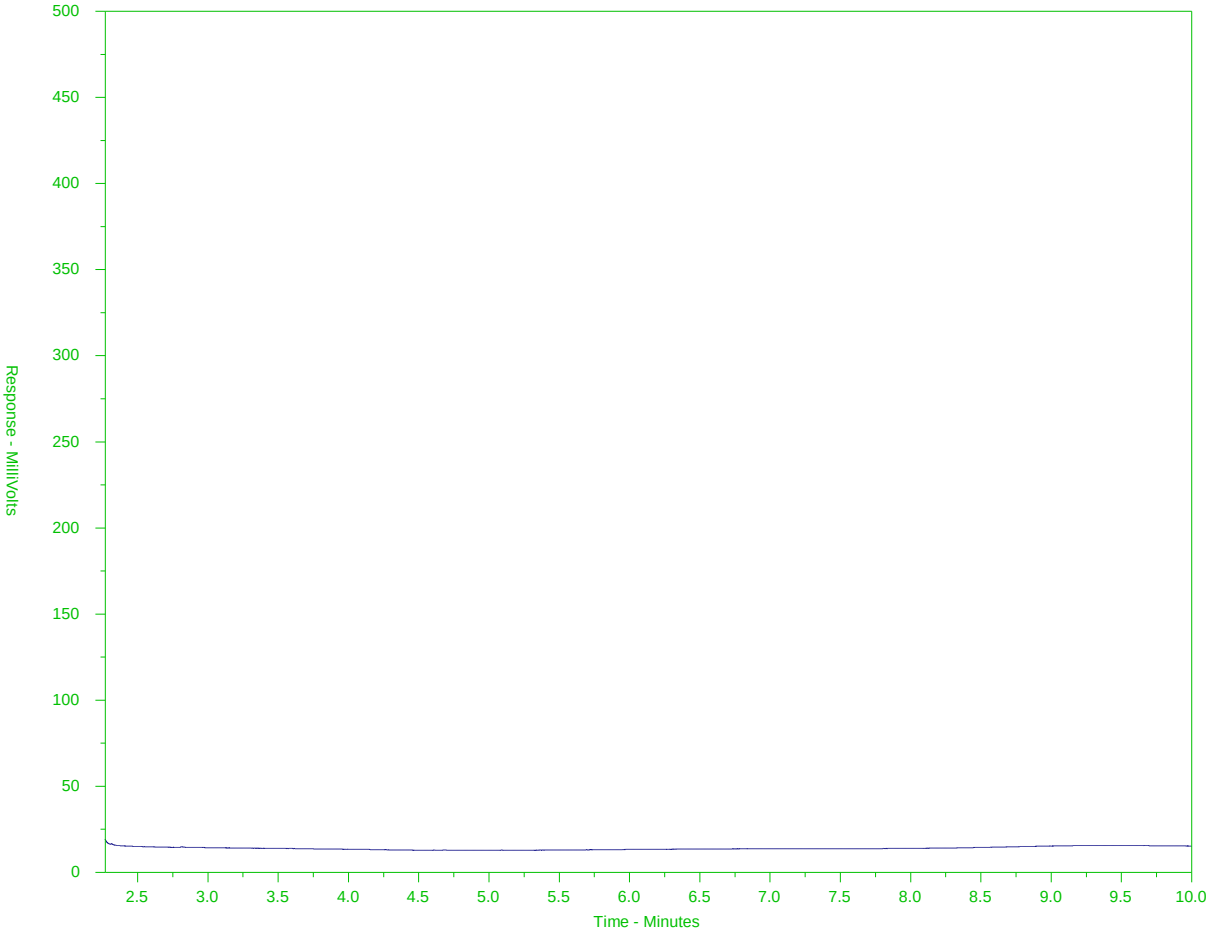
BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1961328-2
Client Sample ID: ESA-7



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.

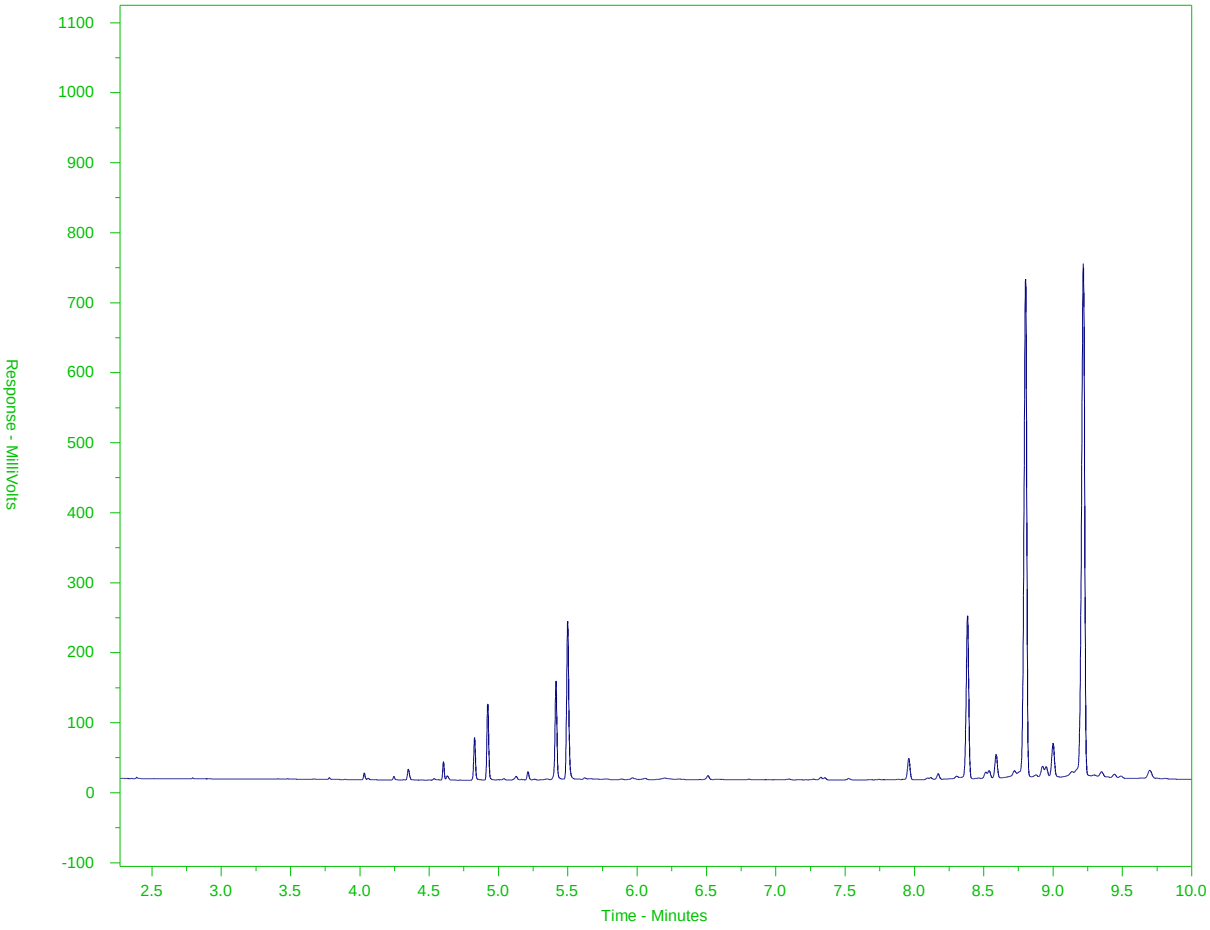
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1961328-3
Client Sample ID: ESA-8



← 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 →		

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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.

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ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1961328-COFC

COC Number: 15 - 609404

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Aecom
Contact:	Michael Gill
Phone:	604 444 6400
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	

Report Format / Distribution	
Select Report Format:	PDF EXCEL EDD (DIGITAL)
Quality Control (QC) Report with Report	YES NO
Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	EMAIL MAIL FAX
Email 1 or Fax	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Select Service Level: Confirm all E&P TATs with your AM - surcharges will apply

Regular [R] — Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4]; 3 day [P3]; 2 day [P2]

EMERGENCY: 1 Business day [E1]; Same Day, Weekend or Statutory holiday [E0]

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To: NO	Copy of Invoice with Report: YES
Company:	Chevron Canada Ltd.	
Contact:	Chris Boys.	

Invoice Distribution	
Select Invoice Distribution:	EMAIL MAIL FAX
Email 1 or Fax	Same as above.
Email 2	

Project Information	
ALS Account # / Quote #:	[redacted]
Job #:	60542455
PO / AFE:	
LSD:	Foreshore

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt Sampler: EAP/JB.

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX (P)	VPH (P)	LEPH/HEPH (F/P)	metals (F)	Number of Containers
	ESA-6	19-Jul-17	9:15	Sediment	X	X	X		4
	ESA-7	↓	9:30	↓	↓	↓	↓		↓
	ESA-8	↓	10:00	↓	↓	↓	↓		↓

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? YES NO

Are samples for human drinking water use? YES NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
		26			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
[signature]	July 19/17	15:00	[signature]	July 19	15:20			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 19-JUL-17
Report Date: 20-JUL-17 15:07 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1961329

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609403
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1961329-1				
	Description	SEDIMENT				
	Sampled Date	19-JUL-17				
	Sampled Time	08:30				
	Client ID	EIRA-8				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	16.8				
	pH (1:2 soil:water) (pH)	8.18				
Metals	Antimony (Sb) (mg/kg)	0.19				
	Arsenic (As) (mg/kg)	2.43				
	Barium (Ba) (mg/kg)	53.0				
	Beryllium (Be) (mg/kg)	0.28				
	Cadmium (Cd) (mg/kg)	<0.050				
	Chromium (Cr) (mg/kg)	29.0				
	Cobalt (Co) (mg/kg)	7.53				
	Copper (Cu) (mg/kg)	23.5				
	Lead (Pb) (mg/kg)	5.81				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.56				
	Nickel (Ni) (mg/kg)	11.8				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.716				
	Vanadium (V) (mg/kg)	66.8				
	Zinc (Zn) (mg/kg)	56.6				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	72.9				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	87.7				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	<200				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1961329-1				
	Description	SEDIMENT				
	Sampled Date	19-JUL-17				
	Sampled Time	08:30				
	Client ID	EIRA-8				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	93.5				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	102.8				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	109.4				
	Surrogate: Chrysene d12 (%)	103.5				
	Surrogate: Naphthalene d8 (%)	104.9				
	Surrogate: Phenanthrene d10 (%)	109.2				

* 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)
Method Blank	Copper (Cu)	B	L1961329-1
Duplicate	Chromium (Cr)	DUP-H	L1961329-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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

Reference Information

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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609403

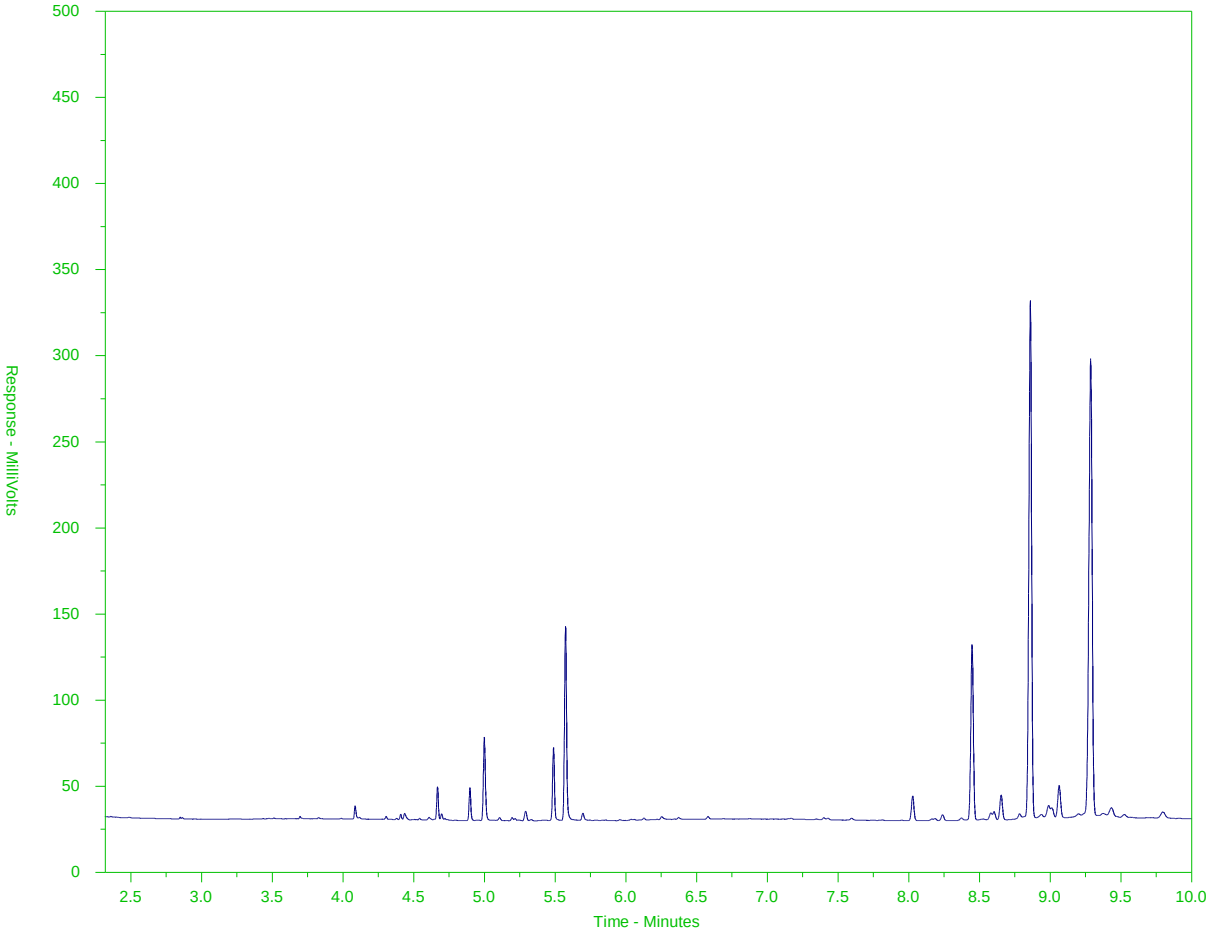
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1961329-1
Client Sample ID: EIRA-8



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1961329-COFC

COC Number: 15 - 609403

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Aecom
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	

Report Format / Distribution

Select Report Format: [X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report [X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: [X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax: michael.gill@aecom.com
Email 2: leslie.southern@aecom.com
Email 3:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] [ ] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [X]

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To [ ] YES [X] NO
	Copy of Invoice with Report [X] YES [ ] NO
Company:	Chevron Canada Ltd
Contact:	Chris Boys

Invoice Distribution

Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax: Same as above.
Email 2:

Project Information

ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore
ALS Lab Work Order # (lab use only)	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Dean Watt	Sampler: EAP/JB

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	ETRA-8	19-Jul-17	8:30	Sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO
Are samples for human drinking water use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
		26			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	July 19/2017	15:00	Trevor	July 19	15:00			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 20-JUL-17
Report Date: 27-JUL-17 17:13 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1962060

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609407
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID: L1962060-1 Description: SEDIMENT Sampled Date: 20-JUL-17 Sampled Time: 11:20 Client ID: ESA-9	Sample ID: L1962060-2 Description: SEDIMENT Sampled Date: 20-JUL-17 Sampled Time: 11:25 Client ID: ESA-10	Sample ID: L1962060-3 Description: SEDIMENT Sampled Date: 20-JUL-17 Sampled Time: 11:30 Client ID: ESA-11		
SOIL						
Physical Tests	Moisture (%)	4.67	12.6	13.8		
	pH (1:2 soil:water) (pH)	7.42	7.46	8.41		
Metals	Antimony (Sb) (mg/kg)	<0.10	0.14	0.16		
	Arsenic (As) (mg/kg)	0.74	1.48	2.09		
	Barium (Ba) (mg/kg)	3.10	120	30.4		
	Beryllium (Be) (mg/kg)	<0.10	0.47	0.13		
	Cadmium (Cd) (mg/kg)	<0.050	<0.050	0.067		
	Chromium (Cr) (mg/kg)	0.93	14.7	9.57		
	Cobalt (Co) (mg/kg)	0.59	9.95	4.39		
	Copper (Cu) (mg/kg)	0.99	31.4	14.9		
	Lead (Pb) (mg/kg)	0.82	4.57	8.88		
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050		
	Molybdenum (Mo) (mg/kg)	0.13	0.13	0.41		
	Nickel (Ni) (mg/kg)	1.82	8.44	6.22		
	Selenium (Se) (mg/kg)	0.51	<0.20	<0.20		
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		
	Thallium (Tl) (mg/kg)	<0.050	0.081	<0.050		
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
	Uranium (U) (mg/kg)	0.128	0.505	0.459		
	Vanadium (V) (mg/kg)	2.00	82.0	35.3		
	Zinc (Zn) (mg/kg)	3.3	71.0	40.6		
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH		
	Benzene (mg/kg)	0.0071	0.0064	0.0208		
	Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015		
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20		
	Styrene (mg/kg)	<0.050	<0.050	<0.050		
	Toluene (mg/kg)	<0.050	<0.050	<0.050		
	ortho-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	meta- & para-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	Xylenes (mg/kg)	<0.075	<0.075	<0.075		
	Surrogate: 4-Bromofluorobenzene (SS) (%)	94.8	94.6	89.9		
	Surrogate: 1,4-Difluorobenzene (SS) (%)	91.8	98.6	89.9		
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200		
	EPH19-32 (mg/kg)	<200	<200	<200		
	LEPH (mg/kg)	<200	<200	<200		
	HEPH (mg/kg)	<200	<200	<200		
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962060-1	L1962060-2	L1962060-3		
	Description	SEDIMENT	SEDIMENT	SEDIMENT		
	Sampled Date	20-JUL-17	20-JUL-17	20-JUL-17		
	Sampled Time	11:20	11:25	11:30		
	Client ID	ESA-9	ESA-10	ESA-11		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	86.7	93.6	93.7		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	208.1 SURR-ND	114.2	104.9		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	0.717	<0.050	<0.050		
	Naphthalene (mg/kg)	0.377	<0.050	<0.050		
	Phenanthrene (mg/kg)	0.081	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	109.0	101.3	105.5		
	Surrogate: Chrysene d12 (%)	104.5	94.5	104.8		
	Surrogate: Naphthalene d8 (%)	111.9	98.5	98.6		
	Surrogate: Phenanthrene d10 (%)	104.4	99.9	101.6		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

XYLENES-CALC-VA	Soil	Sum of Xylene Isomer Concentrations	EPA 8260B & 524.2

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:

15-609407

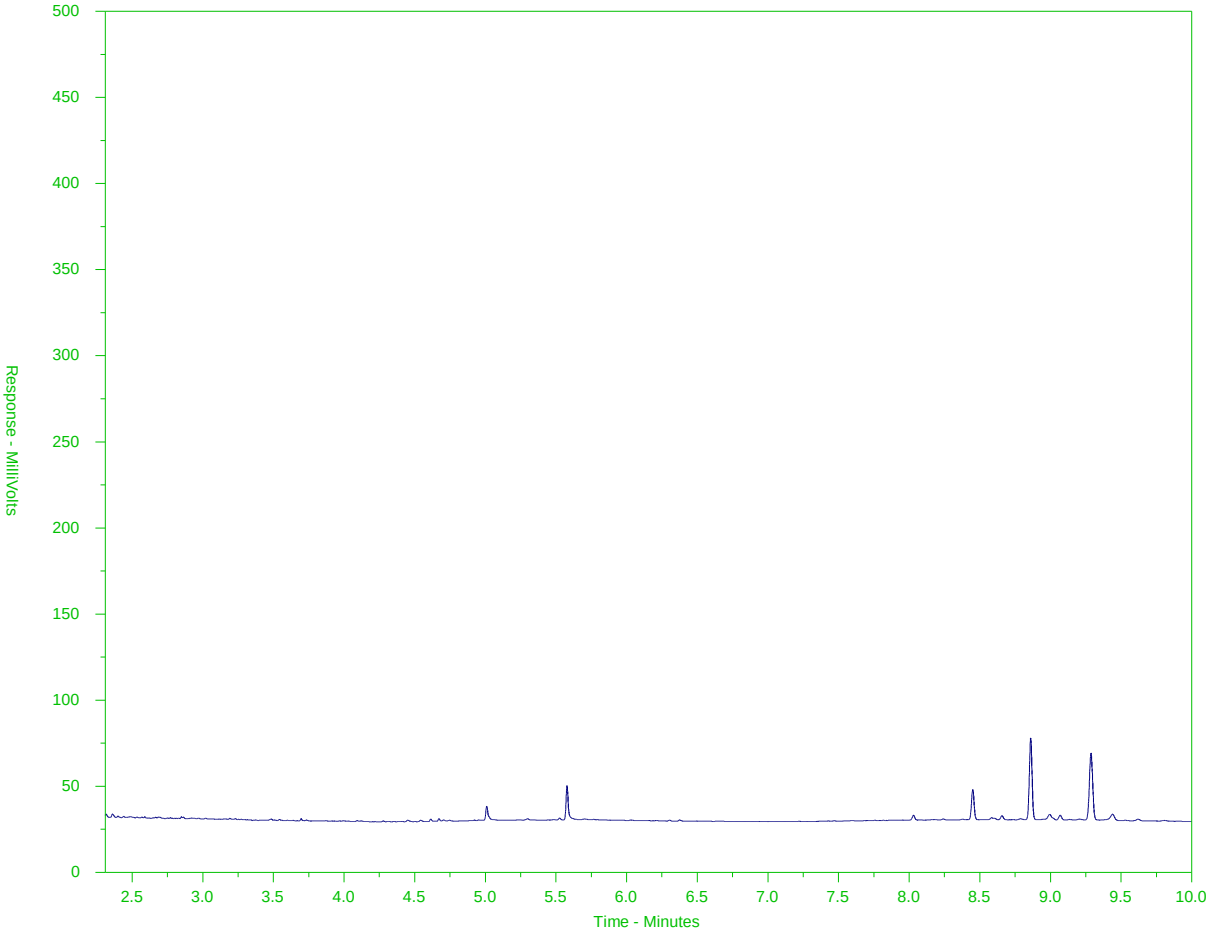
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1962060-1
Client Sample ID: ESA-9



← 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.

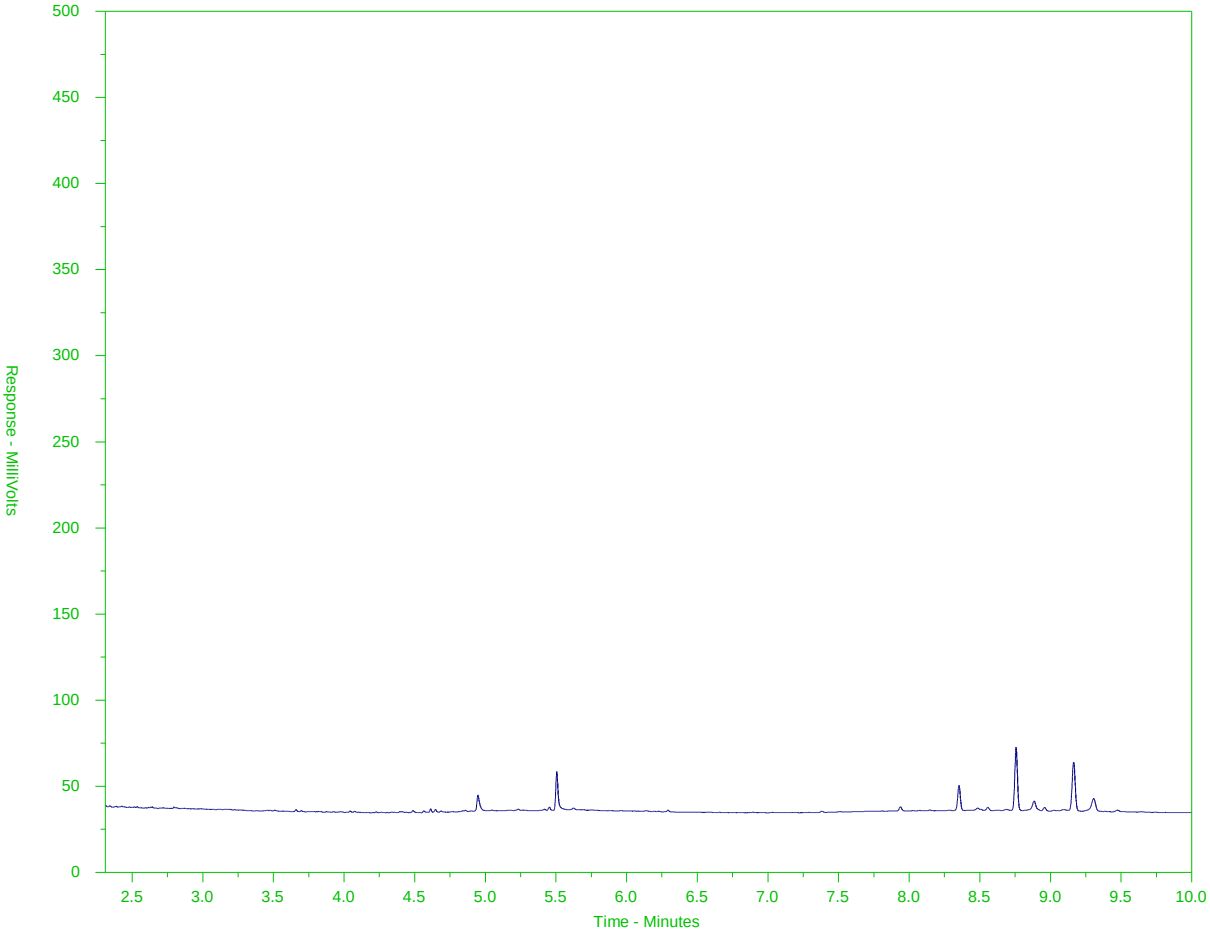
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2575771-4#L1962060-1
Client Sample ID: ESA-9



← 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.

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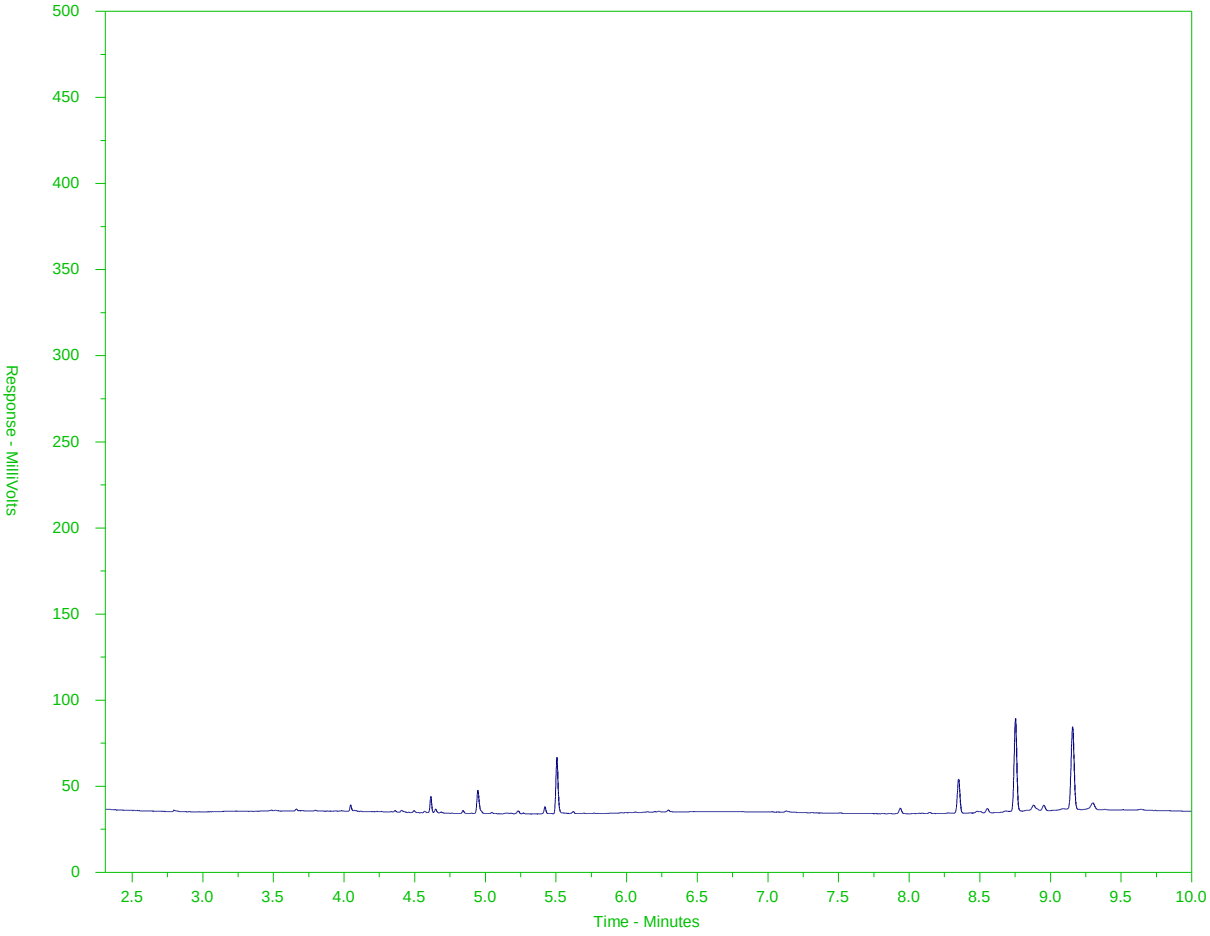
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962060-2
Client Sample ID: ESA-10



← 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.

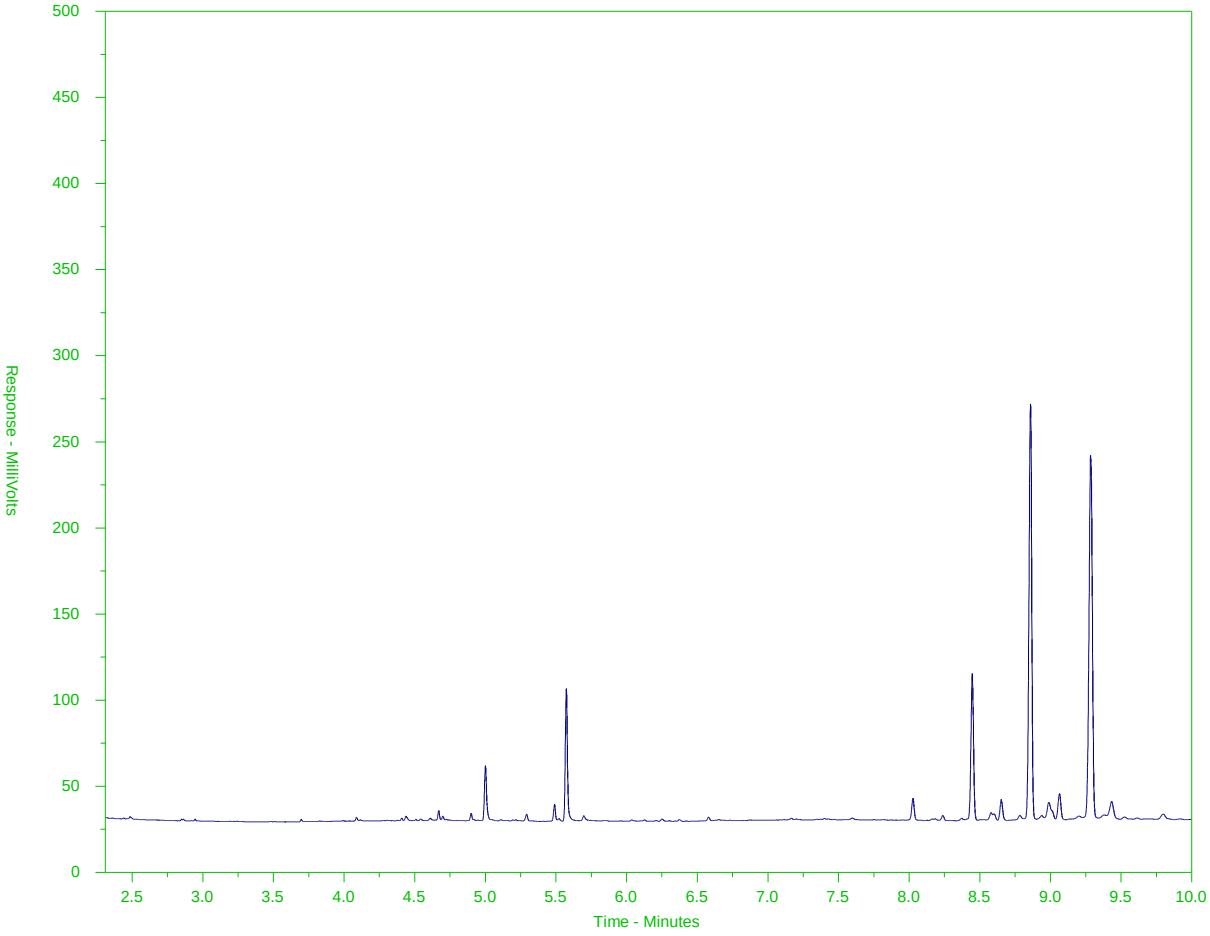
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962060-3
Client Sample ID: ESA-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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1962060-COFC

COC Number: 15 - 609407

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs with your AM - surcharges will apply

Regular [R] [✓] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [ ]

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To		
	Same as Report To	[ ] YES [X] NO
	Copy of Invoice with Report	[X] YES [ ] NO
Company:	Chevron Canada Ltd.	
Contact:	Chris Boys	

Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Same as above
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: EAP / CXW

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX / VPH	LEPH / HEPH	Metals	Number of Containers
	ESA - 9	20-Jul-17	11:20	Sediment		X	X	X	4
	ESA - 10	↓	11:25	↓		↓	↓	↓	↓
	ESA - 11	↓	11:30	↓		↓	↓	↓	↓

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human drinking water use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	24 °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: MARK H	Date: July 20, 2017	Time: 2:30 PM	Received by:	Date:	Time:	Received by: Lady	Date: July 20	Time: 2:30pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 20-JUL-17
Report Date: 21-JUL-17 13:08 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1962063

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609405
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1962063-1 SEDIMENT 20-JUL-17 10:00 EIRA-9	L1962063-2 SEDIMENT 20-JUL-17 10:05 EIRA-10	L1962063-3 SEDIMENT 20-JUL-17 10:10 EIRA-11	L1962063-4 SEDIMENT 20-JUL-17 10:15 EIRA-12	L1962063-5 SEDIMENT 20-JUL-17 10:20 EIRA-13
SOIL						
Physical Tests	Moisture (%)	12.6	16.9	17.6	12.6	15.0
	pH (1:2 soil:water) (pH)	7.50	8.66	8.60	8.06	7.63
Metals	Antimony (Sb) (mg/kg)	0.17	0.17	0.16	0.13	0.15
	Arsenic (As) (mg/kg)	3.73	2.95	3.68	3.28	3.11
	Barium (Ba) (mg/kg)	89.6	70.2	65.3	73.5	76.3
	Beryllium (Be) (mg/kg)	0.26	0.25	0.26	0.26	0.25
	Cadmium (Cd) (mg/kg)	0.111	0.097	0.110	0.105	0.098
	Chromium (Cr) (mg/kg)	18.4	18.5	17.8	20.2	17.3
	Cobalt (Co) (mg/kg)	5.08	5.32	5.39	5.21	5.62
	Copper (Cu) (mg/kg)	17.3	15.8	20.5	15.3	17.4
	Lead (Pb) (mg/kg)	6.06	5.50	5.63	5.69	5.78
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Molybdenum (Mo) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni) (mg/kg)	17.7	18.1	17.1	18.7	19.4
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Uranium (U) (mg/kg)	0.874	0.812	0.809	0.907	0.877
	Vanadium (V) (mg/kg)	36.9	34.9	38.0	35.1	39.7
	Zinc (Zn) (mg/kg)	38.0	33.4	34.5	35.6	37.0
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	Field MeOH	Field MeOH
	Benzene (mg/kg)	0.0124	0.0101	0.0899	0.0083	0.0111
	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
	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	0.178
	Xylenes (mg/kg)	<0.075	<0.075	<0.075	<0.075	0.178
	Surrogate: 4-Bromofluorobenzene (SS) (%)	76.8	86.8	79.5	83.5	85.2
	Surrogate: 1,4-Difluorobenzene (SS) (%)	89.4	97.9	90.7	96.8	96.7
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200	<200	<200
	EPH19-32 (mg/kg)	660	790	680	680	660
	LEPH (mg/kg)	<200	<200	<200	<200	<200
	HEPH (mg/kg)	660	790	680	680	660
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	<100	<100

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962063-6				
	Description	SEDIMENT				
	Sampled Date	20-JUL-17				
	Sampled Time	10:25				
	Client ID	EIRA-14				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	18.9				
	pH (1:2 soil:water) (pH)	8.34				
Metals	Antimony (Sb) (mg/kg)	0.17				
	Arsenic (As) (mg/kg)	2.82				
	Barium (Ba) (mg/kg)	56.4				
	Beryllium (Be) (mg/kg)	0.24				
	Cadmium (Cd) (mg/kg)	0.098				
	Chromium (Cr) (mg/kg)	19.7				
	Cobalt (Co) (mg/kg)	6.46				
	Copper (Cu) (mg/kg)	16.2				
	Lead (Pb) (mg/kg)	6.11				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	<0.50				
	Nickel (Ni) (mg/kg)	17.0				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.716				
	Vanadium (V) (mg/kg)	39.3				
	Zinc (Zn) (mg/kg)	37.6				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	0.0779				
	Ethylbenzene (mg/kg)	0.046				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	0.062				
	meta- & para-Xylene (mg/kg)	0.340				
	Xylenes (mg/kg)	0.402				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	79.1				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	89.4				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	740				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	740				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962063-1	L1962063-2	L1962063-3	L1962063-4	L1962063-5
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	20-JUL-17	20-JUL-17	20-JUL-17	20-JUL-17	20-JUL-17
	Sampled Time	10:00	10:05	10:10	10:15	10:20
	Client ID	EIRA-9	EIRA-10	EIRA-11	EIRA-12	EIRA-13
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
	Surrogate: 2-Bromobenzotrifluoride (%)	95.8	110.4	100.5	108.3	98.8
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	73.3	79.9	76.8	75.3	76.5
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: Acenaphthene d10 (%)	66.1	125.3	97.0	105.1	117.1
	Surrogate: Chrysene d12 (%)	60.5	112.2	89.1	109.7	121.4
	Surrogate: Naphthalene d8 (%)	60.1	116.5	99.3	99.4	112.3
	Surrogate: Phenanthrene d10 (%)	60.6	119.3	91.5	107.0	114.9

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962063-6				
	Description	SEDIMENT				
	Sampled Date	20-JUL-17				
	Sampled Time	10:25				
	Client ID	EIRA-14				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	112.2				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	80.1				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	122.4				
	Surrogate: Chrysene d12 (%)	120.2				
	Surrogate: Naphthalene d8 (%)	116.9				
	Surrogate: Phenanthrene d10 (%)	119.2				

* 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)
Certified Reference Material	Silver (Ag)	MES	L1962063-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).

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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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"

Reference Information

(Version 2.1 July 1999).

VH-SURR-FID-VA	Soil	VH Surrogates for Soils	BC Env. Lab Manual (VH in Solids)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609405

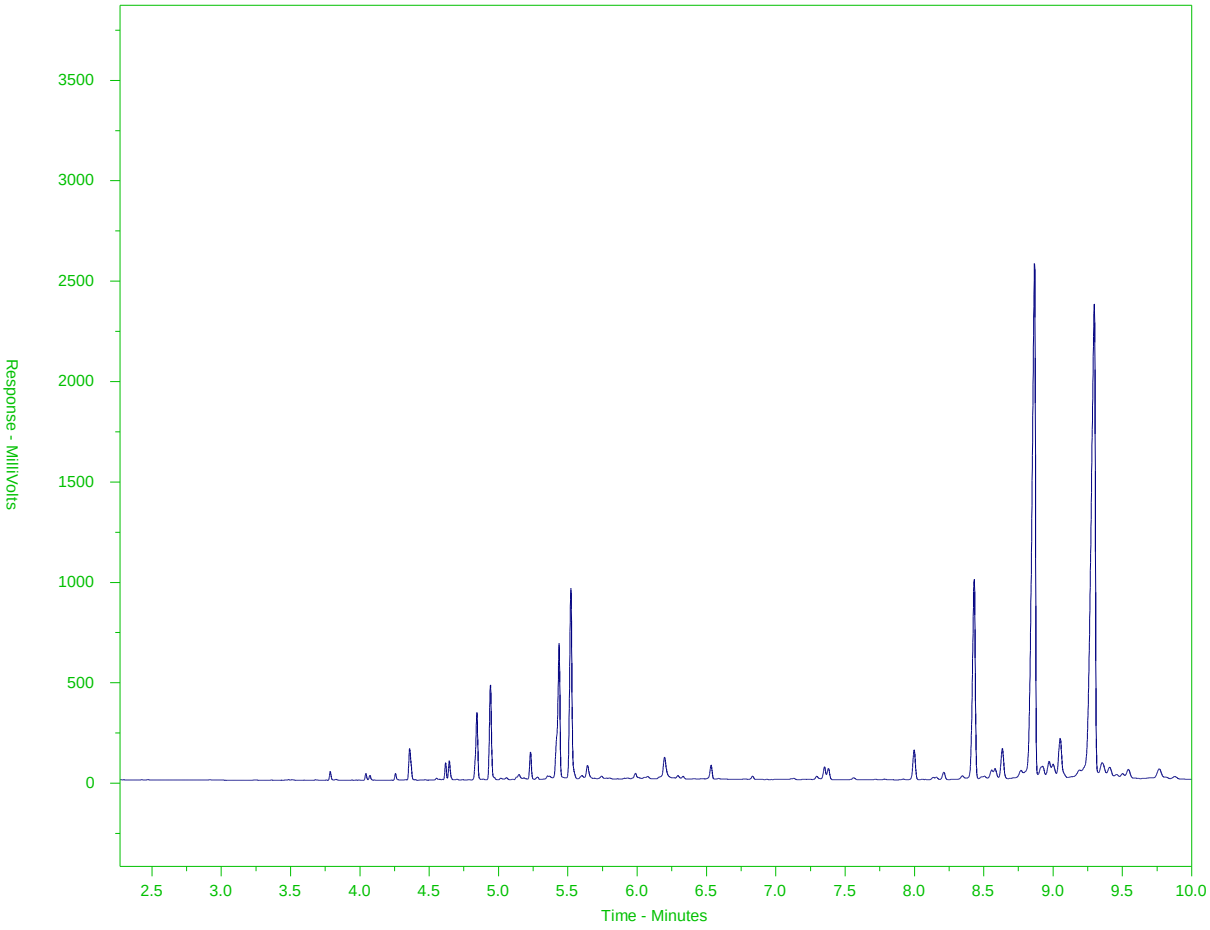
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1962063-1
Client Sample ID: EIRA-9



← 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.

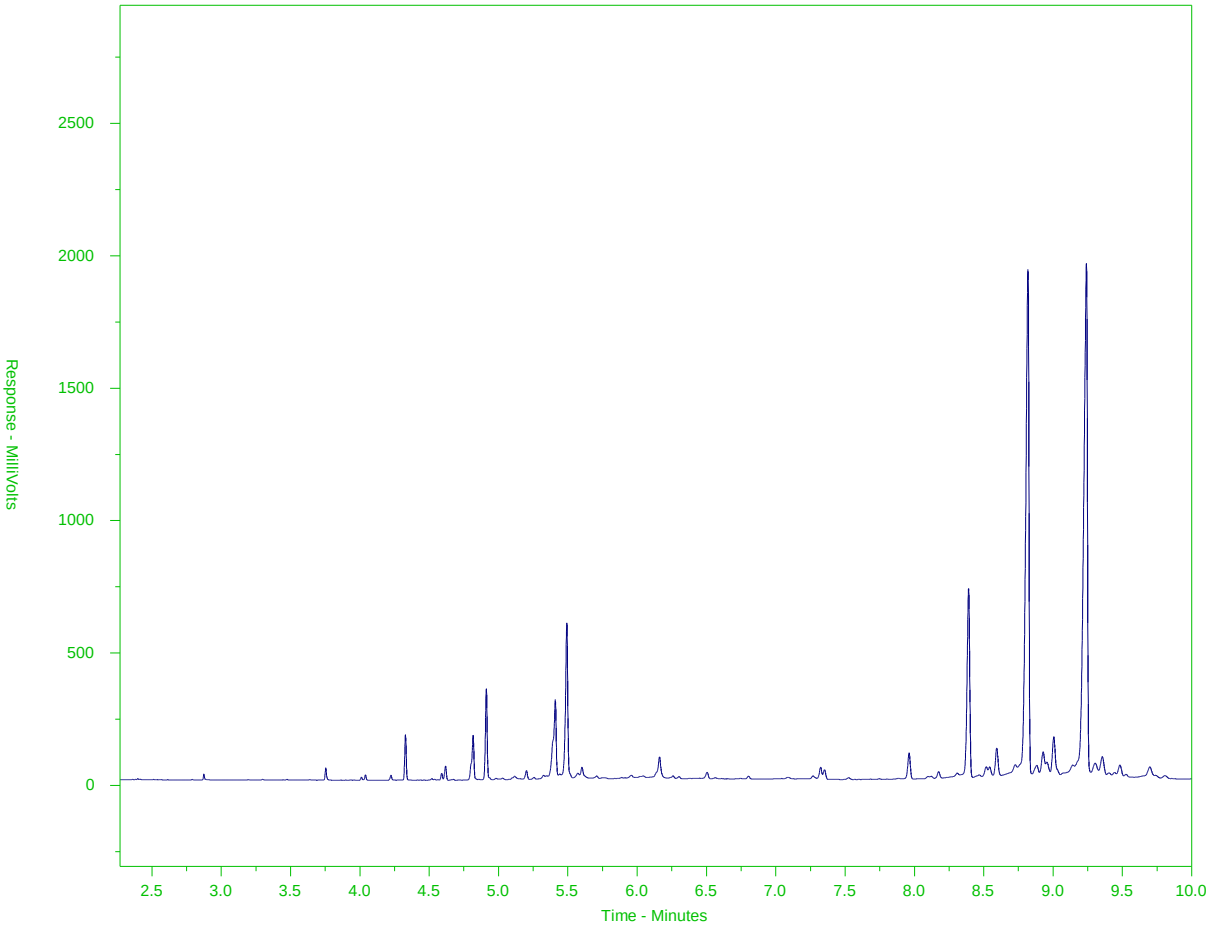
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962063-2
Client Sample ID: EIRA-10



← 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 →		

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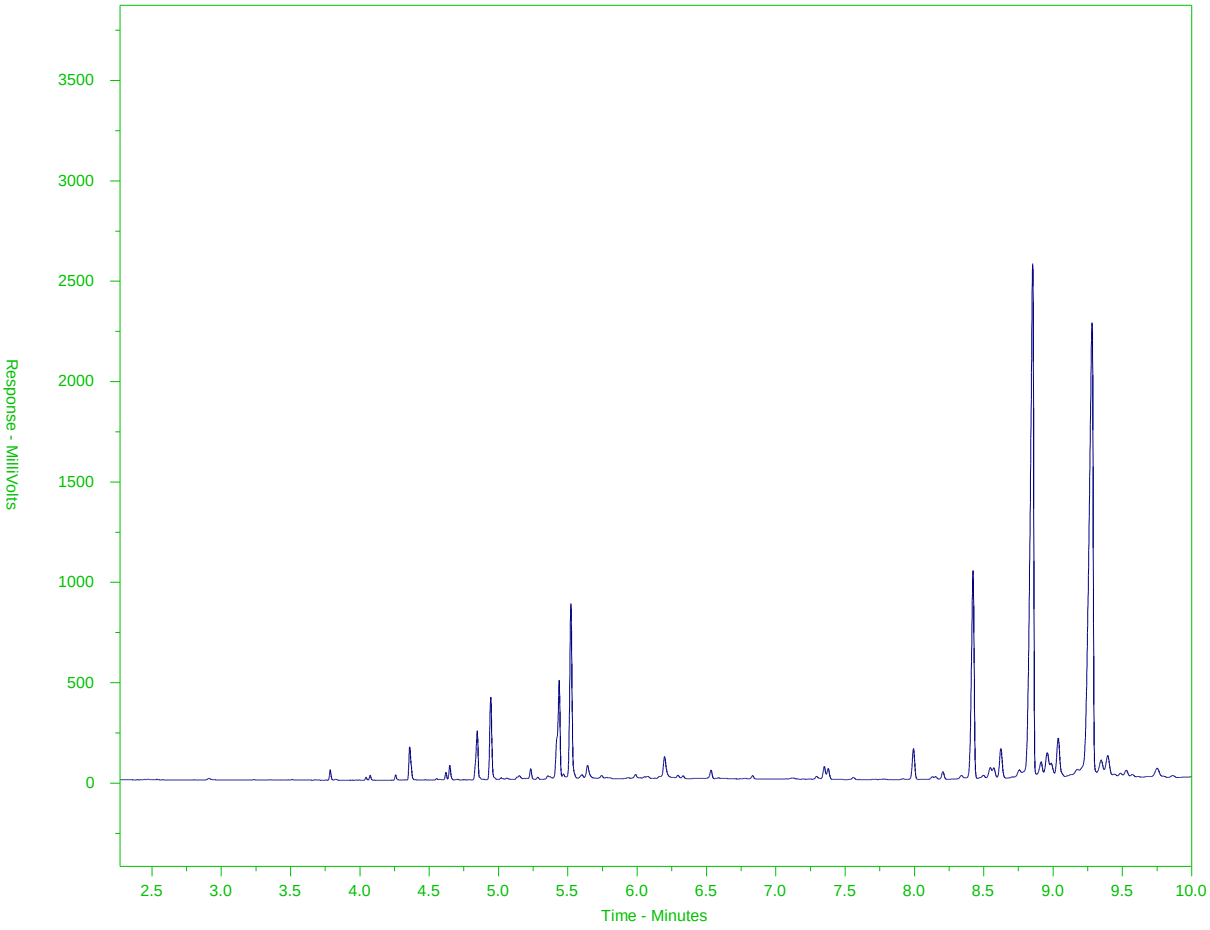
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962063-3
Client Sample ID: EIRA-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.

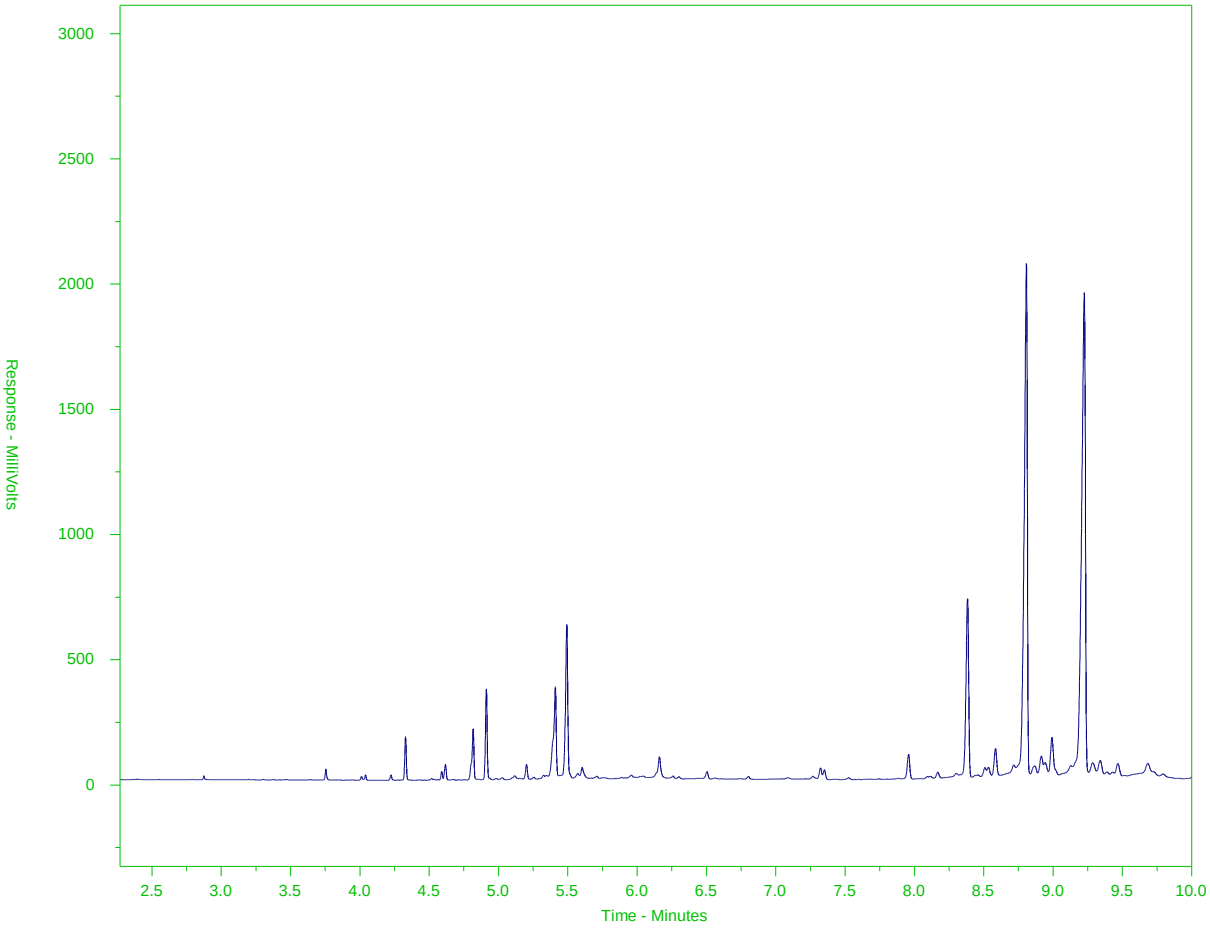
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962063-4
Client Sample ID: EIRA-12



← 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.

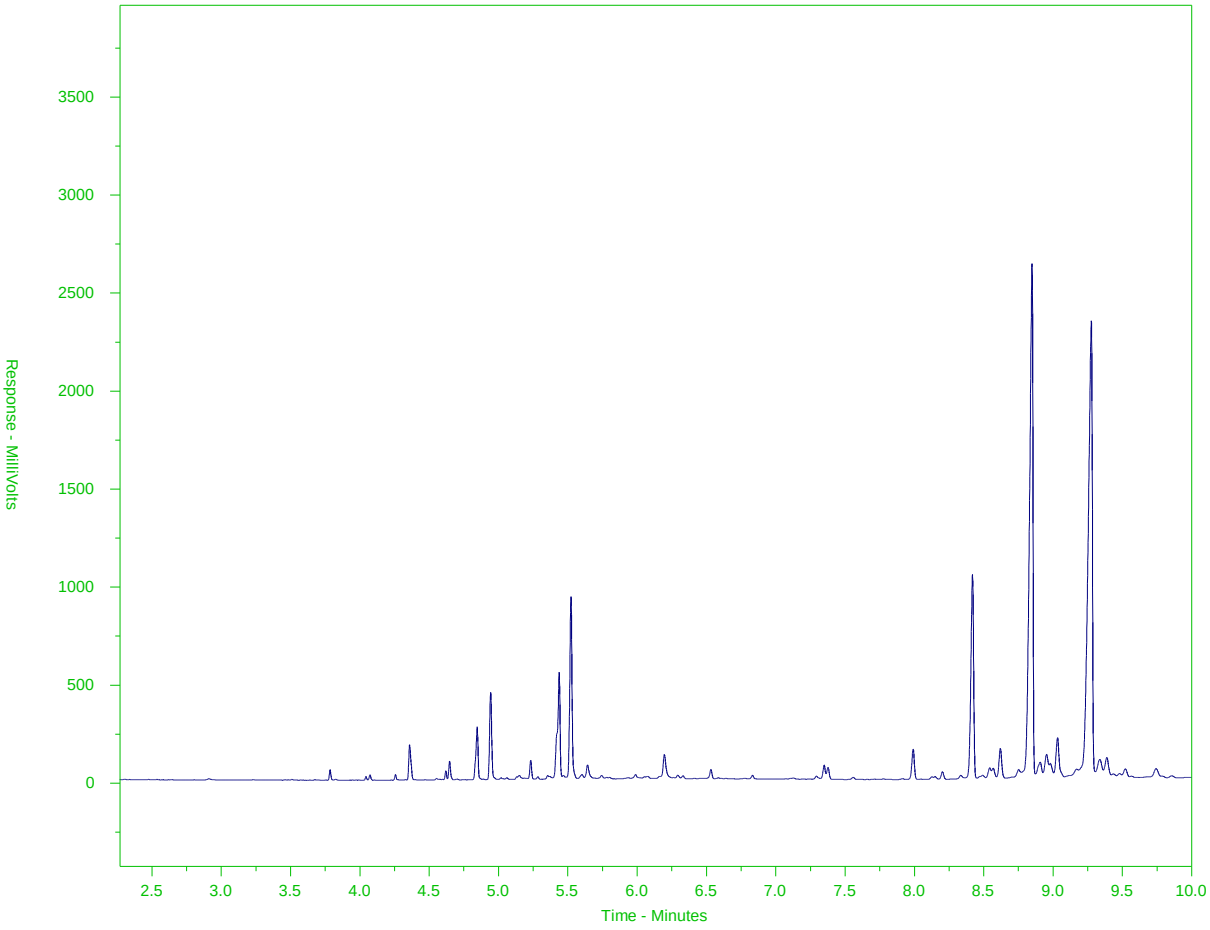
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962063-5
Client Sample ID: EIRA-13



← 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.

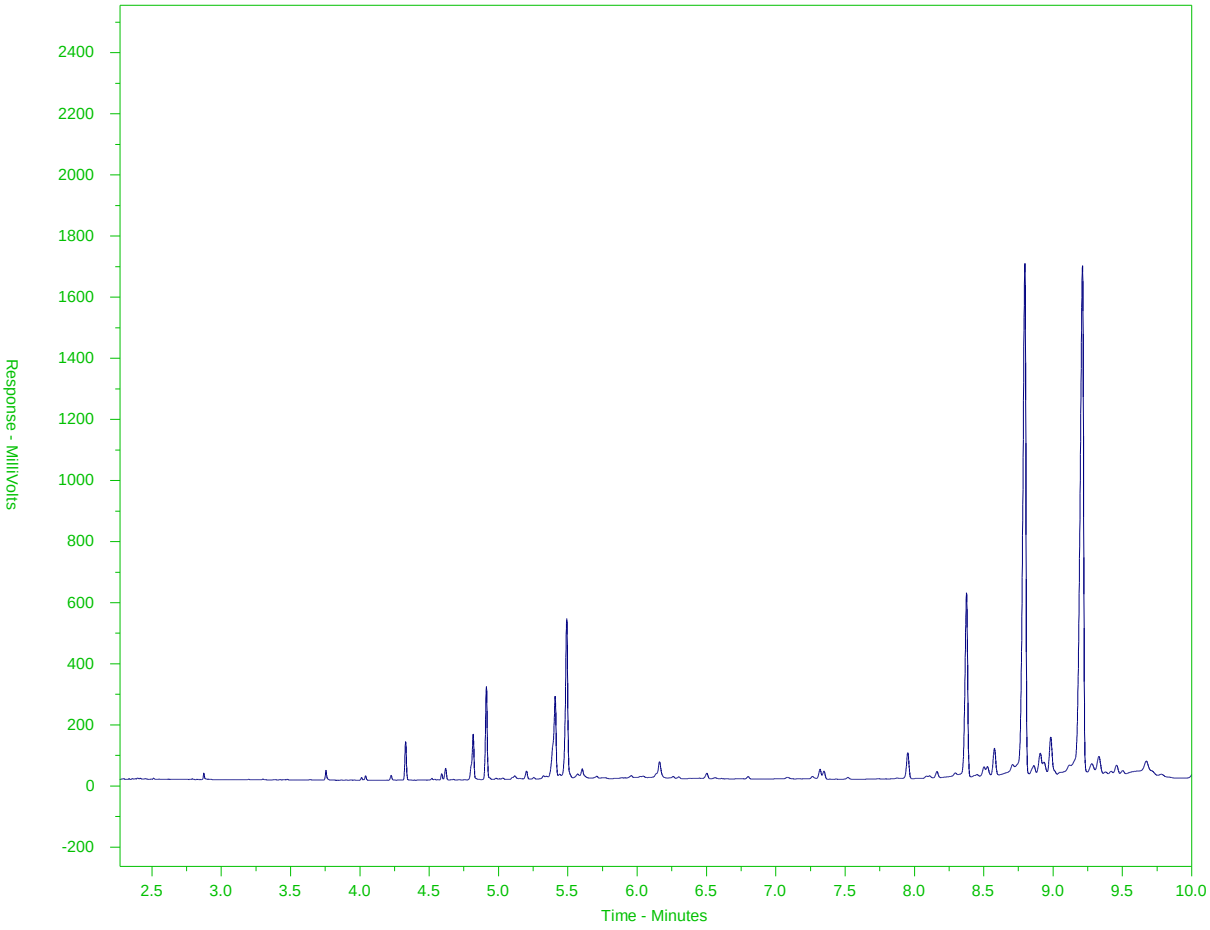
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1962063-6
Client Sample ID: EIRA-14



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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1962063-COFC

COC Number: 15 - 609405

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Regular [R] [ ] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [X]

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To [ ] YES [X] NO
	Copy of Invoice with Report [X] YES [ ] NO
Company:	Chevron Canada Ltd
Contact:	Chris Boys

Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Same as above
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt

Sampler: EAP/CXW

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIRA-9	20-Jul-17	10:00	Sediment		X	X	X	4
	EIRA-10		10:05						
	EIRA-11		10:10						
	EIRA-12		10:15						
	EIRA-13		10:20						
	EIRA-14		10:25						

Drinking Water (DW) Samples[1] (client use)

Samples taken from a Regulated DW System? [ ] YES [X] NO

Samples for human drinking water use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	24.6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	July 20, 2017	2:30 PM				lady	July 20	2:39pm

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

SEE BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

[1] If samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 21-JUL-17
Report Date: 22-JUL-17 17:45 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1962860

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609408
Legal Site Desc: Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962860-1				
	Description	Sediment				
	Sampled Date	21-JUL-17				
	Sampled Time	09:00				
	Client ID	EIRA-15				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	17.5				
	pH (1:2 soil:water) (pH)	9.06				
Metals	Antimony (Sb) (mg/kg)	0.14				
	Arsenic (As) (mg/kg)	3.19				
	Barium (Ba) (mg/kg)	76.8				
	Beryllium (Be) (mg/kg)	0.24				
	Cadmium (Cd) (mg/kg)	0.102				
	Chromium (Cr) (mg/kg)	21.8				
	Cobalt (Co) (mg/kg)	4.99				
	Copper (Cu) (mg/kg)	14.8				
	Lead (Pb) (mg/kg)	6.21				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.57				
	Nickel (Ni) (mg/kg)	17.9				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.882				
	Vanadium (V) (mg/kg)	37.2				
	Zinc (Zn) (mg/kg)	32.4				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	0.0303				
	Ethylbenzene (mg/kg)	0.101				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.070 DLB				
	ortho-Xylene (mg/kg)	0.148				
	meta- & para-Xylene (mg/kg)	0.386				
	Xylenes (mg/kg)	0.534				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	90.7				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.9				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	670				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	670				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962860-1				
	Description	Sediment				
	Sampled Date	21-JUL-17				
	Sampled Time	09:00				
	Client ID	EIRA-15				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	89.3				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	97.5				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	0.272				
	Naphthalene (mg/kg)	<0.20 DLQ				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	92.2				
	Surrogate: Chrysene d12 (%)	85.3				
	Surrogate: Naphthalene d8 (%)	86.7				
	Surrogate: Phenanthrene d10 (%)	91.8				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLQ	Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609408

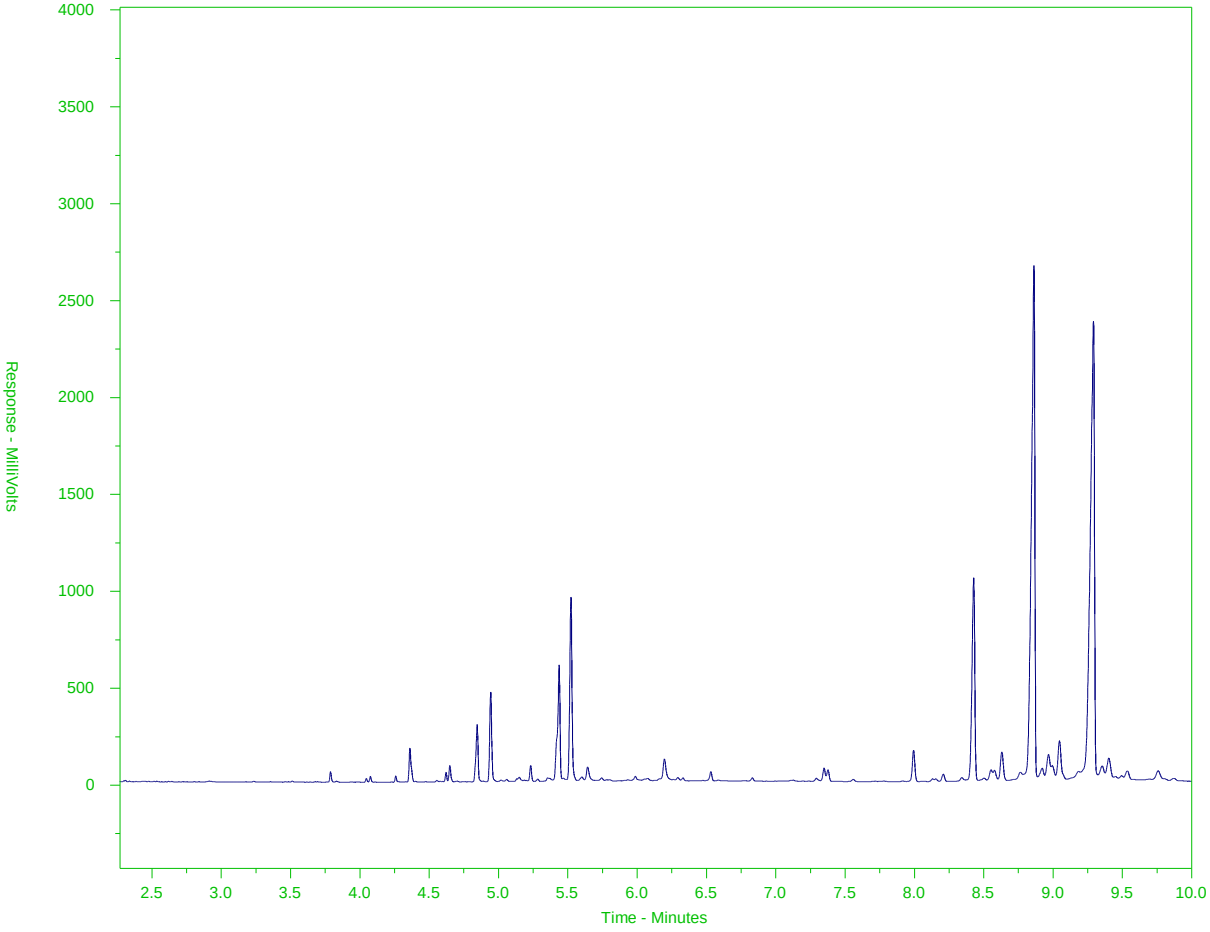
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1962860-1
Client Sample ID: EIRA-15



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1962860-COFC

COC Number: 15 - 609408

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[ ] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] [ ] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [X]

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To [ ] YES [X] NO
	Copy of Invoice with Report [X] YES [ ] NO
Company:	Chevron Canada Ltd.
Contact:	Chris Bays

Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	same as above
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt

Sampler: EAP/CXW

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIRA-15	21-Jul-17	9:00	sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human drinking water use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			22		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: 7/21/2017	Time: 4:30 pm	Received by:	Date:	Time:	Received by:	Date: 7/21/17	Time: 16:35

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 22-JUL-17
Report Date: 25-JUL-17 14:56 (MT)
Version: FINAL REV. 2

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1962974

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609406
Legal Site Desc: Foreshore

Comments:

25-JUL-2017 LEPH, HEPH , EPH and PAH results have been added.

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962974-1				
	Description	SEDIMENT				
	Sampled Date	22-JUL-17				
	Sampled Time	09:25				
	Client ID	EIRA-16				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	22.9				
	pH (1:2 soil:water) (pH)	8.65				
Metals	Antimony (Sb) (mg/kg)	0.12				
	Arsenic (As) (mg/kg)	3.53				
	Barium (Ba) (mg/kg)	46.4				
	Beryllium (Be) (mg/kg)	0.40				
	Cadmium (Cd) (mg/kg)	0.089				
	Chromium (Cr) (mg/kg)	6.47				
	Cobalt (Co) (mg/kg)	3.66				
	Copper (Cu) (mg/kg)	12.1				
	Lead (Pb) (mg/kg)	14.6				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.39				
	Nickel (Ni) (mg/kg)	5.77				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	1.77				
	Vanadium (V) (mg/kg)	23.1				
	Zinc (Zn) (mg/kg)	41.8				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	217				
	Ethylbenzene (mg/kg)	1570				
	Methyl t-butyl ether (MTBE) (mg/kg)	<8.0 DLA				
	Styrene (mg/kg)	<2.0 DLA				
	Toluene (mg/kg)	1950				
	ortho-Xylene (mg/kg)	2210				
	meta- & para-Xylene (mg/kg)	5330				
	Xylenes (mg/kg)	7530				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	100.0				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	100.0				
Hydrocarbons	EPH10-19 (mg/kg)	32400 SMI				
	EPH19-32 (mg/kg)	22900				
	LEPH (mg/kg)	32200				
	HEPH (mg/kg)	22900				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	97000				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1962974-1				
	Description	SEDIMENT				
	Sampled Date	22-JUL-17				
	Sampled Time	09:25				
	Client ID	EIRA-16				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	86000				
	Surrogate: 2-Bromobenzotrifluoride (%)	Not Reportable SDO:RNA				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	Not Reportable				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<4.0 DLCI				
	Acenaphthylene (mg/kg)	<2.0 DLCI				
	Anthracene (mg/kg)	<2.0 DLCI				
	Benz(a)anthracene (mg/kg)	<0.60 DLCI				
	Benzo(a)pyrene (mg/kg)	<0.40 DLQ				
	Benzo(b)fluoranthene (mg/kg)	<0.50 DLQ				
	Benzo(g,h,i)perylene (mg/kg)	0.569				
	Benzo(k)fluoranthene (mg/kg)	<0.30 DLQ				
	Chrysene (mg/kg)	<2.0 DLQ				
	Dibenz(a,h)anthracene (mg/kg)	<0.40 DLQ				
	Fluoranthene (mg/kg)	<0.90 DLCI				
	Fluorene (mg/kg)	8.51				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.40 DLA				
	2-Methylnaphthalene (mg/kg)	239				
	Naphthalene (mg/kg)	142				
	Phenanthrene (mg/kg)	13.7				
	Pyrene (mg/kg)	5.56				
	Surrogate: Acenaphthene d10 (%)	113.1				
	Surrogate: Chrysene d12 (%)	94.5				
	Surrogate: Naphthalene d8 (%)	101.1				
	Surrogate: Phenanthrene d10 (%)	76.7				

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
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.
SDO:RNA	Surrogate diluted out:% recovery not available
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

Reference Information

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609406

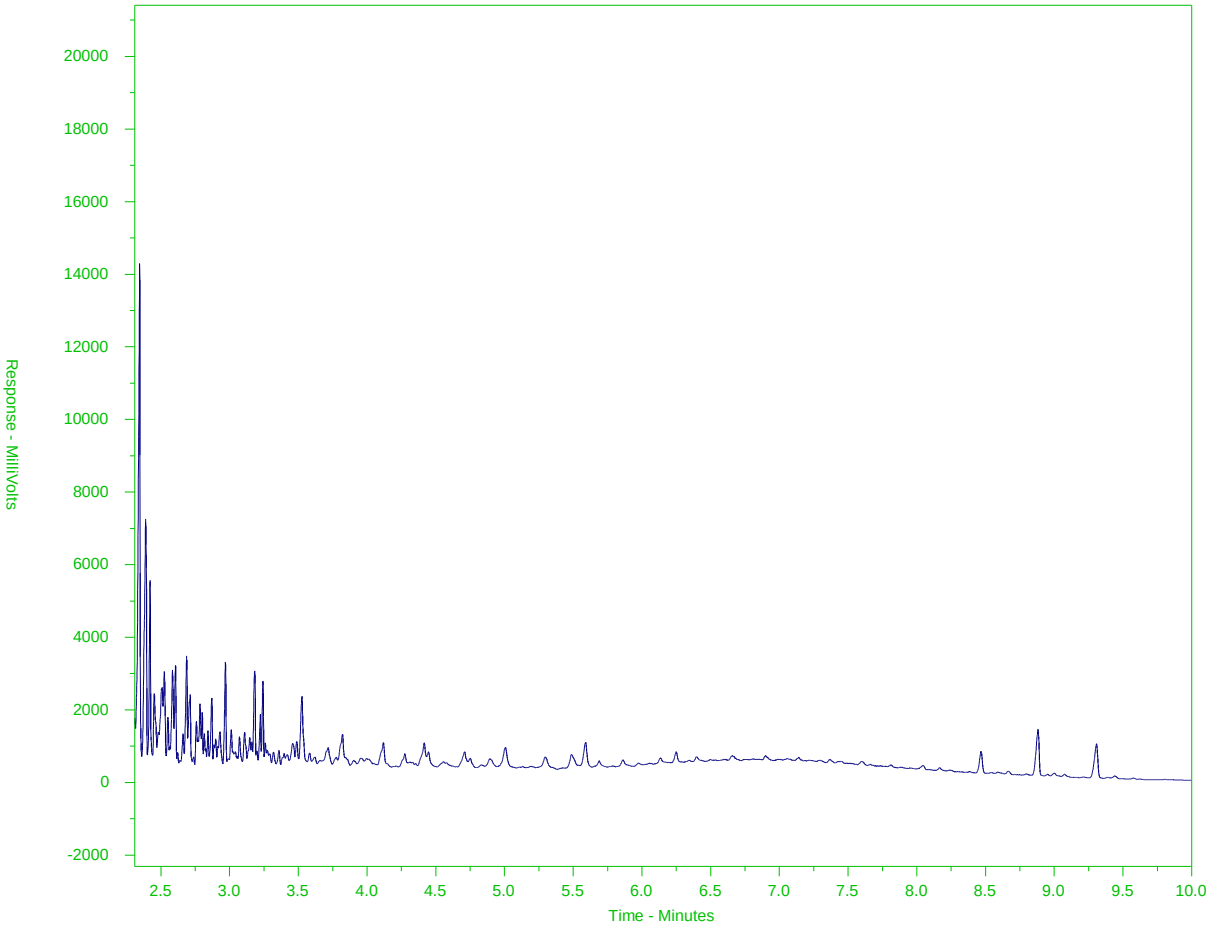
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1962974-1
Client Sample ID: EIRA-16



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1962974-COFC

COC Number: 15 - 609406

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	AECOM	Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☒
Phone:	604 444 6400	☒ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: ASAP
Street:	3292 Production	Email 1 or Fax: michael.gill@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Burnaby	Email 2: leslie.southern@aecom.com	
Postal Code:		Email 3	

Invoice To		Invoice Distribution	Analysis Request
	Same as Report To ☐ YES ☒ NO		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☒ YES ☐ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	P
Company:	Chevron Canada Ltd.	Email 1 or Fax: Same as above	
Contact:	Chris Bous	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: EAP

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIRA-16	22-Jul-17	9:25	Sediment	X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice Packs	☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			20.4		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: Jul, 22, 2017	Time:	Received by:	Date:	Time:	Received by:	Date: July 22	Time: 1:10 PM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 24-JUL-17
Report Date: 26-JUL-17 10:40 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1963473

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609409
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1963473-1				
	Description	SEDIMENT				
	Sampled Date	24-JUL-17				
	Sampled Time	10:50				
	Client ID	EIRA-17				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	20.1				
	pH (1:2 soil:water) (pH)	8.85				
Metals	Antimony (Sb) (mg/kg)	0.17				
	Arsenic (As) (mg/kg)	3.71				
	Barium (Ba) (mg/kg)	52.9				
	Beryllium (Be) (mg/kg)	0.29				
	Cadmium (Cd) (mg/kg)	0.111				
	Chromium (Cr) (mg/kg)	22.4				
	Cobalt (Co) (mg/kg)	5.06				
	Copper (Cu) (mg/kg)	15.9				
	Lead (Pb) (mg/kg)	6.94				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.29				
	Nickel (Ni) (mg/kg)	19.1				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.964				
	Vanadium (V) (mg/kg)	38.9				
	Zinc (Zn) (mg/kg)	35.7				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	2.44				
	Ethylbenzene (mg/kg)	0.056				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	0.082				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	88.6				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	88.5				
Hydrocarbons	EPH10-19 (mg/kg)	210				
	EPH19-32 (mg/kg)	790				
	LEPH (mg/kg)	210				
	HEPH (mg/kg)	790				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1963473-1				
	Description	SEDIMENT				
	Sampled Date	24-JUL-17				
	Sampled Time	10:50				
	Client ID	EIRA-17				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	91.1				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	115.3				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	121.7				
	Surrogate: Chrysene d12 (%)	129.8				
	Surrogate: Naphthalene d8 (%)	67.8				
	Surrogate: Phenanthrene d10 (%)	104.7				

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PAH-TMB-D/A-MS-VA	Soil	PAH - Rotary Extraction (DCM/Acetone)	EPA 3570/8270

Polycyclic Aromatic Hydrocarbons in Sediment/Soil
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 DCM 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

** 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:

15-609409

GLOSSARY OF REPORT TERMS

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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.
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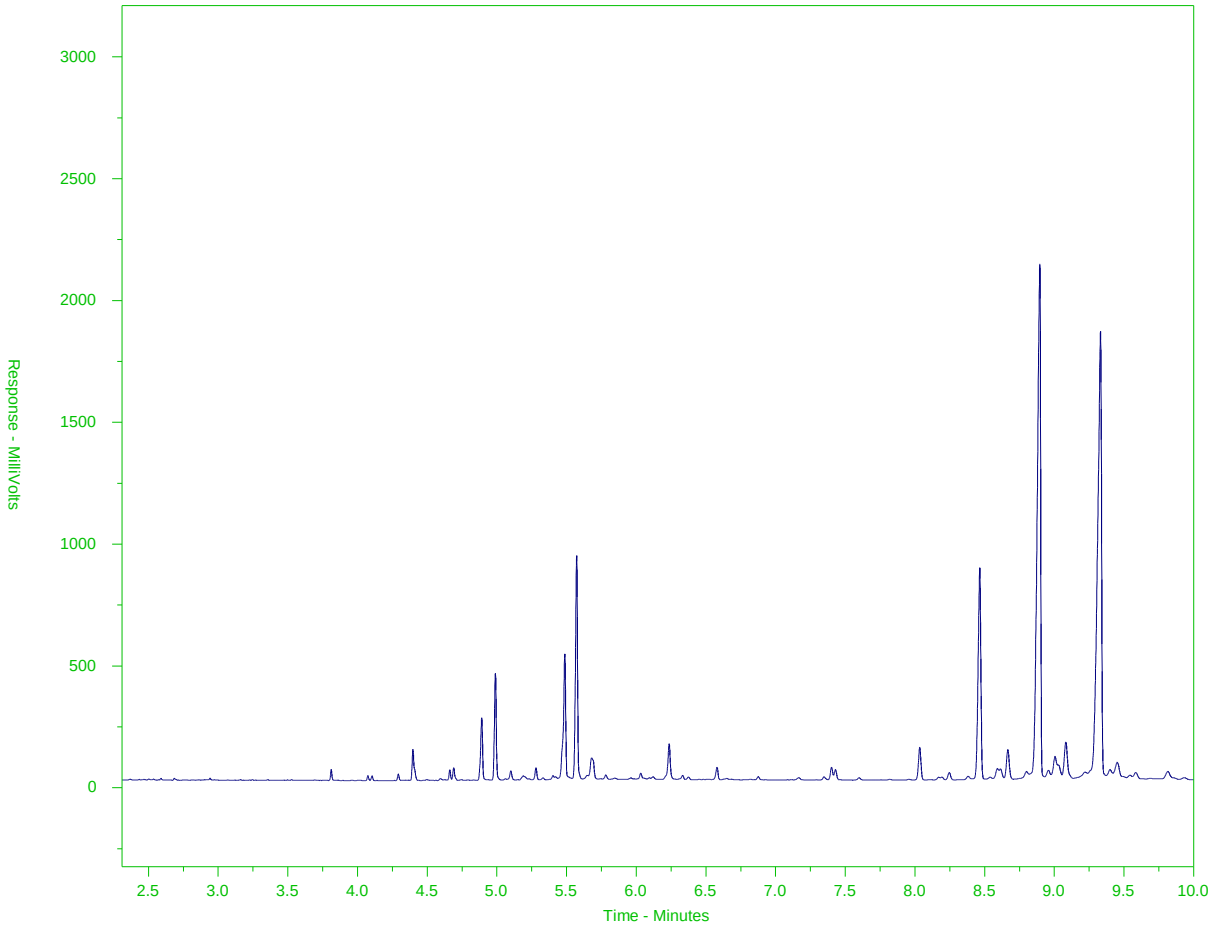
BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1963473-1
Client Sample ID: EIRA-17



← 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.

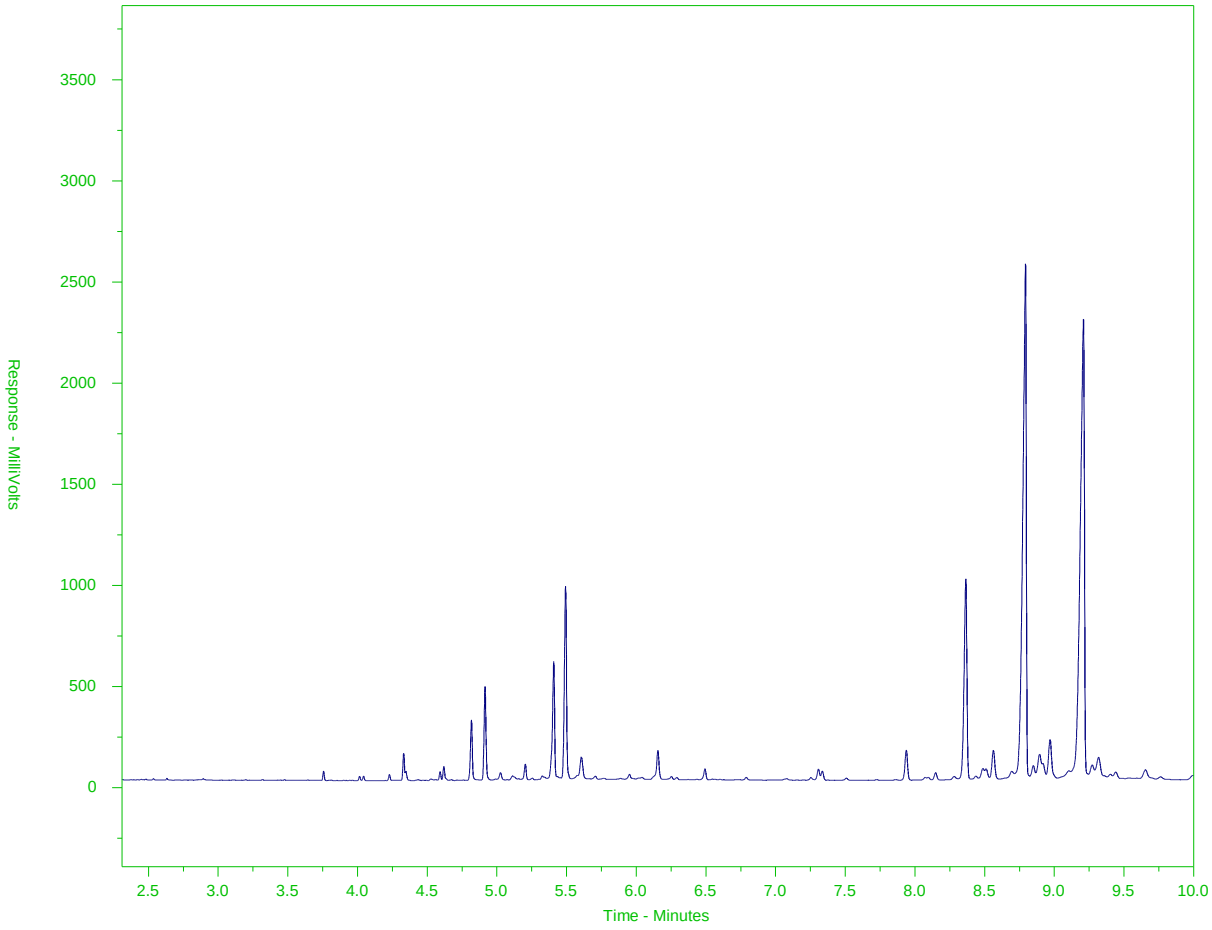
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2577422-3#L1963473-1
Client Sample ID: EIRA-17



← 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 →		

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ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1963473-COFC

COC Number: 15 - 609409

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	
City/Province:	Burnaby
Postal Code:	
Invoice To	Same as Report To: NO
	Copy of Invoice with Report: YES
Company:	Chevron Canada
Contact:	~~Rebecca Wood~~ Chris Boys

Report Format / Distribution

- Select Report Format: PDF, EXCEL, EDD (DIGITAL)
- Quality Control (QC) Report with Report: YES, NO
- Compare Results to Criteria on Report - provide details below if box checked
- Select Distribution: EMAIL, MAIL, FAX
- Email 1 or Fax: Michael.Gill@aecom.com
- Email 2: Leslie.Southern@aecom.com
- Email 3

Invoice Distribution

- Select Invoice Distribution: EMAIL, MAIL, FAX
- Email 1 or Fax: Same as above
- Email 2

Project Information

- ALS Account # / Quote #:
- Job #: 60542455
- PO / AFE:
- LSD: Foreshore
- ALS Lab Work Order # (lab use only):

Oil and Gas Required Fields (client use)

- AFE/Cost Center: PO#
- Major/Minor Code: Routing Code:
- Requisitioner:
- Location:
- ALS Contact: Sean Watt
- Sampler: EAP/JB

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R]

Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4]		1 Business day [E1]
	3 day [P3]		Same Day, Weekend or Statutory holiday [E0] X
	2 day [P2]		

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIRA-17	24-Jul-17	10:50	Sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? YES / NO X

Are samples for human drinking water use? YES / NO X

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			24		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Justin Beeler	Date: July 24th, 2017	Time: 17:38	Received by:	Date:	Time:	Received by: ND	Date: 7/24/17	Time: 17:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 24-JUL-17
Report Date: 01-AUG-17 17:09 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1963798

Project P.O. #:	NOT SUBMITTED
Job Reference:	60542455
C of C Numbers:	15-609416
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1963798-1	L1963798-2	L1963798-3		
Description	Sediment	Sediment	Sediment		
Sampled Date	24-JUL-17	24-JUL-17	24-JUL-17		
Sampled Time	12:10	12:15	12:20		
Client ID	ESA-12	ESA-13	ESA-14		
Grouping	**Analyte**				
SOIL					
Physical Tests	Moisture (%)	16.9	19.1	15.1	
	pH (1:2 soil:water) (pH)	7.88	7.91	8.10	
Metals	Antimony (Sb) (mg/kg)	0.13	0.16	0.13	
	Arsenic (As) (mg/kg)	1.22	1.30	1.40	
	Barium (Ba) (mg/kg)	65.3	95.5	65.2	
	Beryllium (Be) (mg/kg)	0.45	0.41	0.27	
	Cadmium (Cd) (mg/kg)	<0.050	0.127	<0.050	
	Chromium (Cr) (mg/kg)	15.7	22.8	9.78	
	Cobalt (Co) (mg/kg)	11.9	8.71	10.6	
	Copper (Cu) (mg/kg)	38.1	32.7	36.5	
	Lead (Pb) (mg/kg)	7.03	4.45	4.54	
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	
	Molybdenum (Mo) (mg/kg)	0.28	0.19	0.23	
	Nickel (Ni) (mg/kg)	8.83	9.56	5.08	
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	
	Thallium (Tl) (mg/kg)	0.062	<0.050	<0.050	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	
	Uranium (U) (mg/kg)	0.498	0.592	0.481	
	Vanadium (V) (mg/kg)	64.5	81.4	49.8	
	Zinc (Zn) (mg/kg)	67.1	68.8	52.9	
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	
	Benzene (mg/kg)	0.0189	0.0220	0.0167	
	Ethylbenzene (mg/kg)	<0.015	0.233	<0.015	
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	
	Styrene (mg/kg)	<0.050	<0.050	<0.050	
	Toluene (mg/kg)	0.099	0.059	<0.050	
	ortho-Xylene (mg/kg)	<0.050	0.354	<0.050	
	meta- & para-Xylene (mg/kg)	<0.050	0.761	<0.050	
	Xylenes (mg/kg)	<0.075	1.11	<0.075	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	87.7	93.7	94.6	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	89.9	90.3	93.4	
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200	
	EPH19-32 (mg/kg)	<200	<200	<200	
	LEPH (mg/kg)	<200	<200	<200	
	HEPH (mg/kg)	<200	<200	<200	
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1963798-1	L1963798-2	L1963798-3		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	24-JUL-17	24-JUL-17	24-JUL-17		
	Sampled Time	12:10	12:15	12:20		
	Client ID	ESA-12	ESA-13	ESA-14		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	95.0	98.1	90.6		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	104.2	112.1	105.8		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	0.284	<0.050		
	Naphthalene (mg/kg)	<0.050	0.145	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	89.3	107.4	100.7		
	Surrogate: Chrysene d12 (%)	94.6	79.4	85.8		
	Surrogate: Naphthalene d8 (%)	89.2	108.0	99.5		
	Surrogate: Phenanthrene d10 (%)	85.9	97.7	98.8		

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

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:

15-609416

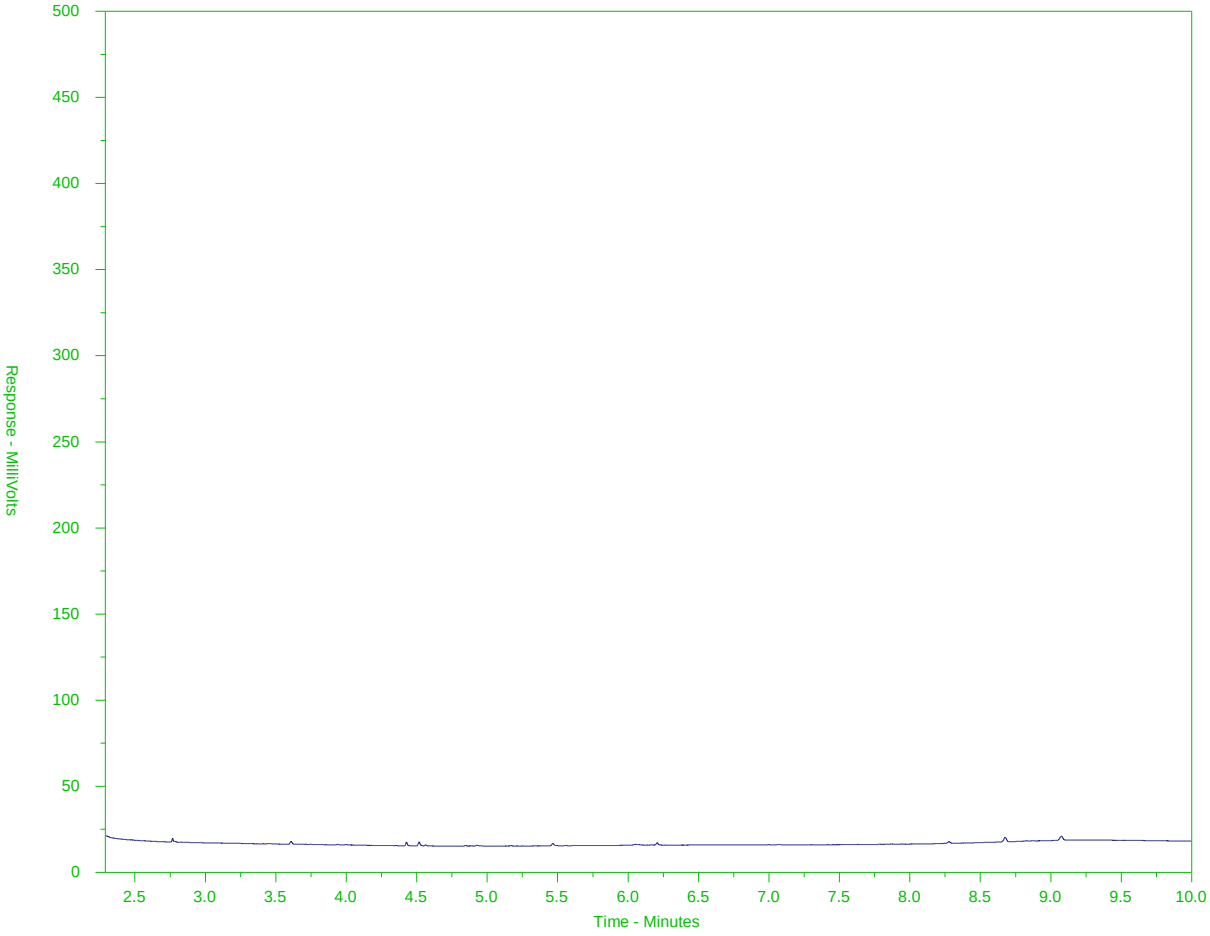
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1963798-1
Client Sample ID: ESA-12



← 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.

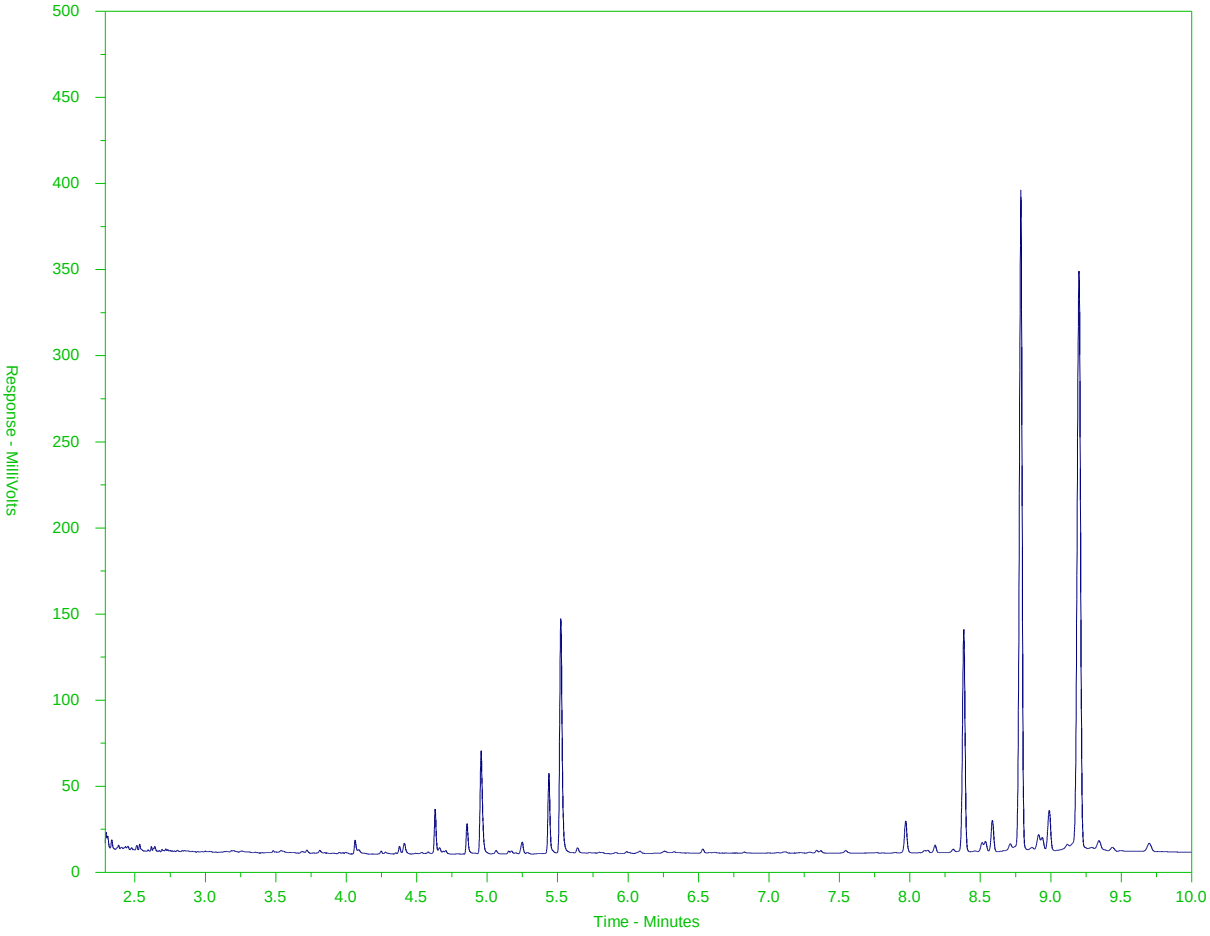
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1963798-2
Client Sample ID: ESA-13



← 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.

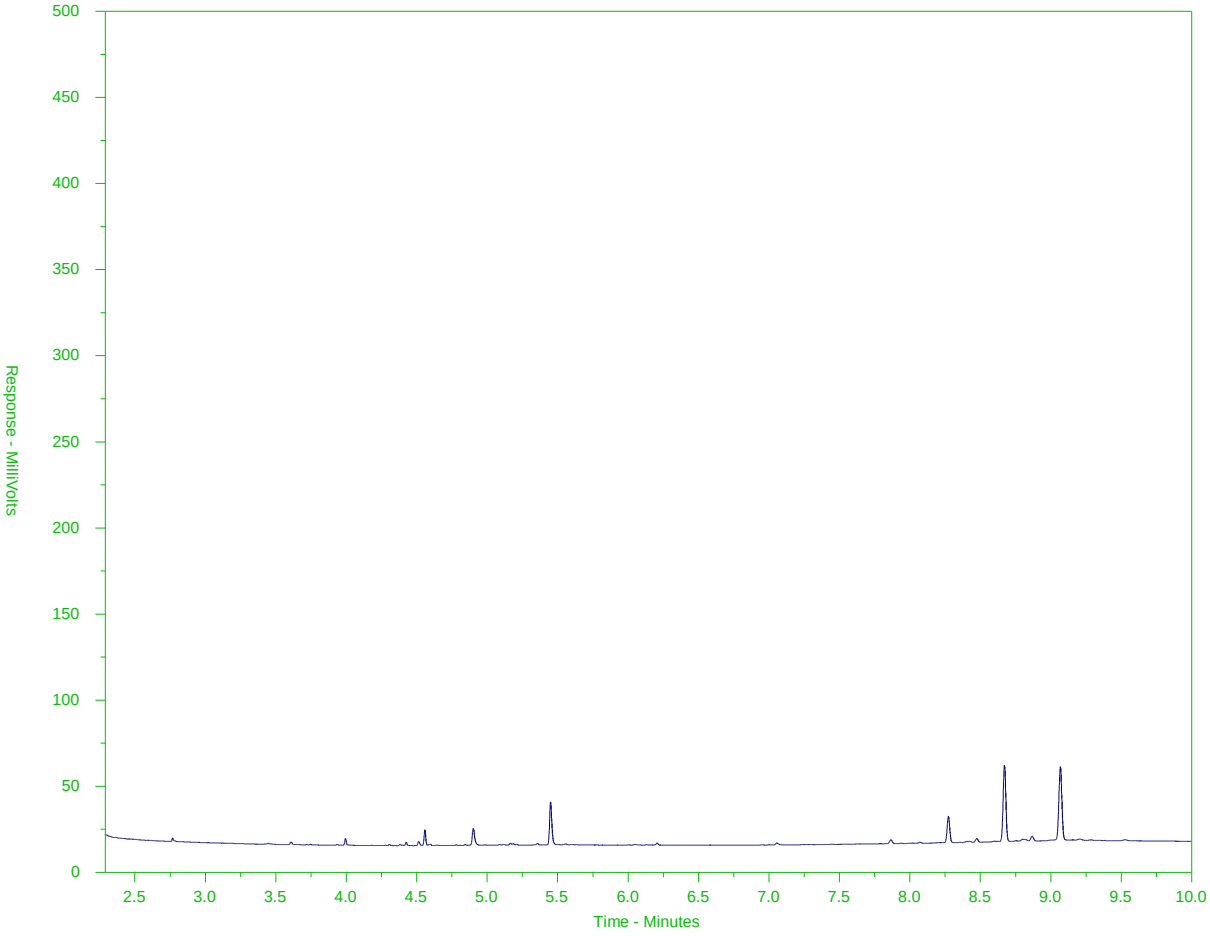
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1963798-3
Client Sample ID: ESA-14



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1963798-COFC

COC Number: 15 - 609416

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	
City/Province:	Burnaby
Postal Code:	
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Report Format / Distribution

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☒ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1: michael.gill@aecom.com
Email 2: leslie.southern@aecom.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: Same as above
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

Project Information

ALS Account # / Quote #:
Job #: 60542455
PO / AFE:
LSD: Foreshore
ALS Lab Work Order # (lab use only):
ALS Contact: Dean Watt
Sampler: EAP / JB

Turnaround Time (TAT) Requirements

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

E&P TATs with your AM - surcharges will apply
Date and Time Required for all E&P TATs:
For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX/VPH (P)	LEPH/HEPH (F/P)	Metals (F)	Number of Containers
	ESA-12	24-Jul-17	12:10	Sediment	X	X	X	4
	ESA-13		12:15					
	ESA-14		12:20					

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO
Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☐ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			24		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Justin Beeler	Date: July 24th, 2017	Time: 17:38	Received by:	Date:	Time:	Received by: NO	Date: 7/24/17	Time: 17:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

OCTOBER 2015 FRONT

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 25-JUL-17
Report Date: 03-AUG-17 19:08 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1964330

Project P.O. #:	NOT SUBMITTED
Job Reference:	60542455
C of C Numbers:	15-609417
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1964330-1	L1964330-2	L1964330-3		
Description	Sediment	Sediment	Sediment		
Sampled Date	25-JUL-17	25-JUL-17	25-JUL-17		
Sampled Time	00:50	01:15	12:55		
Client ID	ESA-15	ESA-16	ESA-17		
Grouping	**Analyte**				
SOIL					
Physical Tests	Moisture (%)	12.7	13.9	14.5	
	pH (1:2 soil:water) (pH)	7.69	8.05	8.12	
Metals	Antimony (Sb) (mg/kg)	0.18	0.13	0.26	
	Arsenic (As) (mg/kg)	1.69	1.27	3.99	
	Barium (Ba) (mg/kg)	65.8	74.8	129	
	Beryllium (Be) (mg/kg)	0.40	0.33	0.49	
	Cadmium (Cd) (mg/kg)	<0.050	0.062	0.051	
	Chromium (Cr) (mg/kg)	12.1	13.0	21.4	
	Cobalt (Co) (mg/kg)	8.14	7.88	11.9	
	Copper (Cu) (mg/kg)	33.4	25.5	44.5	
	Lead (Pb) (mg/kg)	6.70	4.09	5.37	
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	
	Molybdenum (Mo) (mg/kg)	0.14	0.24	0.24	
	Nickel (Ni) (mg/kg)	6.99	9.66	10.6	
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	
	Thallium (Tl) (mg/kg)	0.058	<0.050	0.070	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	
	Uranium (U) (mg/kg)	0.394	0.479	0.465	
	Vanadium (V) (mg/kg)	72.4	62.2	83.6	
	Zinc (Zn) (mg/kg)	54.0	50.8	61.1	
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	
	Benzene (mg/kg)	<0.0050	<0.030 DLCI	0.0112	
	Ethylbenzene (mg/kg)	<0.015	0.101	<0.015	
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	
	Styrene (mg/kg)	<0.050	<0.050	<0.050	
	Toluene (mg/kg)	<0.050	<0.050	<0.050	
	ortho-Xylene (mg/kg)	<0.050	0.117	<0.050	
	meta- & para-Xylene (mg/kg)	<0.050	0.309	<0.050	
	Xylenes (mg/kg)	<0.075	0.426	<0.075	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	83.3	90.3	87.9	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	94.0	90.7	90.6	
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200	
	EPH19-32 (mg/kg)	<200	<200	<200	
	LEPH (mg/kg)	<200	<200	<200	
	HEPH (mg/kg)	<200	<200	<200	
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1964330-1	L1964330-2	L1964330-3		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	25-JUL-17	25-JUL-17	25-JUL-17		
	Sampled Time	00:50	01:15	12:55		
	Client ID	ESA-15	ESA-16	ESA-17		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	91.0	95.3	89.3		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	100.3	90.4	329.9 SURR-ND		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	0.112	<0.050		
	Naphthalene (mg/kg)	<0.050	0.066	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	85.0	108.1	92.7		
	Surrogate: Chrysene d12 (%)	82.6	70.9	89.1		
	Surrogate: Naphthalene d8 (%)	84.0	98.9	89.1		
	Surrogate: Phenanthrene d10 (%)	84.3	94.8	93.6		

* 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	Lead (Pb)	DUP-H	L1964330-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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

Reference Information

VPH-CALC-VA	Soil	VPH is VH minus select aromatics	BC MOE LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609417

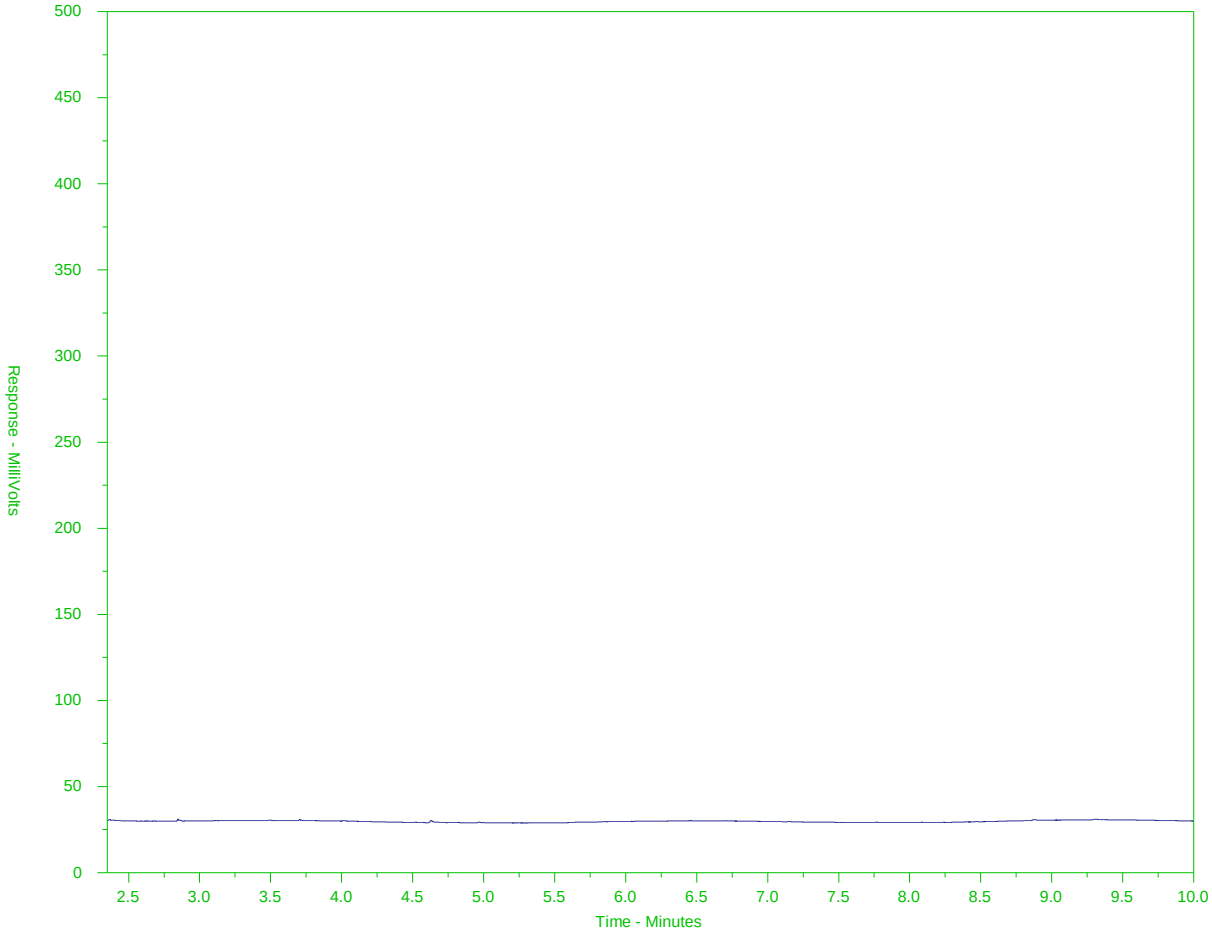
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1964330-1
Client Sample ID: ESA-15



← 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.

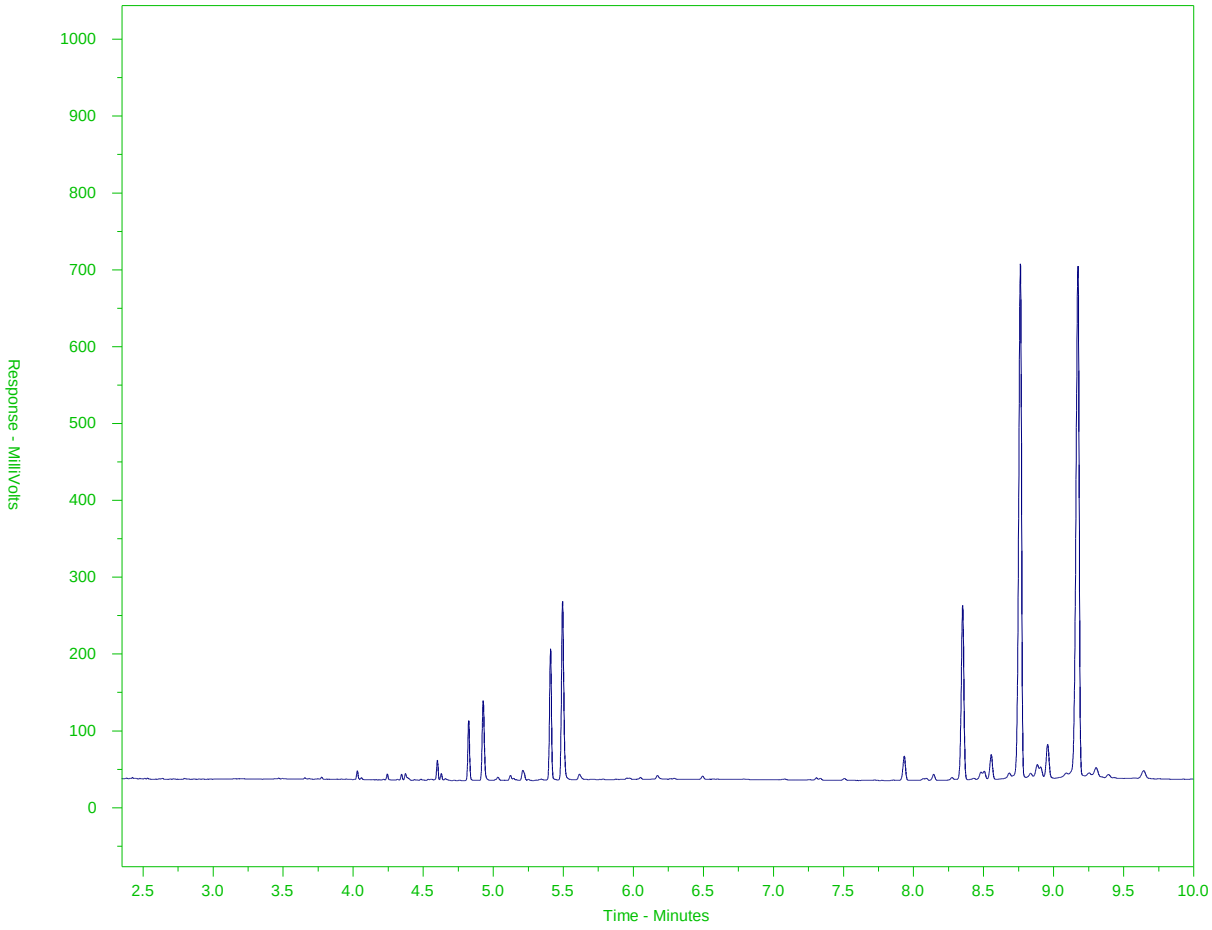
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1964330-2
Client Sample ID: ESA-16



← 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.

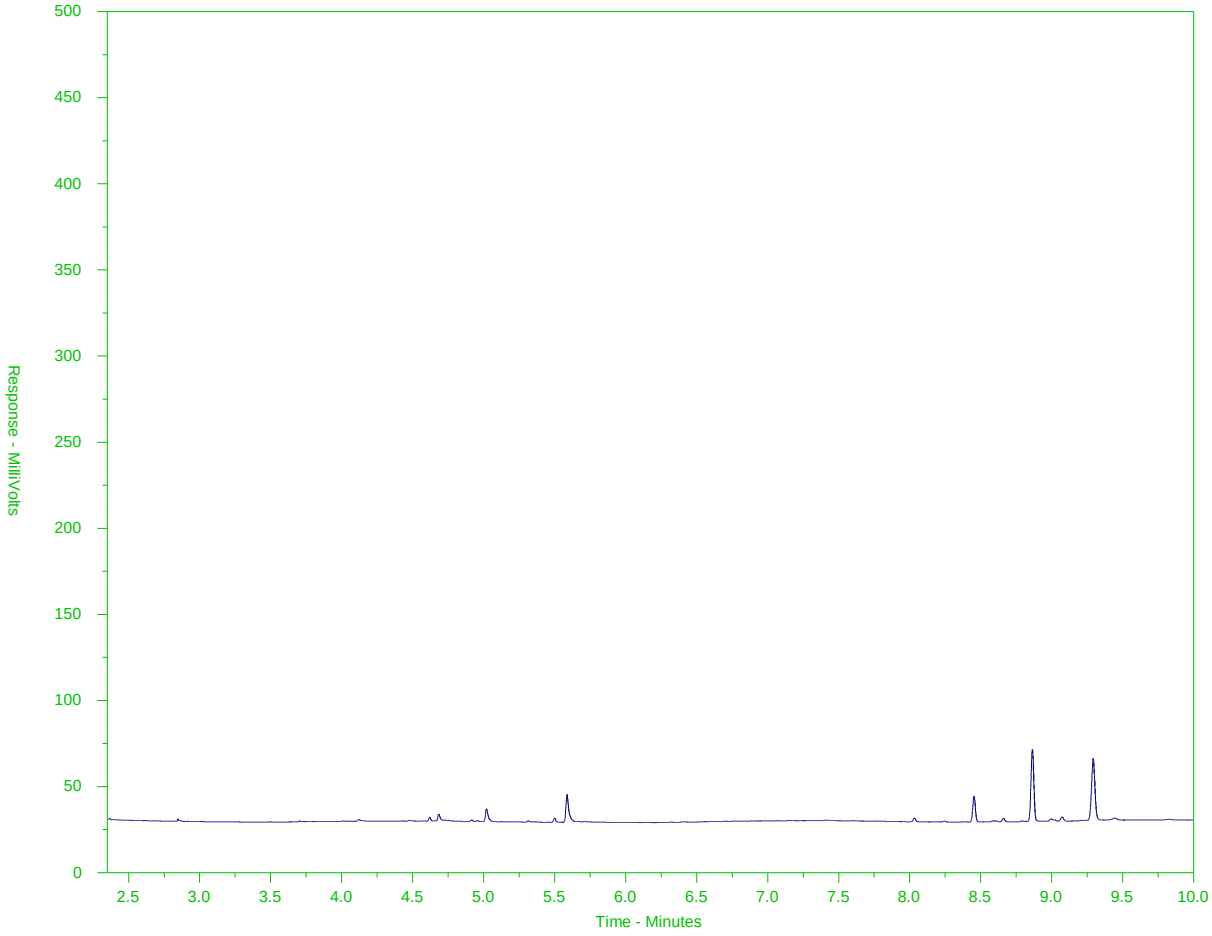
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1964330-3
Client Sample ID: ESA-17



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1964330-COFC

COC Number: 15 - 609417

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	

Invoice To		
	Same as Report To	YES NO (X)
	Copy of Invoice with Report	(X) YES NO
Company:	Chevron Canada Ltd.	
Contact:	Chris Boys	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore
ALS Lab Work Order # (lab use only)	

Report Format / Distribution	
Select Report Format:	(X) PDF (X) EXCEL ( ) EDD (DIGITAL)
Quality Control (QC) Report with Report	(X) YES ( ) NO
(X) Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	(X) EMAIL ( ) MAIL ( ) FAX
Email 1 or Fax	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Invoice Distribution	
Select Invoice Distribution:	(X) EMAIL ( ) MAIL ( ) FAX
Email 1 or Fax	Same as above
Email 2	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Dean Watt	Sampler: EAP + JB

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] (X) Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ( )		1 Business day [E1] ( )
	3 day [P3] ( )		Same Day, Weekend or Statutory holiday [E0] ( )
	2 day [P2] ( )		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	ESA - 15	25-Jul-17	12:50	Sediment		X	X	X	4
	ESA - 16	↓	13:15	↓		↓	↓	↓	↓
	ESA - 17	↓	12:55	↓		↓	↓	↓	↓

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ( ) YES (X) NO

Are samples for human drinking water use? ( ) YES (X) NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ( ) SIF Observations Yes ( ) No ( )

Ice Packs ( ) Ice Cubes ( ) Custody seal intact Yes ( ) No ( )

Cooling Initiated ( )

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
		25.9			

SHIPMENT RELEASE (client use)		
Released by: Justin Beckler	Date: July 25, 2017	Time: 16:25

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by: TP	Date: Jly25	Time: 16:25

FINAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 26-JUL-17
Report Date: 27-JUL-17 18:02 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1965280

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609410
Legal Site Desc: Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1965280-1	L1965280-2			
	Description	Sediment	Sediment			
	Sampled Date	26-JUL-17	26-JUL-17			
	Sampled Time	12:30	12:30			
	Client ID	EIRA-18	DUP-2			
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	21.7	23.4			
	pH (1:2 soil:water) (pH)	8.93	8.94			
Metals	Antimony (Sb) (mg/kg)	0.18	0.14			
	Arsenic (As) (mg/kg)	3.01	3.37			
	Barium (Ba) (mg/kg)	54.1	51.4			
	Beryllium (Be) (mg/kg)	0.24	0.24			
	Cadmium (Cd) (mg/kg)	0.091	0.108			
	Chromium (Cr) (mg/kg)	25.4	20.1			
	Cobalt (Co) (mg/kg)	5.17	5.75			
	Copper (Cu) (mg/kg)	16.8	16.9			
	Lead (Pb) (mg/kg)	5.32	5.78			
	Mercury (Hg) (mg/kg)	<0.050	<0.050			
	Molybdenum (Mo) (mg/kg)	0.29	0.30			
	Nickel (Ni) (mg/kg)	18.5	18.1			
	Selenium (Se) (mg/kg)	<0.20	<0.20			
	Silver (Ag) (mg/kg)	<0.10	<0.10			
	Thallium (Tl) (mg/kg)	<0.050	<0.050			
	Tin (Sn) (mg/kg)	<2.0	<2.0			
	Uranium (U) (mg/kg)	0.708	0.740			
	Vanadium (V) (mg/kg)	36.6	41.0			
	Zinc (Zn) (mg/kg)	38.7	39.5			
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH			
	Benzene (mg/kg)	0.0116	0.0132			
	Ethylbenzene (mg/kg)	<0.015	<0.015			
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20			
	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) (%)	89.0	76.3			
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.9	81.0			
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200			
	EPH19-32 (mg/kg)	670	710			
	LEPH (mg/kg)	<200	<200			
	HEPH (mg/kg)	670	710			
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1965280-1	L1965280-2			
	Description	Sediment	Sediment			
	Sampled Date	26-JUL-17	26-JUL-17			
	Sampled Time	12:30	12:30			
	Client ID	EIRA-18	DUP-2			
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100			
	Surrogate: 2-Bromobenzotrifluoride (%)	73.9	75.7			
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	65.4 SURR-ND	72.5			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050			
	Acenaphthylene (mg/kg)	<0.050	<0.050			
	Anthracene (mg/kg)	<0.050	<0.050			
	Benz(a)anthracene (mg/kg)	<0.050	<0.050			
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050			
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050			
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050			
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050			
	Chrysene (mg/kg)	<0.050	<0.050			
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050			
	Fluoranthene (mg/kg)	<0.050	<0.050			
	Fluorene (mg/kg)	<0.050	<0.050			
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050			
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050			
	Naphthalene (mg/kg)	<0.050	<0.050			
	Phenanthrene (mg/kg)	<0.050	<0.050			
	Pyrene (mg/kg)	<0.050	<0.050			
	Surrogate: Acenaphthene d10 (%)	103.3	94.0			
	Surrogate: Chrysene d12 (%)	69.9	124.2			
	Surrogate: Naphthalene d8 (%)	103.0	91.8			
	Surrogate: Phenanthrene d10 (%)	90.7	91.0			

* 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	Uranium (U)	DUP-H	L1965280-1, -2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

Reference Information

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609410

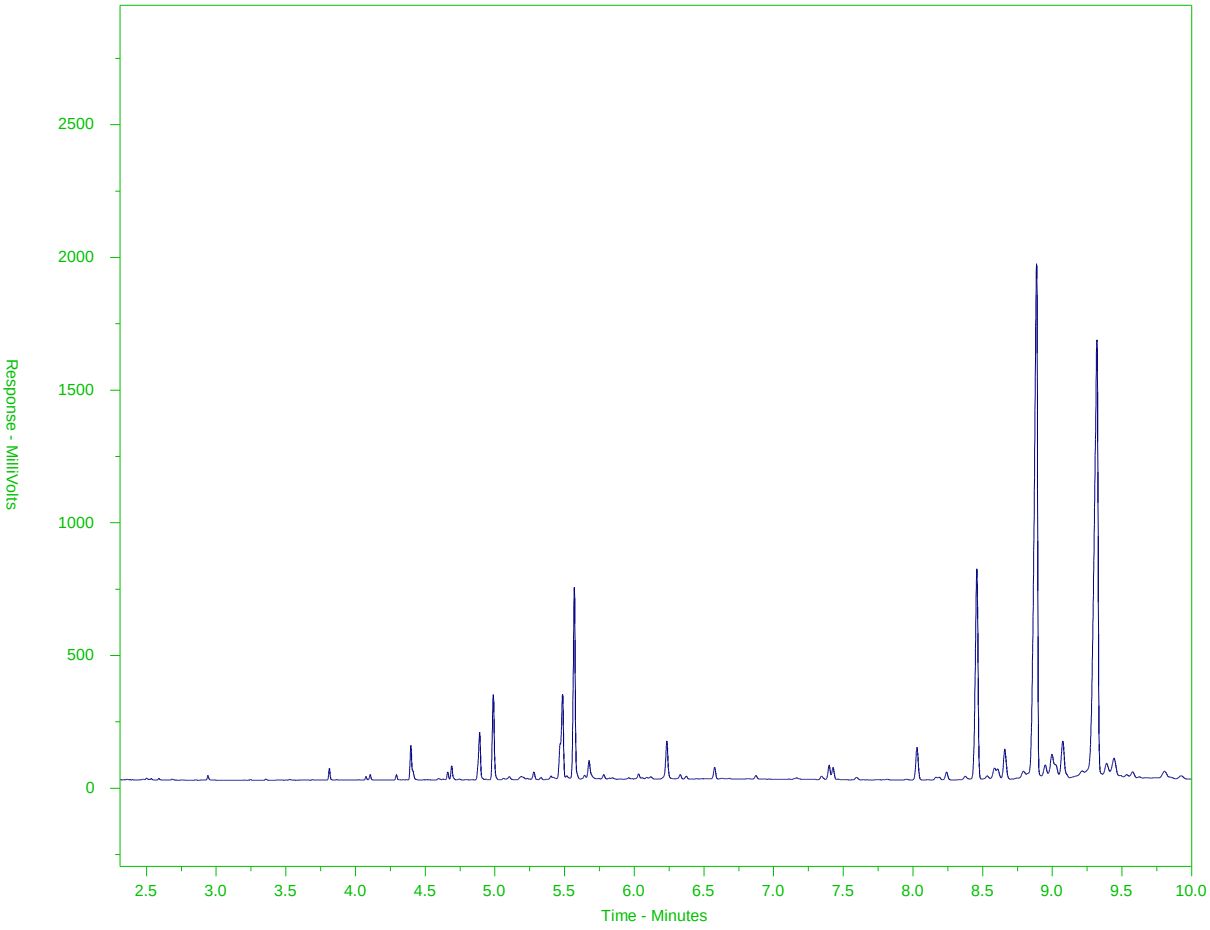
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1965280-1
Client Sample ID: EIRA-18



← 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.

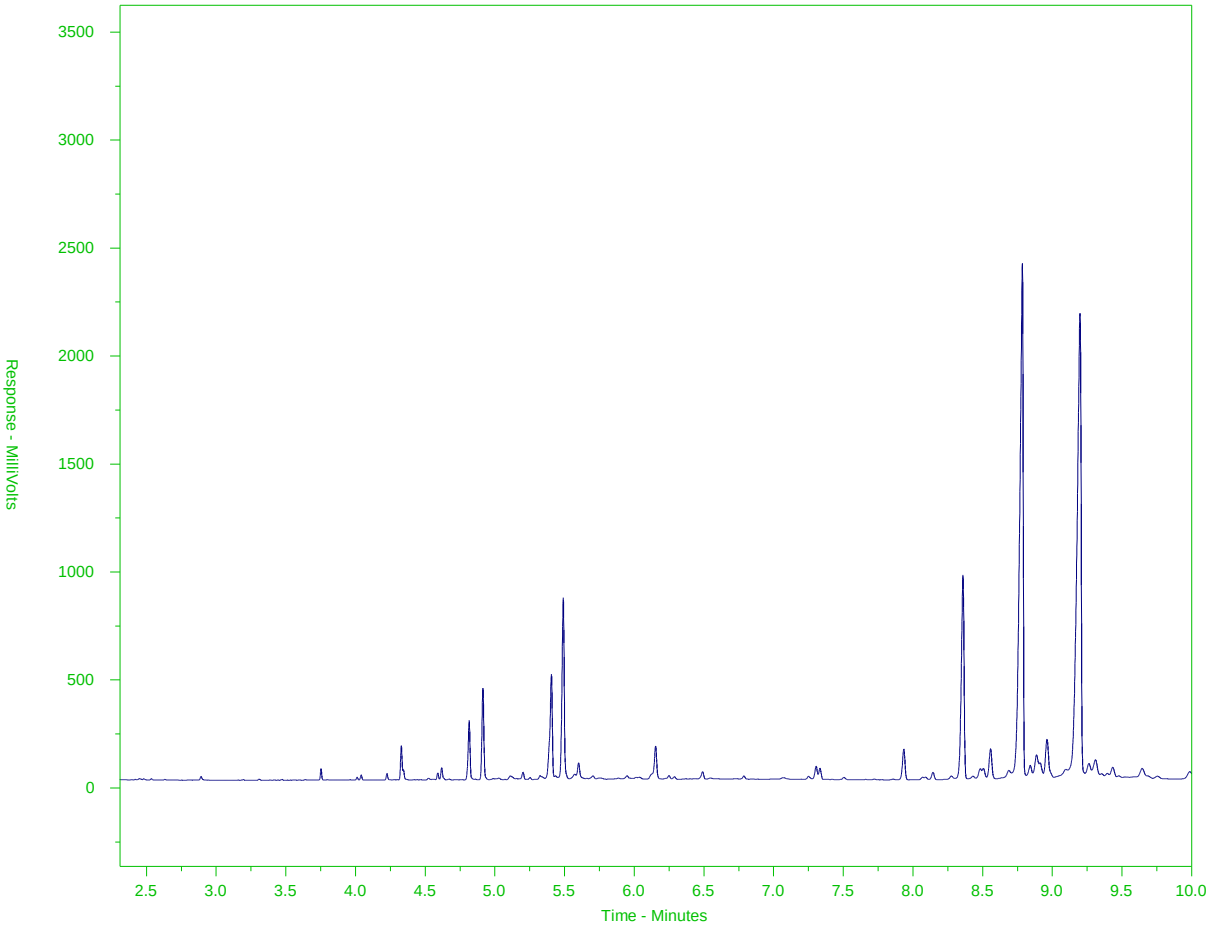
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2578998-4#L1965280-1
Client Sample ID: EIRA-18



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.

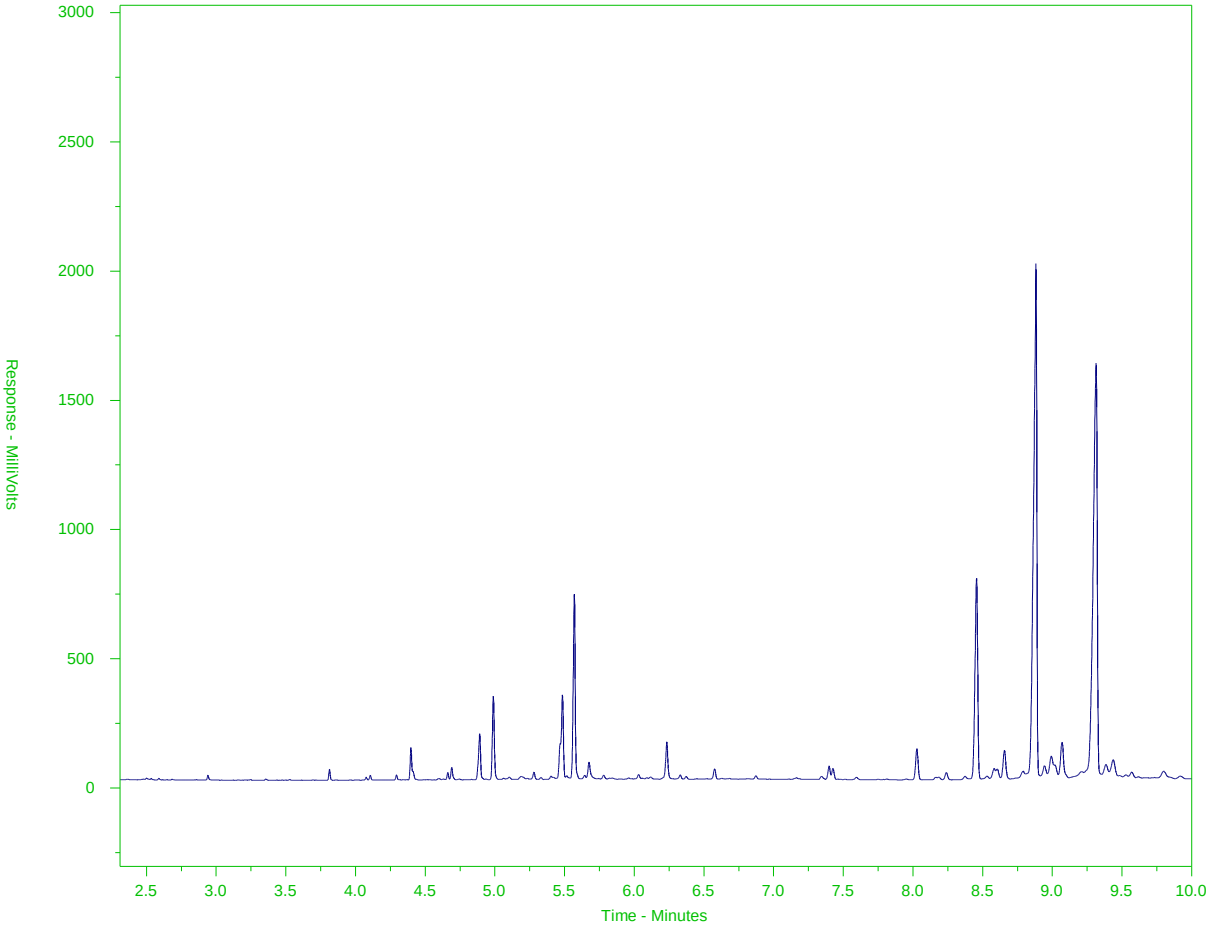
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1965280-2
Client Sample ID: DUP-2



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1965280-COFC

COC Number: 15 - 609410

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution		Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	AECOM	Select Report Format:	PDF EXCEL EDD (DIGITAL)	Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report	YES NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☒
Phone:	604 444 6400	Compare Results to Criteria on Report - provide details below if box checked		
Company address below will appear on the final report		Select Distribution:	EMAIL MAIL FAX	Date and Time Required for all E&P TATs: ASAP
Street:	3292 Production Way	Email 1 or Fax	michael.gill@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Burnaby	Email 2	leslie.southern@aecom.com	
Postal Code:		Email 3		

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution:	EMAIL MAIL FAX
	Copy of Invoice with Report ☒ YES ☐ NO	Email 1 or Fax	Same as above
Company:	Chevron Canada Ltd.	Email 2	
Contact:	Chris Boys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Sean Watt	Sampler: EAP/JB

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Analysis Request: P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIRA-18	26-Jul-17	12:30 PM	Sediment	X	X	X		4
	DUP-2	↓	↓	↓	X	X	X		↓

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐		
Ice Packs	☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐	
Cooling Initiated	☐					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2.5		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Justin Beedle	July 26th, 2017	18:35					7/26/17	18:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 26-JUL-17
Report Date: 10-AUG-17 14:01 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1965281

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	15-609419
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1965281-1	L1965281-2	L1965281-3		
Description	Sediment	Sediment	Sediment		
Sampled Date	26-JUL-17	26-JUL-17	26-JUL-17		
Sampled Time	13:30	13:35	13:40		
Client ID	ESA-21	ESA-22	ESA-23		
Grouping	**Analyte**				
SOIL					
Physical Tests	Moisture (%)	16.6	19.2	20.1	
	pH (1:2 soil:water) (pH)	7.57	7.69	7.52	
Metals	Antimony (Sb) (mg/kg)	0.19	0.19	0.21	
	Arsenic (As) (mg/kg)	1.32	1.25	1.49	
	Barium (Ba) (mg/kg)	45.6	55.4	49.2	
	Beryllium (Be) (mg/kg)	0.31	0.38	0.33	
	Cadmium (Cd) (mg/kg)	0.064	0.053	<0.050	
	Chromium (Cr) (mg/kg)	13.7	17.5	12.8	
	Cobalt (Co) (mg/kg)	7.85	10.5	8.49	
	Copper (Cu) (mg/kg)	22.4	29.4	26.9	
	Lead (Pb) (mg/kg)	5.81	5.30	5.13	
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	
	Molybdenum (Mo) (mg/kg)	0.20	0.15	0.13	
	Nickel (Ni) (mg/kg)	8.25	7.16	6.16	
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	
	Thallium (Tl) (mg/kg)	0.054	0.057	0.056	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	
	Uranium (U) (mg/kg)	0.517	0.600	0.411	
	Vanadium (V) (mg/kg)	65.2	73.3	65.0	
	Zinc (Zn) (mg/kg)	52.0	59.9	52.3	
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	
	Benzene (mg/kg)	<0.0050	0.0147	0.0104	
	Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015	
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	
	Styrene (mg/kg)	<0.050	<0.050	<0.050	
	Toluene (mg/kg)	<0.050	0.058	<0.050	
	ortho-Xylene (mg/kg)	<0.050	<0.050	<0.050	
	meta- & para-Xylene (mg/kg)	0.061	<0.050	<0.050	
	Xylenes (mg/kg)	<0.075	<0.075	<0.075	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	97.2	97.6	91.5	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	93.4	98.0	88.1	
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200	
	EPH19-32 (mg/kg)	<200	<200	<200	
	LEPH (mg/kg)	<200	<200	<200	
	HEPH (mg/kg)	<200	<200	<200	
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1965281-1	L1965281-2	L1965281-3		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	26-JUL-17	26-JUL-17	26-JUL-17		
	Sampled Time	13:30	13:35	13:40		
	Client ID	ESA-21	ESA-22	ESA-23		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	85.4	93.6	91.4		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	118.1	108.4	121.6		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	0.125		
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	97.2	98.9	95.6		
	Surrogate: Chrysene d12 (%)	112.5	103.6	99.4		
	Surrogate: Naphthalene d8 (%)	101.2	100.2	99.1		
	Surrogate: Phenanthrene d10 (%)	94.6	93.1	97.8		

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

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:

15-609419

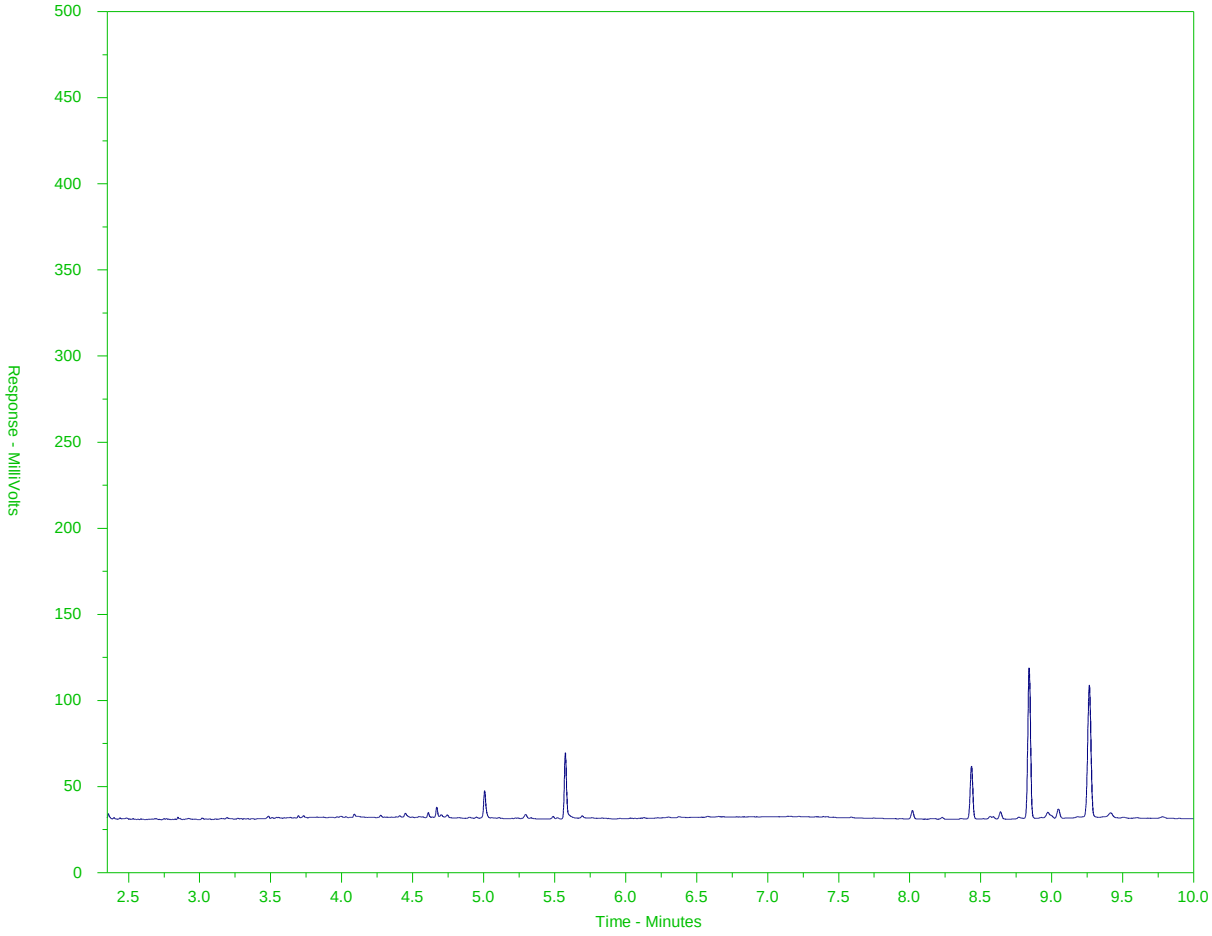
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1965281-1
Client Sample ID: ESA-21



← 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.

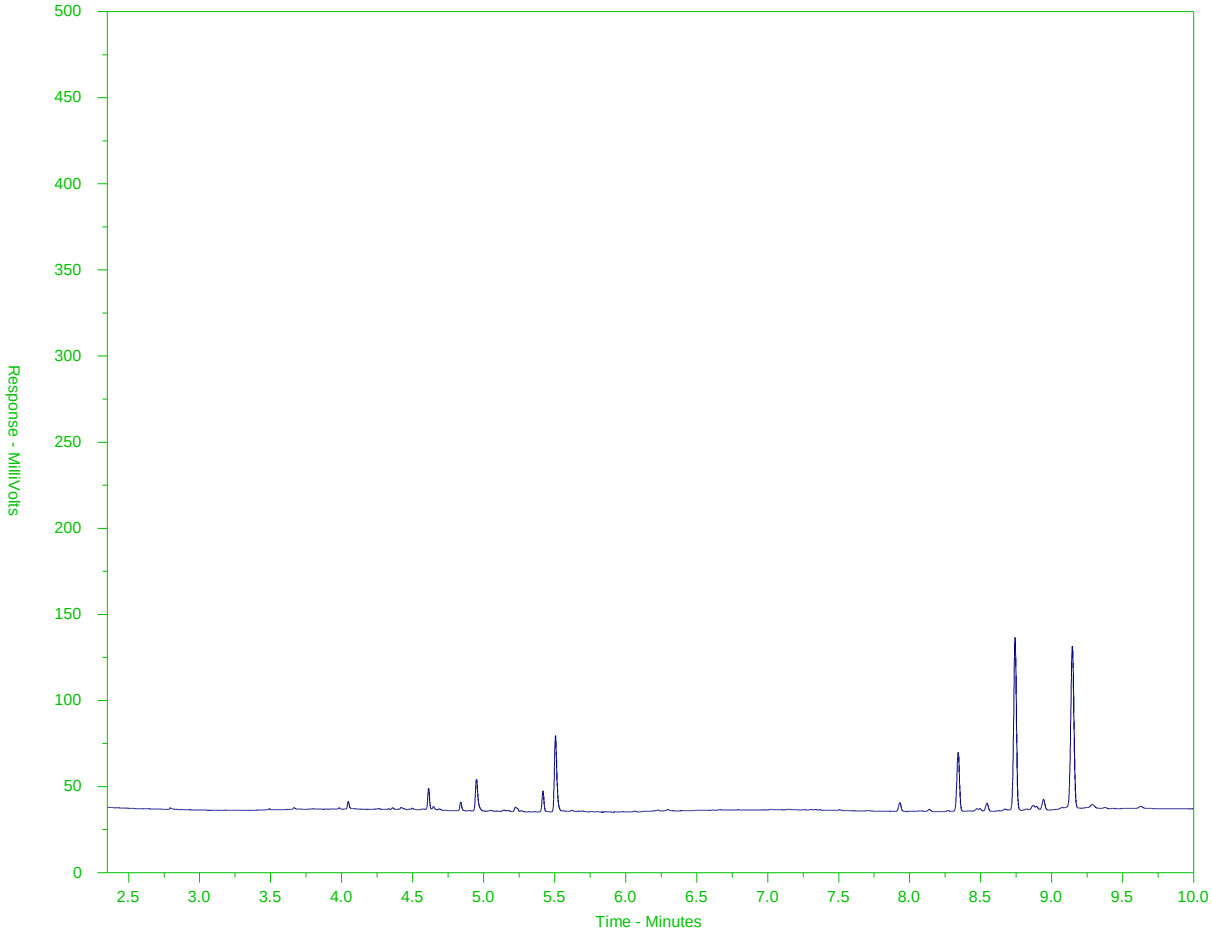
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1965281-2
Client Sample ID: ESA-22



← 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.

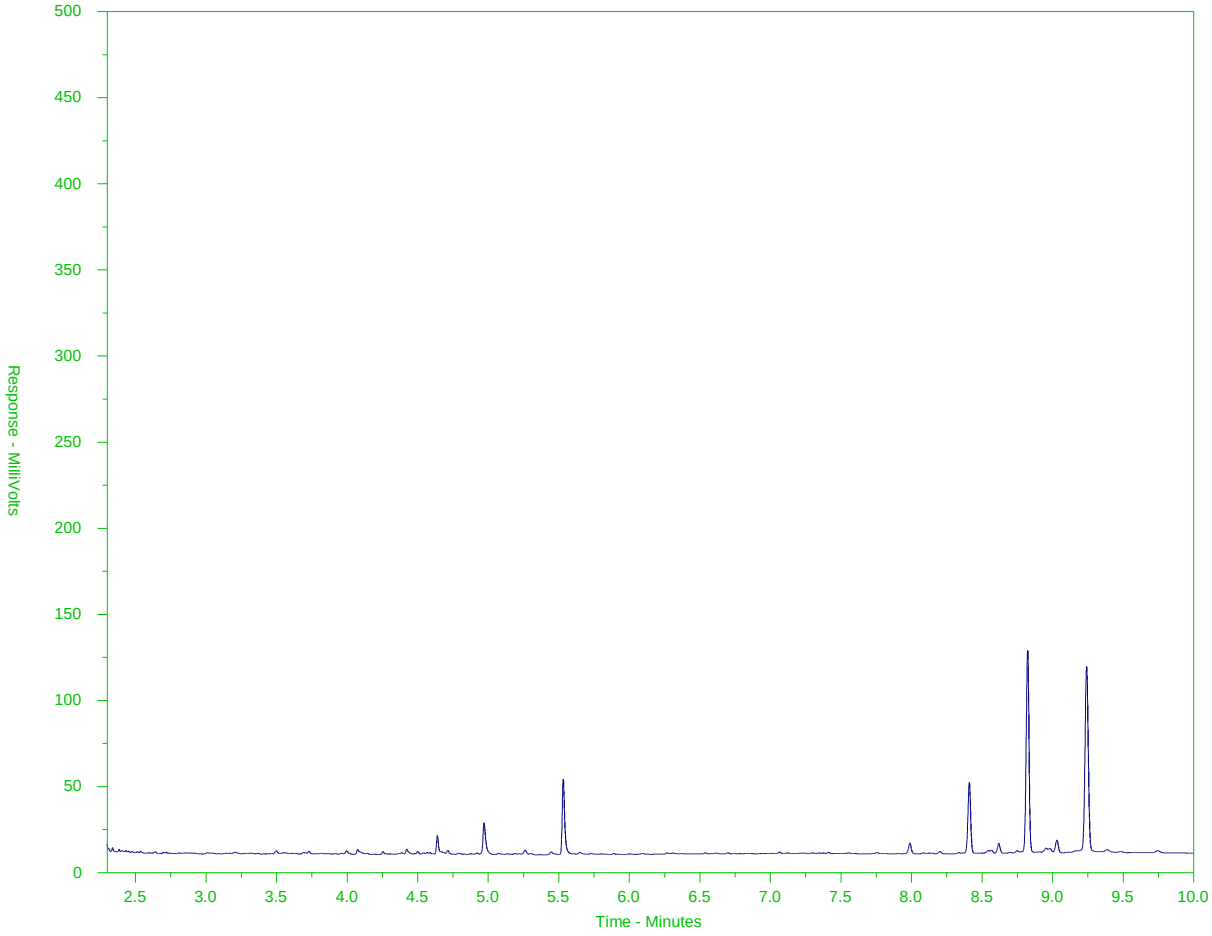
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1965281-3
Client Sample ID: ESA-23



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1965281-COFC

COC Number: 15 - 609419

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	
Company:	AECOM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Contact:	Michael Gill	Quality Control (QC) Report with Report	☒ YES ☐ NO
Phone:	604 444 6400	☒ Compare Results to Criteria on Report - provide details below if box checked	
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Street:	3292 Production Way	Email 1	michael.gill@aecom.com
City/Province:	Burnaby	Email 2	leslie.southern@aecom.com
Postal Code:		Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☒ YES ☐ NO	Email 1 or Fax	Same as above
Company:	Cheston Canada Ltd.	Email 2	
Contact:	Chris Boys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: EAP/JB

Select Service Level: ☒ E&P TATs with your AM - surcharges will apply

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	ESA-[redacted]21	26-Jul-17	13:30	Sediment		X	X	X	4
	ESA-[redacted]22		13:35						
	ESA-[redacted]23		13:40						
	[redacted]		[redacted]						
	[redacted]		[redacted]						
	[redacted]		[redacted]						

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			25		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Justin Beecher	Date: July 26, 2017	Time: 18:35	Received by:	Date:	Time:	Received by: ND	Date: 7/26/17	Time: 18:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 27-JUL-17
Report Date: 28-JUL-17 17:46 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1966069

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	608559
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1966069-1	L1966069-2	L1966069-3	L1966069-4	L1966069-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17
Sampled Time	13:00	13:10	13:15	13:20	13:30
Client ID	EIRA-19	EIRA-20	EIRA-21	EIRA-22	EIRA-23
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	13.2	14.5	7.31	19.7	19.2
pH (1:2 soil:water) (pH)	8.85	8.93	8.89	9.12	8.94
Metals Antimony (Sb) (mg/kg)	0.19	0.19	0.20	0.17	0.18
Arsenic (As) (mg/kg)	3.81	3.69	3.27	2.92	2.36
Barium (Ba) (mg/kg)	71.5	105	64.8	37.1	39.0
Beryllium (Be) (mg/kg)	0.26	0.26	0.25	0.28	0.22
Cadmium (Cd) (mg/kg)	0.105	0.080	0.102	0.096	0.074
Chromium (Cr) (mg/kg)	28.4	21.5	20.0	23.4	11.2
Cobalt (Co) (mg/kg)	4.91	5.31	5.11	5.08	4.04
Copper (Cu) (mg/kg)	15.9	18.7	15.6	16.8	11.7
Lead (Pb) (mg/kg)	6.21	7.10	6.29	6.13	5.57
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo) (mg/kg)	0.36	0.33	0.36	0.38	0.28
Nickel (Ni) (mg/kg)	19.0	20.5	17.1	19.4	9.46
Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U) (mg/kg)	0.862	1.00	1.05	0.874	0.762
Vanadium (V) (mg/kg)	37.0	41.2	40.0	40.0	35.5
Zinc (Zn) (mg/kg)	35.3	37.7	34.4	35.4	29.7
Volatile Organic Compounds VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	Field MeOH	Field MeOH
Benzene (mg/kg)	0.0099	0.0140	0.0134	0.0390	0.0060
Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015	0.034	<0.015
Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
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) (%)	85.5	94.0	85.1	90.5	81.6
Surrogate: 1,4-Difluorobenzene (SS) (%)	90.4	98.1	87.6	90.5	85.8
Hydrocarbons EPH10-19 (mg/kg)	<200	<200	<200	210	230
EPH19-32 (mg/kg)	670	720	660	770	740
LEPH (mg/kg)	<200	<200	<200	210	230
HEPH (mg/kg)	670	720	660	770	740
Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100	<100	<100

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1966069-6	L1966069-7			
	Description	Sediment	Sediment			
	Sampled Date	27-JUL-17	27-JUL-17			
	Sampled Time	13:35	12:00			
	Client ID	EIRA-24	DUP-3			
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	25.0	21.4			
	pH (1:2 soil:water) (pH)	9.14	9.06			
Metals	Antimony (Sb) (mg/kg)	0.18	0.15			
	Arsenic (As) (mg/kg)	2.06	2.75			
	Barium (Ba) (mg/kg)	60.6	32.4			
	Beryllium (Be) (mg/kg)	0.30	0.23			
	Cadmium (Cd) (mg/kg)	0.081	0.088			
	Chromium (Cr) (mg/kg)	11.9	17.9			
	Cobalt (Co) (mg/kg)	3.54	4.56			
	Copper (Cu) (mg/kg)	9.55	15.6			
	Lead (Pb) (mg/kg)	7.11	6.17			
	Mercury (Hg) (mg/kg)	<0.050	<0.050			
	Molybdenum (Mo) (mg/kg)	0.27	0.25			
	Nickel (Ni) (mg/kg)	8.54	16.8			
	Selenium (Se) (mg/kg)	<0.20	<0.20			
	Silver (Ag) (mg/kg)	<0.10	<0.10			
	Thallium (Tl) (mg/kg)	<0.050	<0.050			
	Tin (Sn) (mg/kg)	<2.0	<2.0			
	Uranium (U) (mg/kg)	1.23	0.844			
	Vanadium (V) (mg/kg)	32.2	35.7			
	Zinc (Zn) (mg/kg)	29.6	32.6			
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH			
	Benzene (mg/kg)	0.0135	0.0278			
	Ethylbenzene (mg/kg)	0.207	0.046			
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20			
	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) (%)	89.6	91.0			
	Surrogate: 1,4-Difluorobenzene (SS) (%)	98.6	94.8			
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200			
	EPH19-32 (mg/kg)	420	720			
	LEPH (mg/kg)	<200	<200			
	HEPH (mg/kg)	420	720			
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100			

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1966069-1	L1966069-2	L1966069-3	L1966069-4	L1966069-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17
Sampled Time	13:00	13:10	13:15	13:20	13:30
Client ID	EIRA-19	EIRA-20	EIRA-21	EIRA-22	EIRA-23
Grouping / **Analyte**					
SOIL					
Hydrocarbons VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
Surrogate: 2-Bromobenzotrifluoride (%)	86.7	80.6	80.8	79.3	76.5
Surrogate: 3,4-Dichlorotoluene (SS) (%)	88.0	102.1	88.1	87.8	90.2
Polycyclic Aromatic Hydrocarbons Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Surrogate: Acenaphthene d10 (%)	111.4	91.1	94.2	109.3	94.8
Surrogate: Chrysene d12 (%)	89.3	64.4	92.6	126.5	128.7
Surrogate: Naphthalene d8 (%)	98.2	78.3	91.3	88.8	91.1
Surrogate: Phenanthrene d10 (%)	99.8	85.8	93.6	88.2	92.5

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1966069-6	L1966069-7			
	Description	Sediment	Sediment			
	Sampled Date	27-JUL-17	27-JUL-17			
	Sampled Time	13:35	12:00			
	Client ID	EIRA-24	DUP-3			
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100			
	Surrogate: 2-Bromobenzotrifluoride (%)	81.1	77.3			
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	87.1	94.9			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050			
	Acenaphthylene (mg/kg)	<0.050	<0.050			
	Anthracene (mg/kg)	<0.050	<0.050			
	Benz(a)anthracene (mg/kg)	<0.050	<0.050			
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050			
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050			
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050			
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050			
	Chrysene (mg/kg)	<0.050	<0.050			
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050			
	Fluoranthene (mg/kg)	<0.050	<0.050			
	Fluorene (mg/kg)	<0.050	<0.050			
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050			
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050			
	Naphthalene (mg/kg)	<0.050	<0.050			
	Phenanthrene (mg/kg)	<0.050	<0.050			
	Pyrene (mg/kg)	<0.050	<0.050			
	Surrogate: Acenaphthene d10 (%)	88.8	115.1			
	Surrogate: Chrysene d12 (%)	83.9	66.9			
	Surrogate: Naphthalene d8 (%)	87.3	102.2			
	Surrogate: Phenanthrene d10 (%)	87.7	78.7			

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

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:

608559

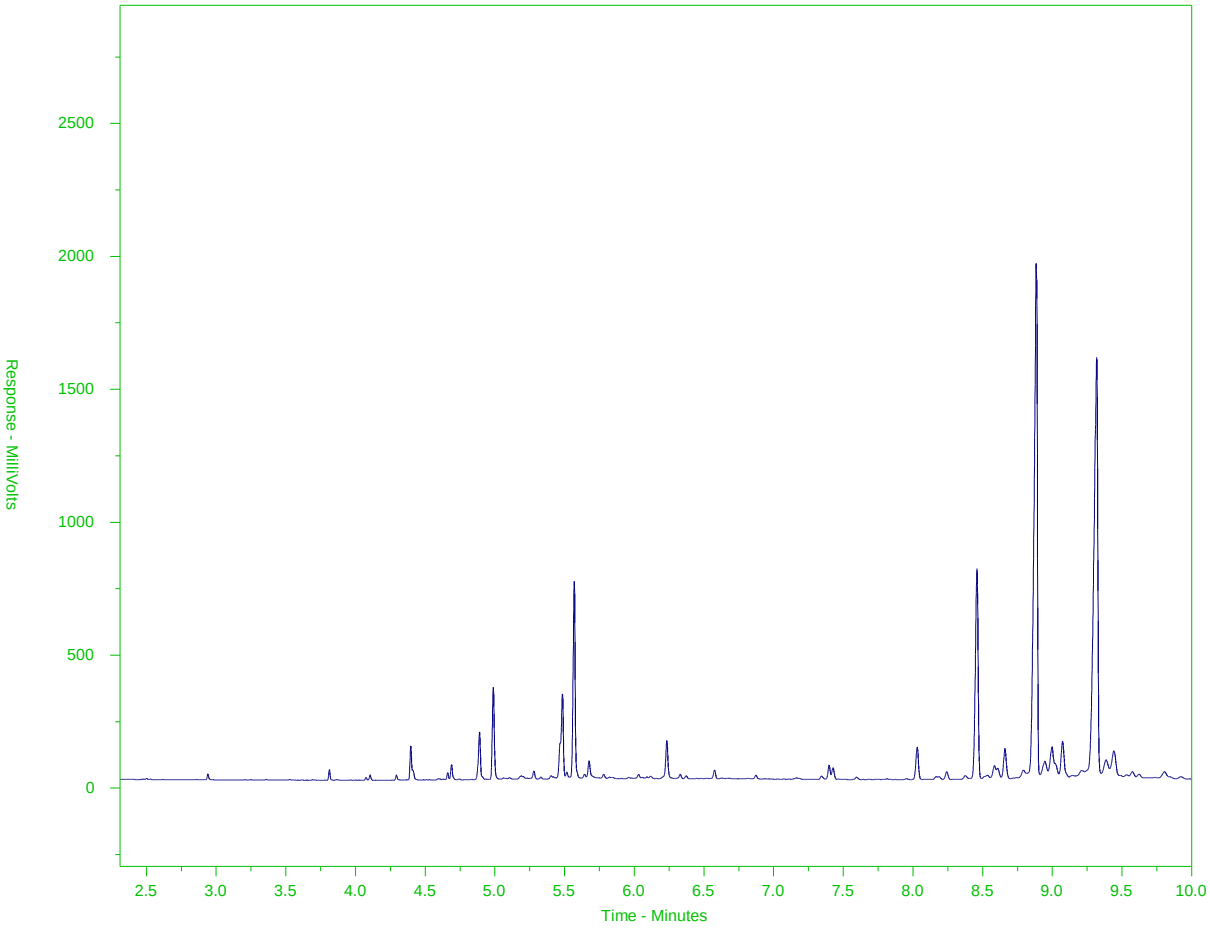
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1966069-1
Client Sample ID: EIRA-19



← 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.

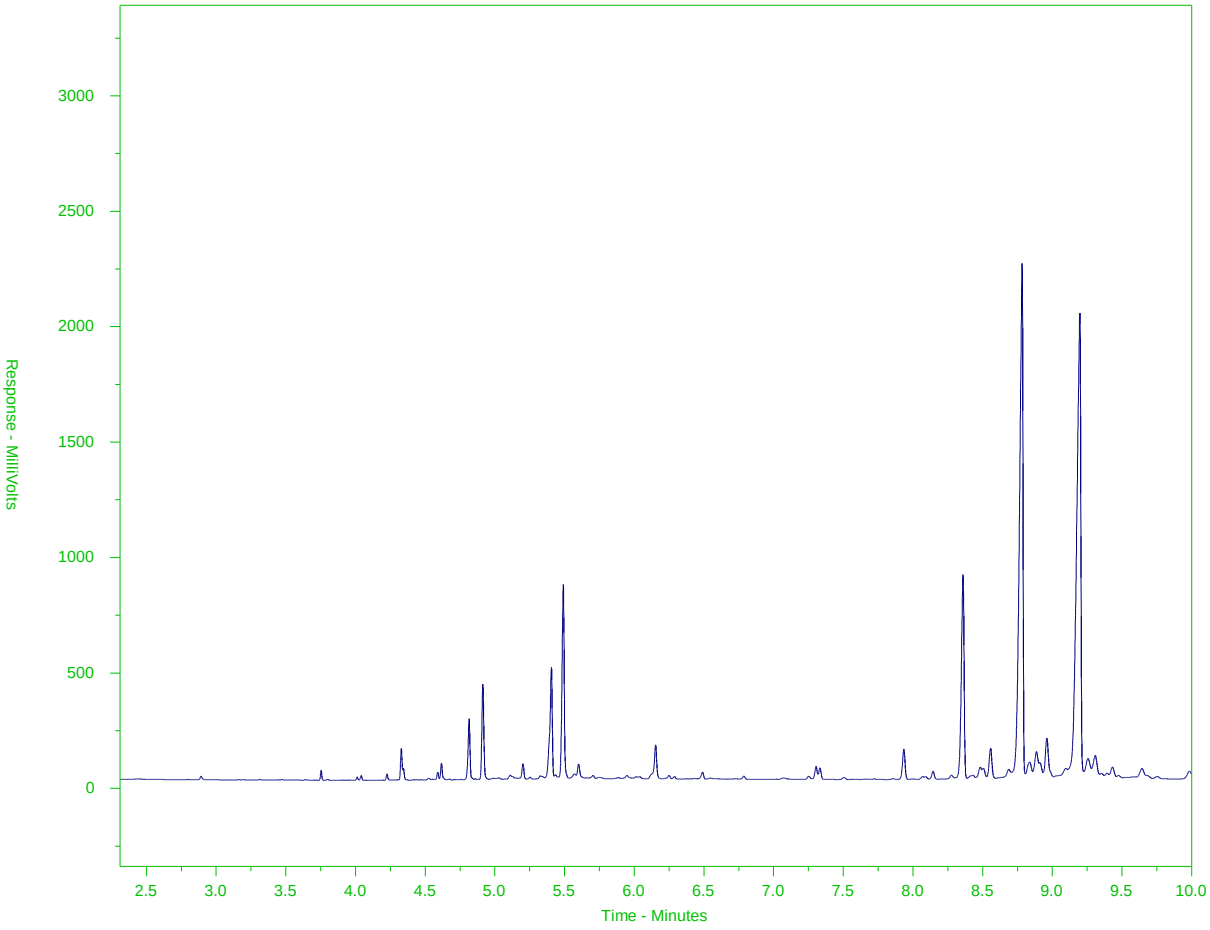
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966069-2
Client Sample ID: EIRA-20



← 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.

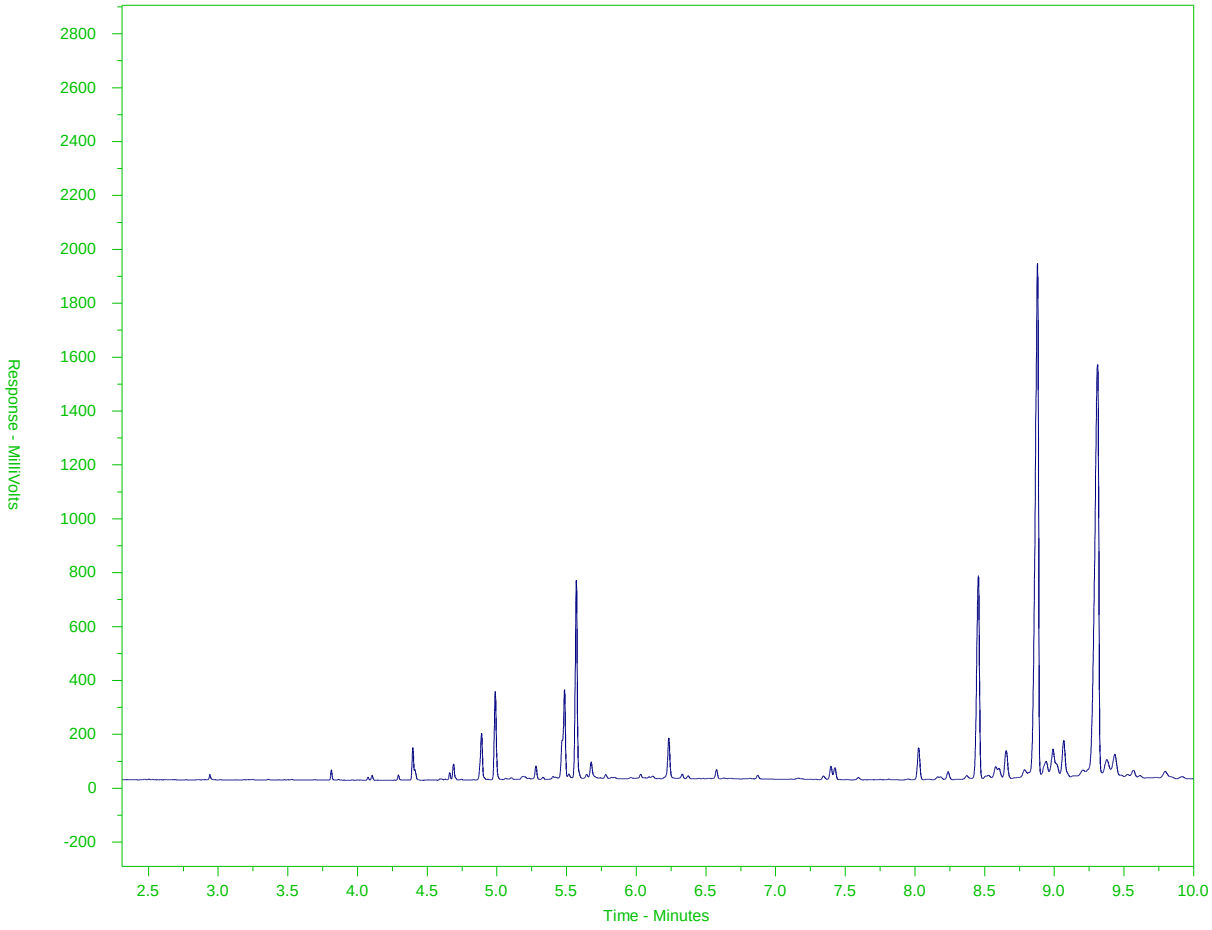
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2579951-4#L1966069-2
Client Sample ID: EIRA-20



← 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.

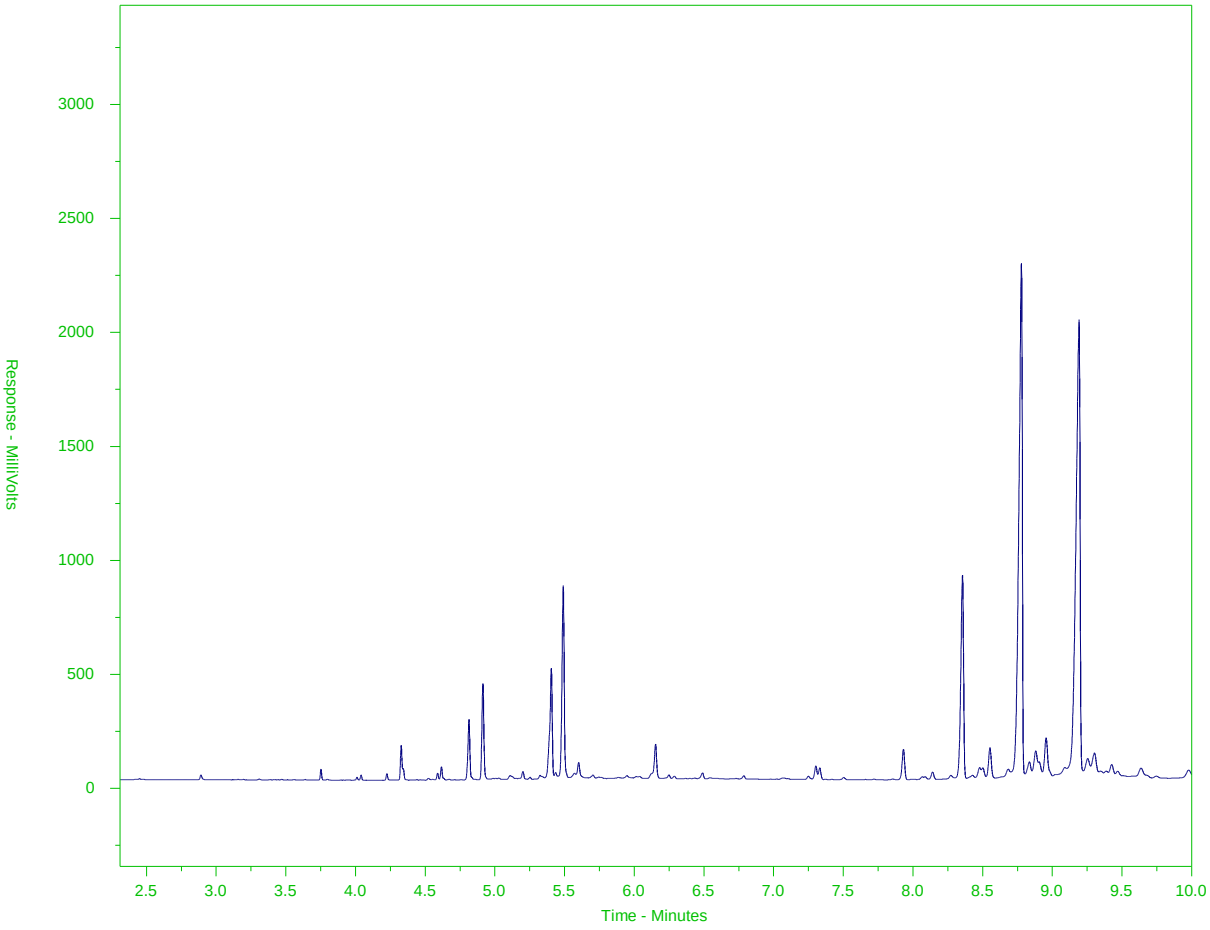
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966069-3
Client Sample ID: EIRA-21



← 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.

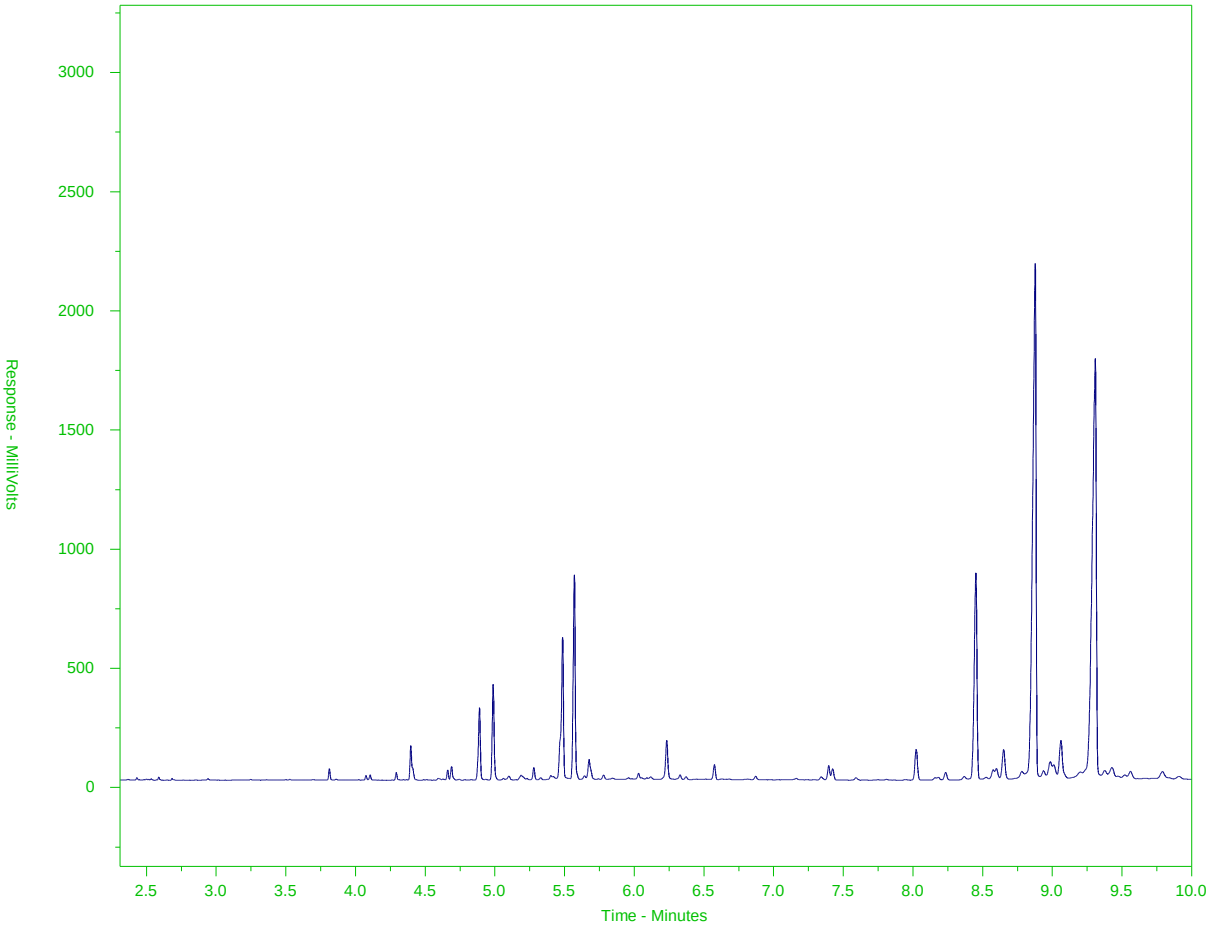
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966069-4
Client Sample ID: EIRA-22



← 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.

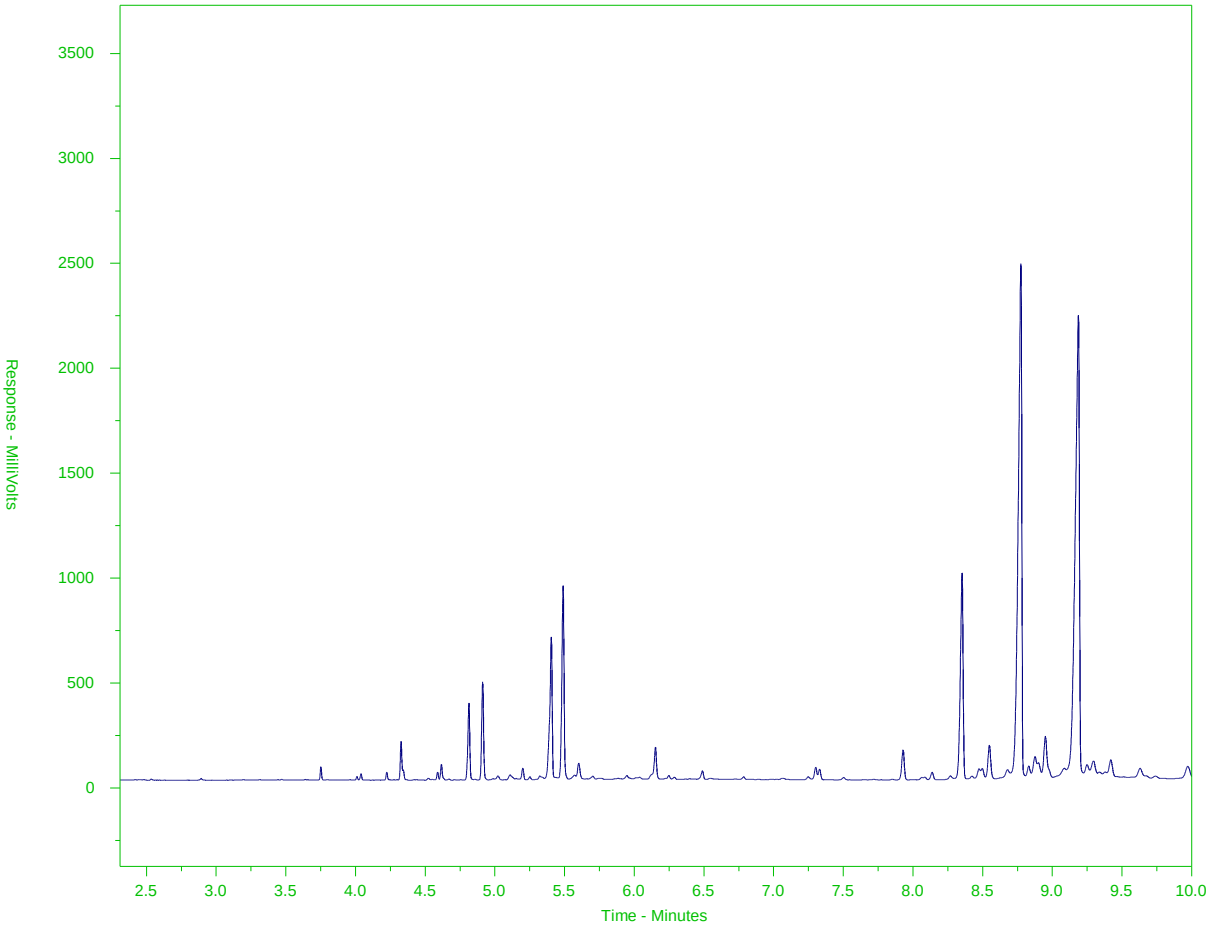
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966069-5
Client Sample ID: EIRA-23



← 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.

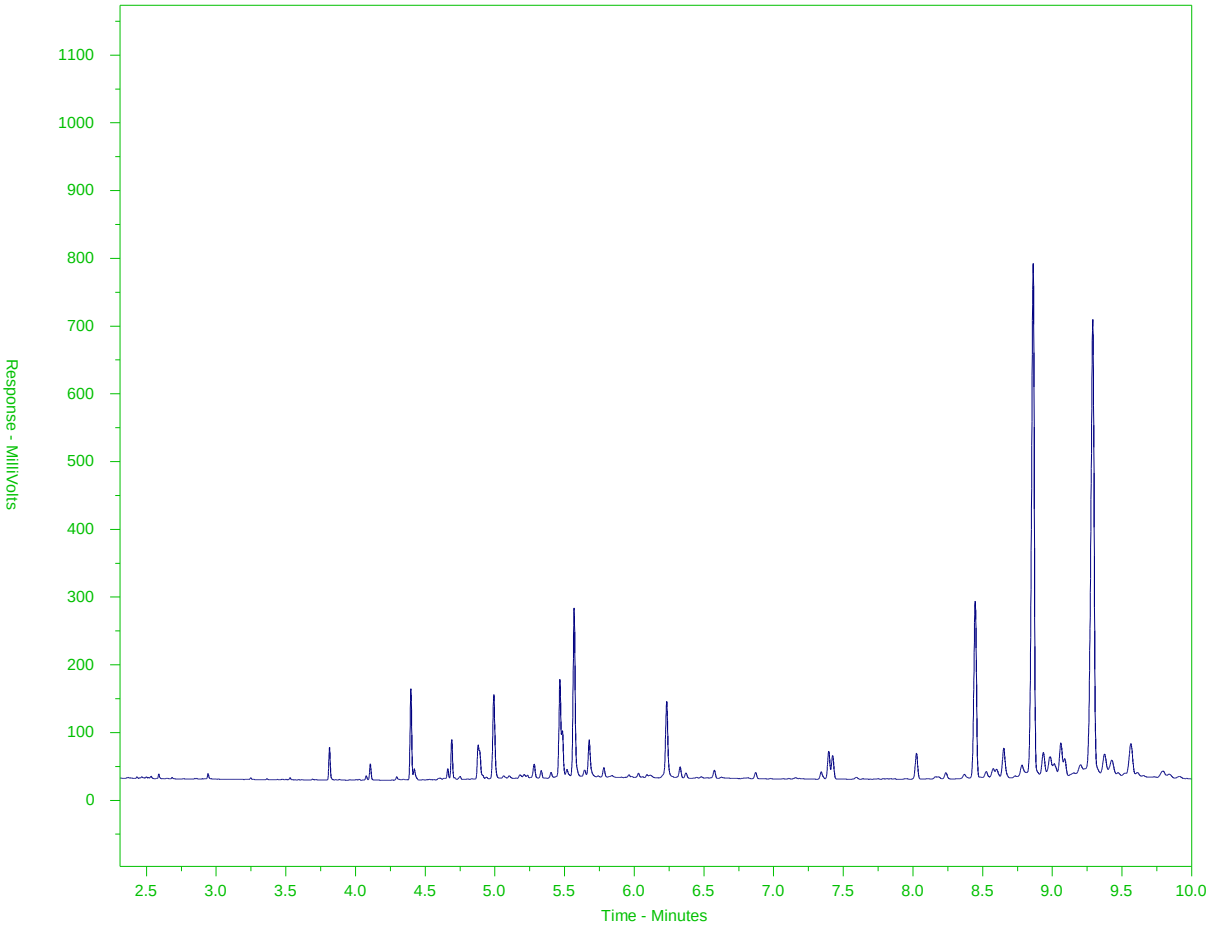
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966069-6
Client Sample ID: EIRA-24



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.

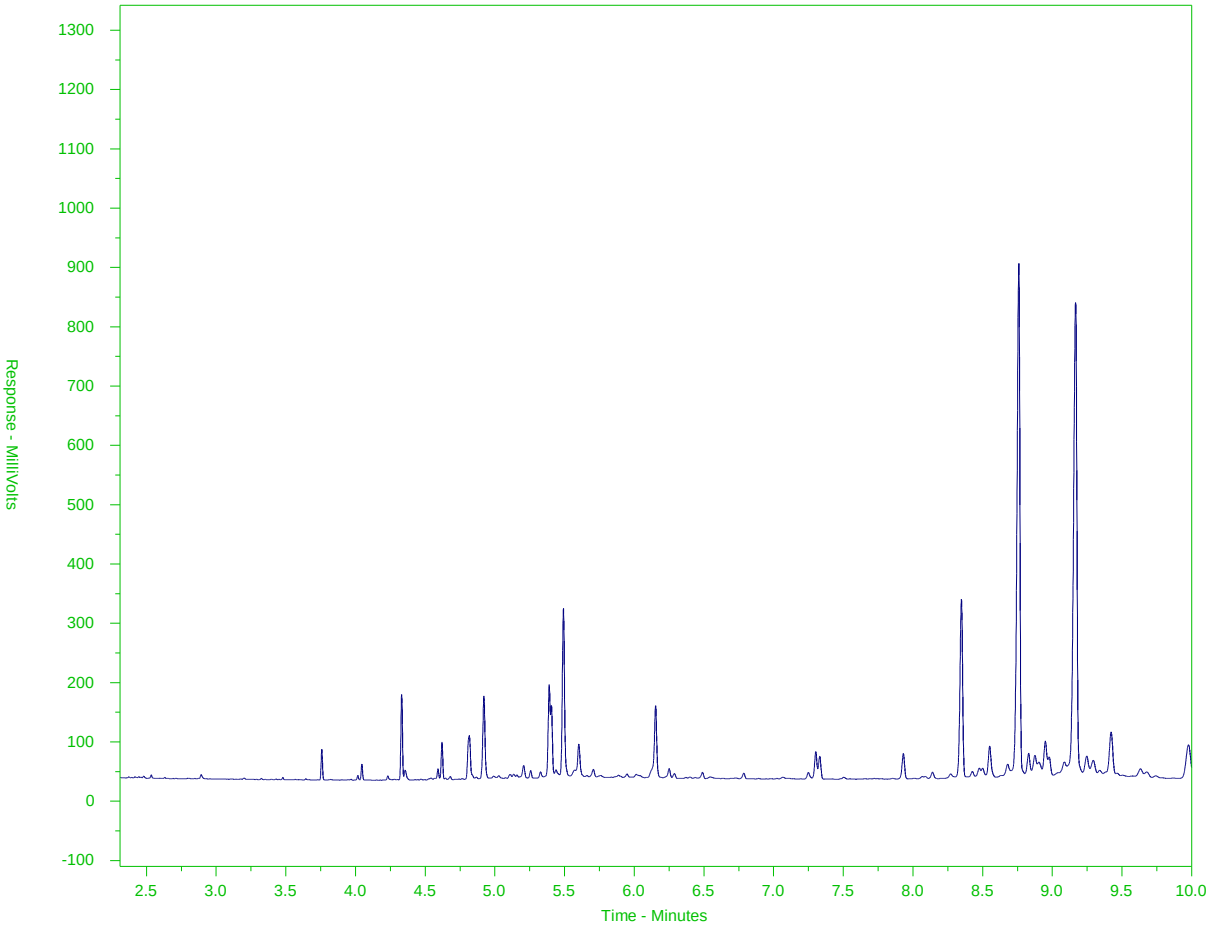
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2579993-4#L1966069-6
Client Sample ID: EIRA-24



← 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.

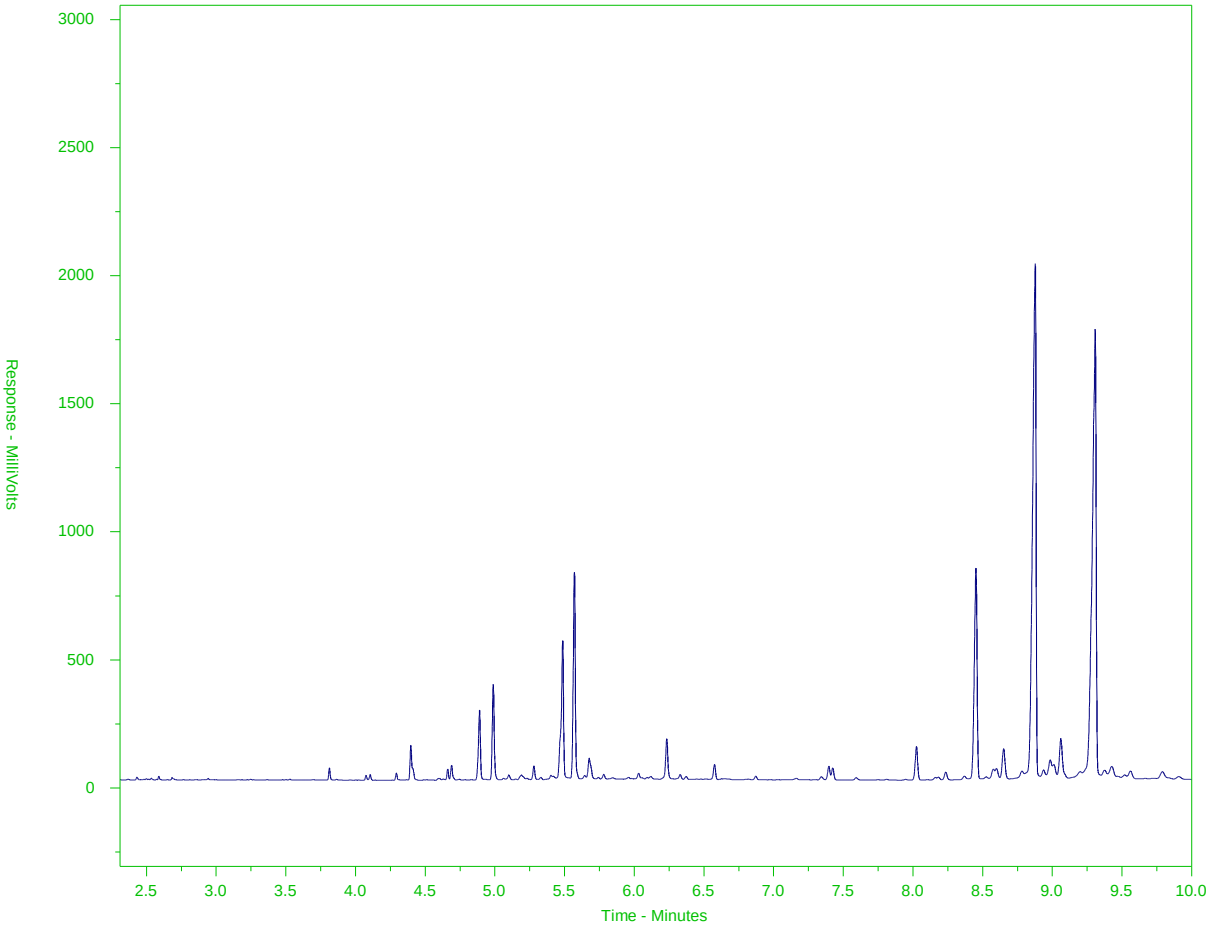
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966069-7
Client Sample ID: DUP-3



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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1966069-COFC

COC Number: 15 - 608559

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Report Format / Distribution

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☒ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: michael.gill@aecom.com
Email 2: leslie.southern@aecom.com
Email 3

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: Same as above
Email 2

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☒

Date and Time Required for all E&P TATs: ASAP
For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #: 60542455
PO / AFE:
LSD: Foreshore

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):
ALS Contact: Dean Watt
Sampler: EAP/JB

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIRA-19	27-Jul-17	13:00	Sediment		X	X	X	4
	EIRA-20		13:10						
	EIRA-21		13:15						
	EIRA-22		13:20						
	EIRA-23		13:30						
	EIRA-24		13:35						
	DUP-3		PM						

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO
Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
23.1°C					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Justin Beeler	July 27, 2017	19:10	ALEX	27/07/2017	1940			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 27-JUL-17
Report Date: 04-AUG-17 17:51 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1966071

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	608373
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1966071-1	L1966071-2	L1966071-3	L1966071-4	L1966071-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17
Sampled Time	15:00	15:10	15:15	15:20	15:45
Client ID	ESA-18	ESA-19	ESA-20	ESA-24	ESA-25
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	14.0	18.7	18.3	16.7	11.7
pH (1:2 soil:water) (pH)	8.02	7.95	8.03	7.19	7.93
Metals Antimony (Sb) (mg/kg)	0.12	0.11	0.14	0.19	0.20
Arsenic (As) (mg/kg)	3.03	1.37	1.91	1.29	2.26
Barium (Ba) (mg/kg)	56.1	104	73.3	110	63.8
Beryllium (Be) (mg/kg)	0.36	0.35	0.36	0.43	0.44
Cadmium (Cd) (mg/kg)	0.068	0.053	0.053	0.069	0.115
Chromium (Cr) (mg/kg)	11.4	12.3	14.9	21.8	26.9
Cobalt (Co) (mg/kg)	10.1	9.45	10.2	10.8	10.5
Copper (Cu) (mg/kg)	18.0	26.8	29.4	34.2	34.9
Lead (Pb) (mg/kg)	4.36	4.27	10.0	6.55	5.81
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo) (mg/kg)	0.11	0.16	0.15	0.11	0.19
Nickel (Ni) (mg/kg)	7.75	8.99	8.23	10.5	12.0
Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (Tl) (mg/kg)	0.110	<0.050	0.066	0.082	0.103
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U) (mg/kg)	0.500	0.450	0.381	0.509	0.517
Vanadium (V) (mg/kg)	61.7	61.2	58.3	84.1	84.6
Zinc (Zn) (mg/kg)	50.3	53.7	59.5	68.1	72.0
Volatile Organic Compounds VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	Field MeOH	Field MeOH
Benzene (mg/kg)	0.0221	<0.018 DLCI	0.0083	<0.0050	0.0066
Ethylbenzene (mg/kg)	0.040	0.087	<0.015	<0.015	<0.015
Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
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	0.118	<0.050	<0.050	<0.050
meta- & para-Xylene (mg/kg)	<0.050	0.416	<0.050	<0.050	<0.050
Xylenes (mg/kg)	<0.075	0.534	<0.075	<0.075	<0.075
Surrogate: 4-Bromofluorobenzene (SS) (%)	84.3	92.2	81.7	74.1	85.5
Surrogate: 1,4-Difluorobenzene (SS) (%)	89.9	87.4	91.9	85.9	93.9
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

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1966071-6	L1966071-7	L1966071-8	L1966071-9	
Description	Sediment	Sediment	Sediment	Sediment	
Sampled Date	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17	
Sampled Time	15:45	15:50	15:20	15:30	
Client ID	DUP-4	ESA-26	ESA-27	ESA-28	
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	15.3	15.4	14.0	10.5	
pH (1:2 soil:water) (pH)	8.08	8.08	8.24	8.38	
Metals Antimony (Sb) (mg/kg)	0.10	0.10	<0.10	0.13	
Arsenic (As) (mg/kg)	0.74	0.78	0.77	1.56	
Barium (Ba) (mg/kg)	58.7	58.2	87.4	62.9	
Beryllium (Be) (mg/kg)	0.32	0.37	0.27	0.32	
Cadmium (Cd) (mg/kg)	<0.050	<0.050	<0.050	<0.050	
Chromium (Cr) (mg/kg)	12.4	12.7	9.76	11.8	
Cobalt (Co) (mg/kg)	7.16	7.13	7.93	9.57	
Copper (Cu) (mg/kg)	23.2	24.3	24.5	29.0	
Lead (Pb) (mg/kg)	3.61	3.69	4.06	4.64	
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	
Molybdenum (Mo) (mg/kg)	<0.10	<0.10	<0.10	0.27	
Nickel (Ni) (mg/kg)	7.58	7.83	6.30	6.09	
Selenium (Se) (mg/kg)	<0.20	<0.20	0.24	<0.20	
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	
Thallium (Tl) (mg/kg)	0.096	0.091	<0.050	0.069	
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	
Uranium (U) (mg/kg)	0.439	0.419	0.450	0.294	
Vanadium (V) (mg/kg)	55.6	55.3	54.8	58.0	
Zinc (Zn) (mg/kg)	58.1	59.7	53.8	50.9	
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	
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	
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) (%)	76.0	82.7	79.3	75.2	
Surrogate: 1,4-Difluorobenzene (SS) (%)	85.5	92.1	85.9	90.9	
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	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1966071-1	L1966071-2	L1966071-3	L1966071-4	L1966071-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17	27-JUL-17
Sampled Time	15:00	15:10	15:15	15:20	15:45
Client ID	ESA-18	ESA-19	ESA-20	ESA-24	ESA-25
Grouping / **Analyte**					
SOIL					
Hydrocarbons VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
Surrogate: 2-Bromobenzotrifluoride (%)	90.0	90.9	88.0	90.1	87.4
Surrogate: 3,4-Dichlorotoluene (SS) (%)	112.2	118.3	130.3 SURR-ND	108.7	129.2
Polycyclic Aromatic Hydrocarbons Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene (mg/kg)	<0.050	0.166	<0.050	<0.050	<0.050
Naphthalene (mg/kg)	<0.050	0.105	<0.050	<0.050	<0.050
Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Surrogate: Acenaphthene d10 (%)	99.6	98.4	93.1	91.7	96.7
Surrogate: Chrysene d12 (%)	101.0	96.6	91.4	93.0	96.5
Surrogate: Naphthalene d8 (%)	97.0	88.3	89.8	88.9	93.4
Surrogate: Phenanthrene d10 (%)	98.1	95.4	92.6	92.0	96.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1966071-6 Sediment 27-JUL-17 15:45 DUP-4	L1966071-7 Sediment 27-JUL-17 15:50 ESA-26	L1966071-8 Sediment 27-JUL-17 15:20 ESA-27	L1966071-9 Sediment 27-JUL-17 15:30 ESA-28	
Sample ID **Description** **Sampled Date** **Sampled Time** **Client ID**						
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	
	Surrogate: 2-Bromobenzotrifluoride (%)	92.1	88.9	89.8	94.6	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	112.2	110.1	118.5	112.0	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	
	Surrogate: Acenaphthene d10 (%)	98.0	96.0	96.3	93.0	
	Surrogate: Chrysene d12 (%)	94.9	92.8	92.3	92.9	
	Surrogate: Naphthalene d8 (%)	95.6	94.4	94.2	90.2	
	Surrogate: Phenanthrene d10 (%)	97.4	96.1	95.3	92.7	

* 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	Lead (Pb)	DUP-H	L1966071-1, -2, -3, -4, -5, -6, -7, -8, -9
Laboratory Control Sample	Volatile Hydrocarbons (VH6-10)	LCS-ND	L1966071-4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
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.
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
VOC7-L-HSMS-VA	Soil	VOCs in soil by Headspace GCMS	EPA 5035A/5021A/8260C

Reference Information

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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

608373

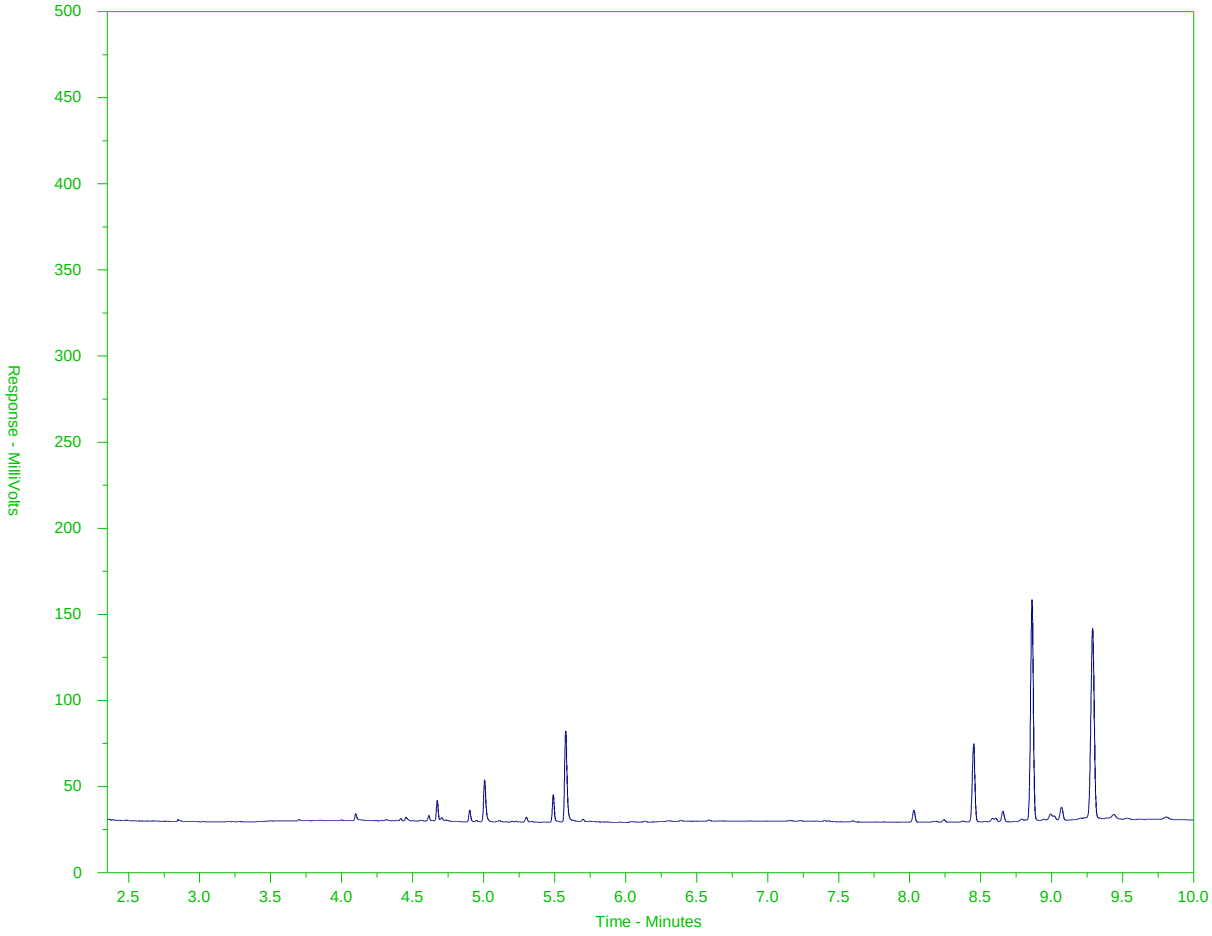
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1966071-1
Client Sample ID: ESA-18



← 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.

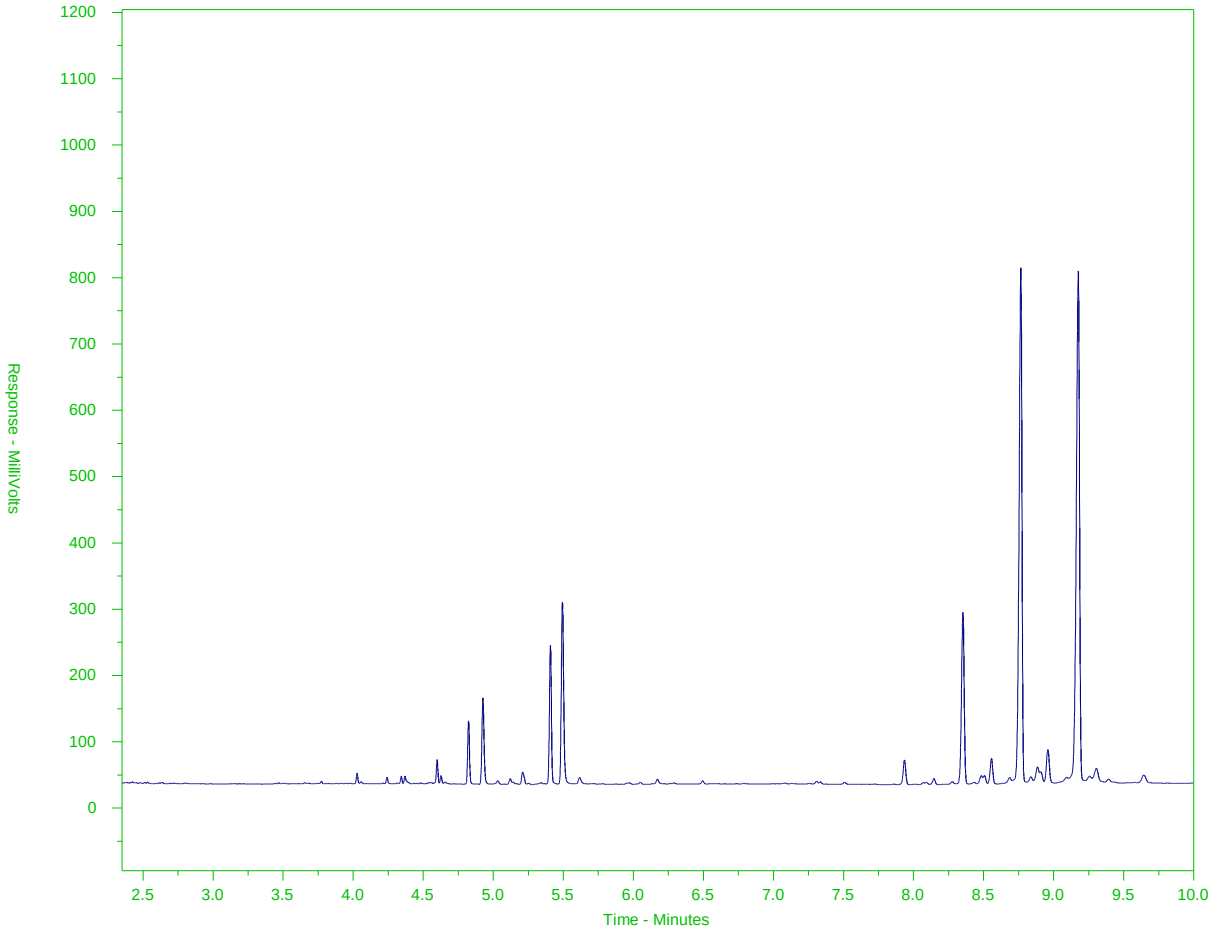
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-2
Client Sample ID: ESA-19



← 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.

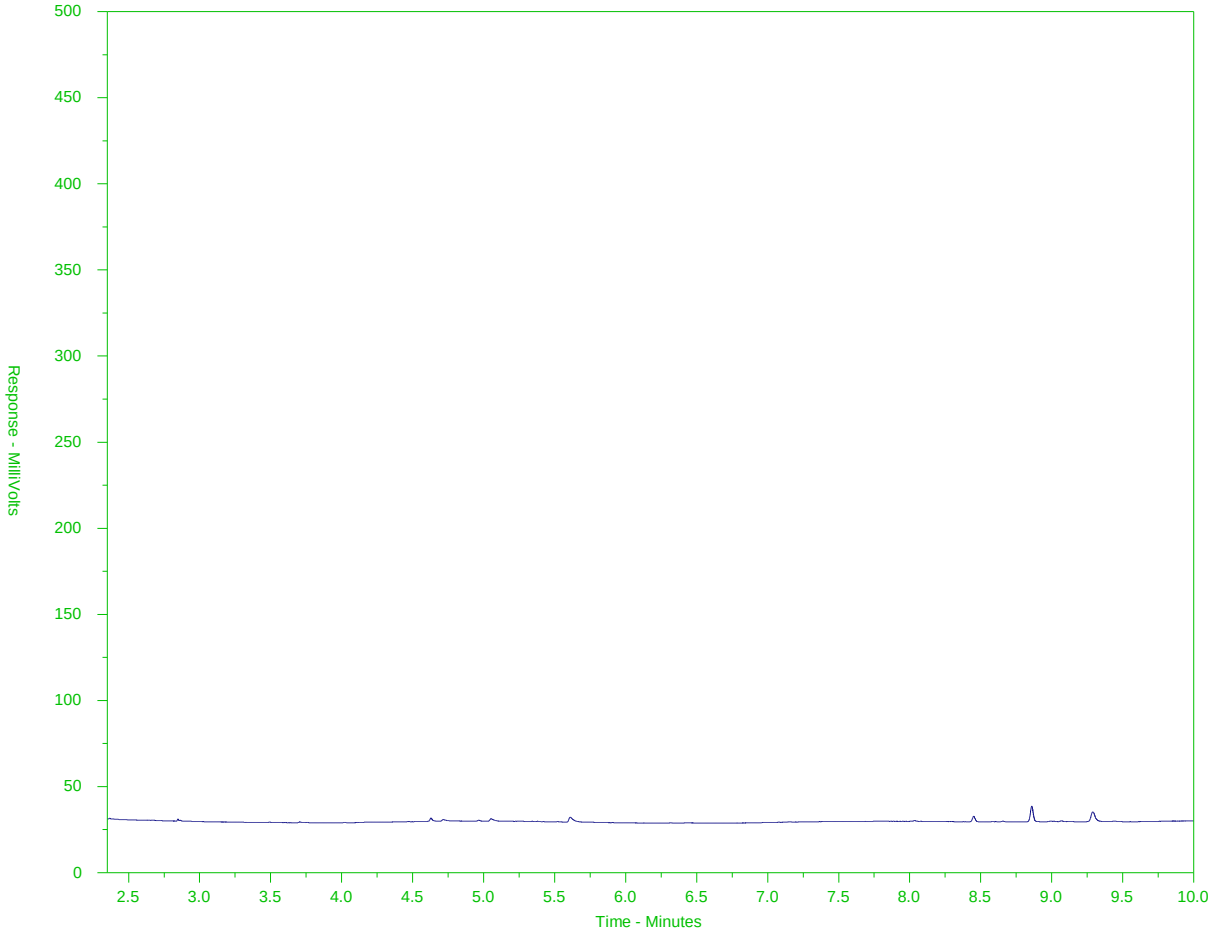
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-3
Client Sample ID: ESA-20



← 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.

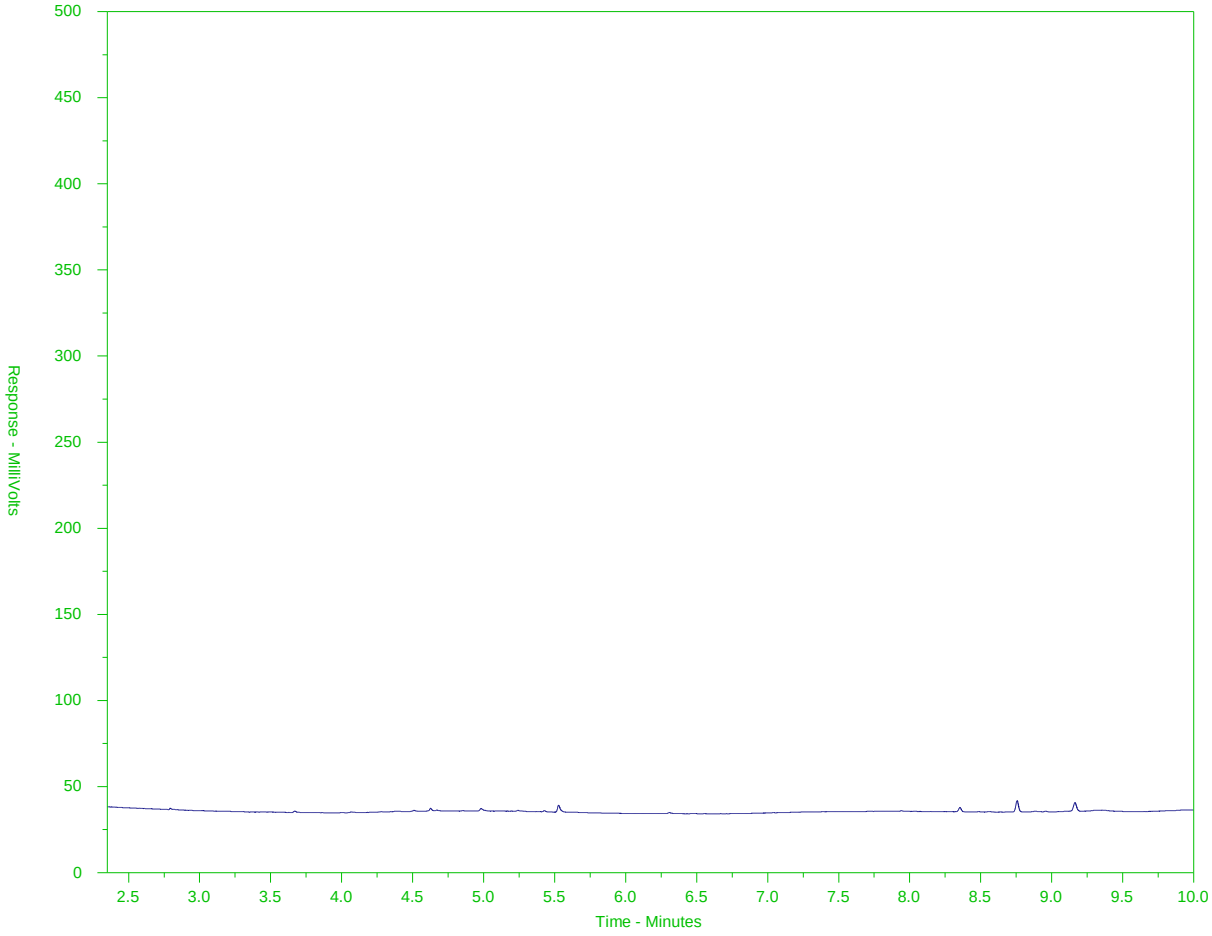
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-4
Client Sample ID: ESA-24



← 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.

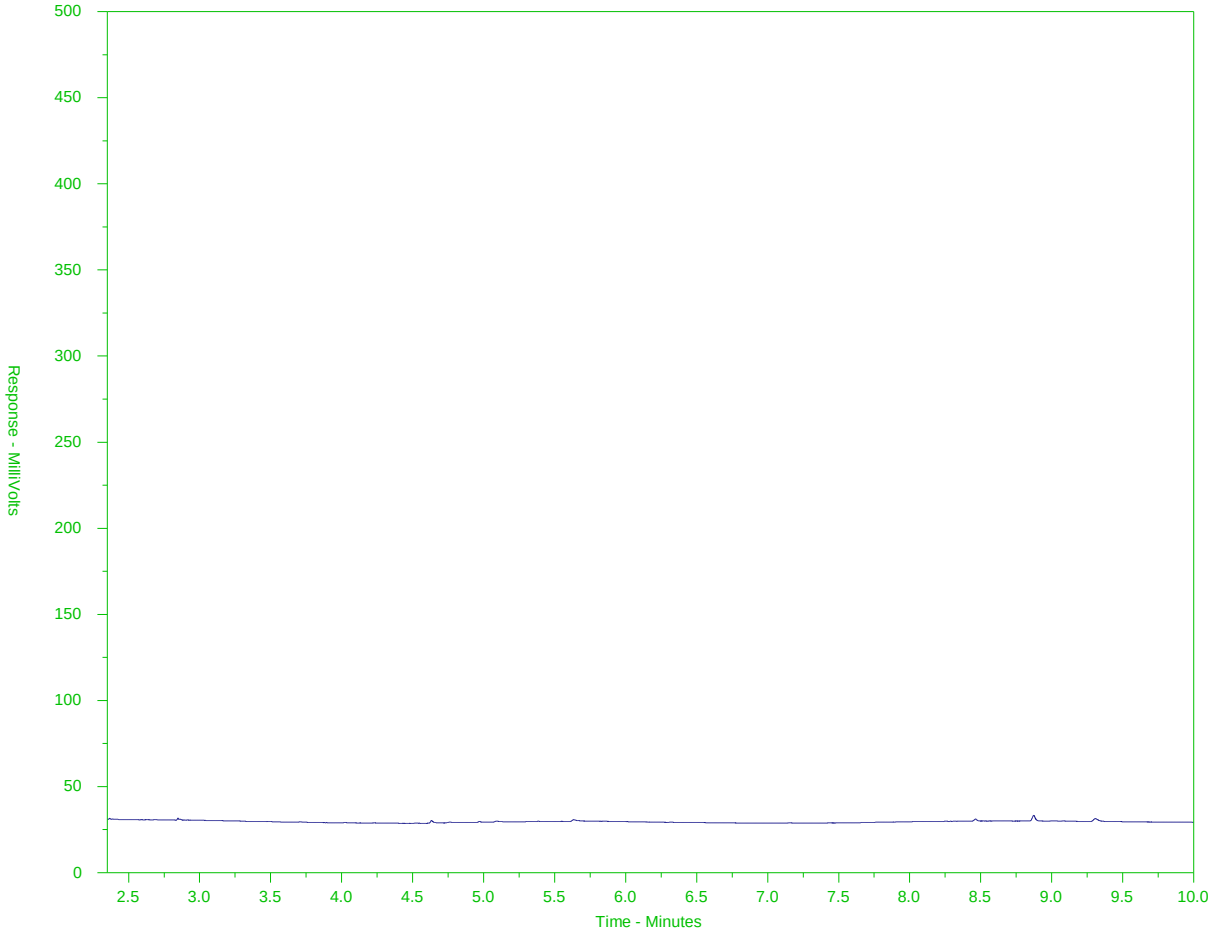
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-5
Client Sample ID: ESA-25



← 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.

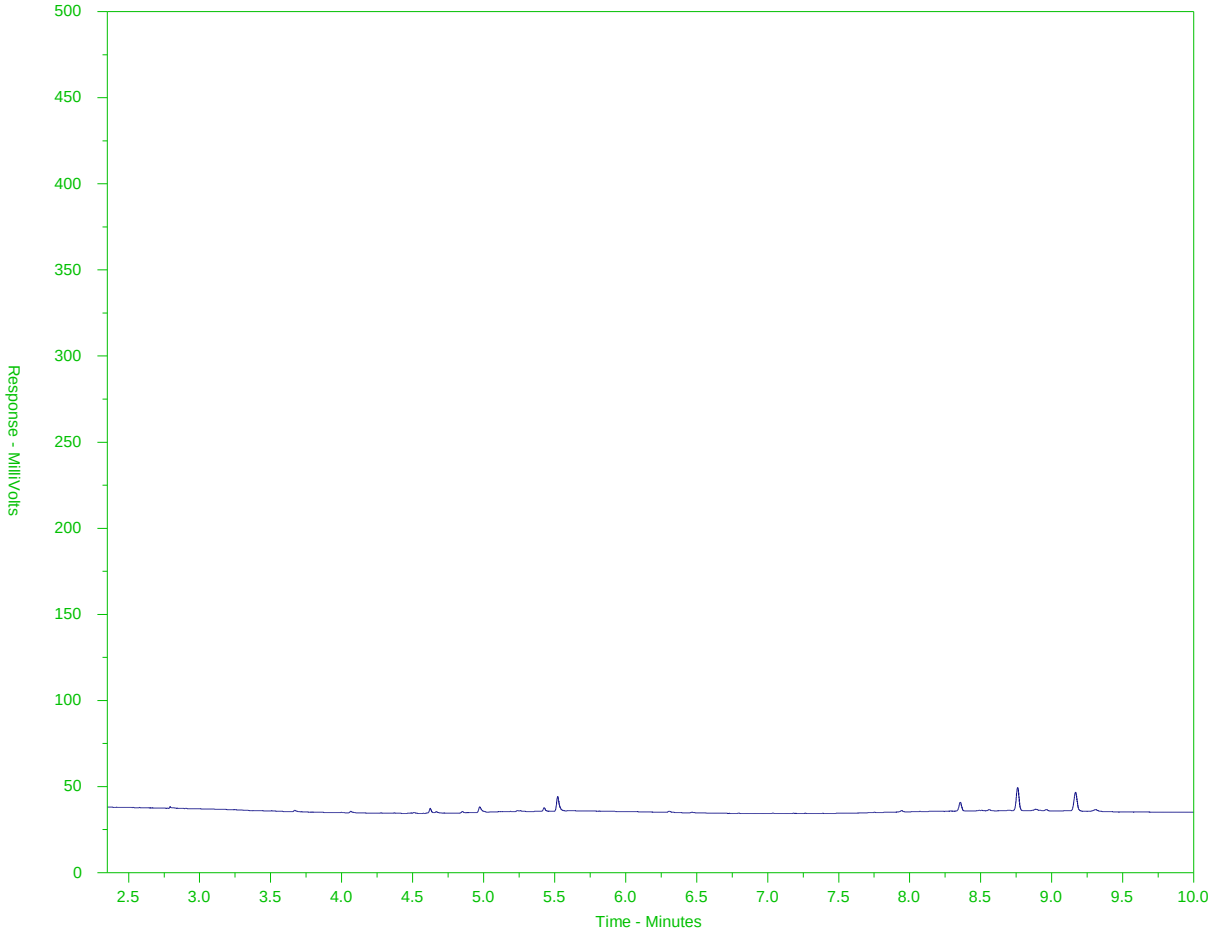
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-6
Client Sample ID: DUP-4



← 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.

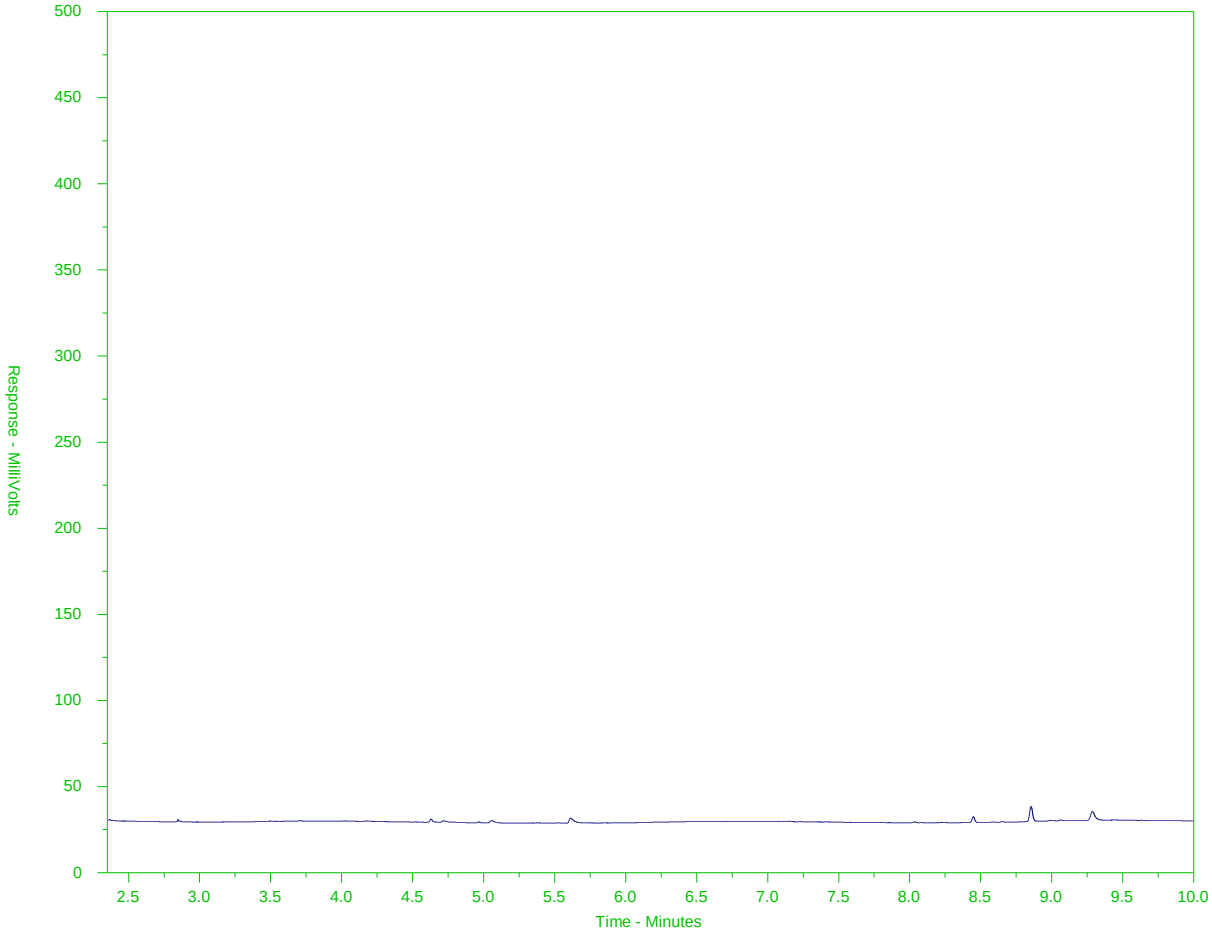
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-7
Client Sample ID: ESA-26



← 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.

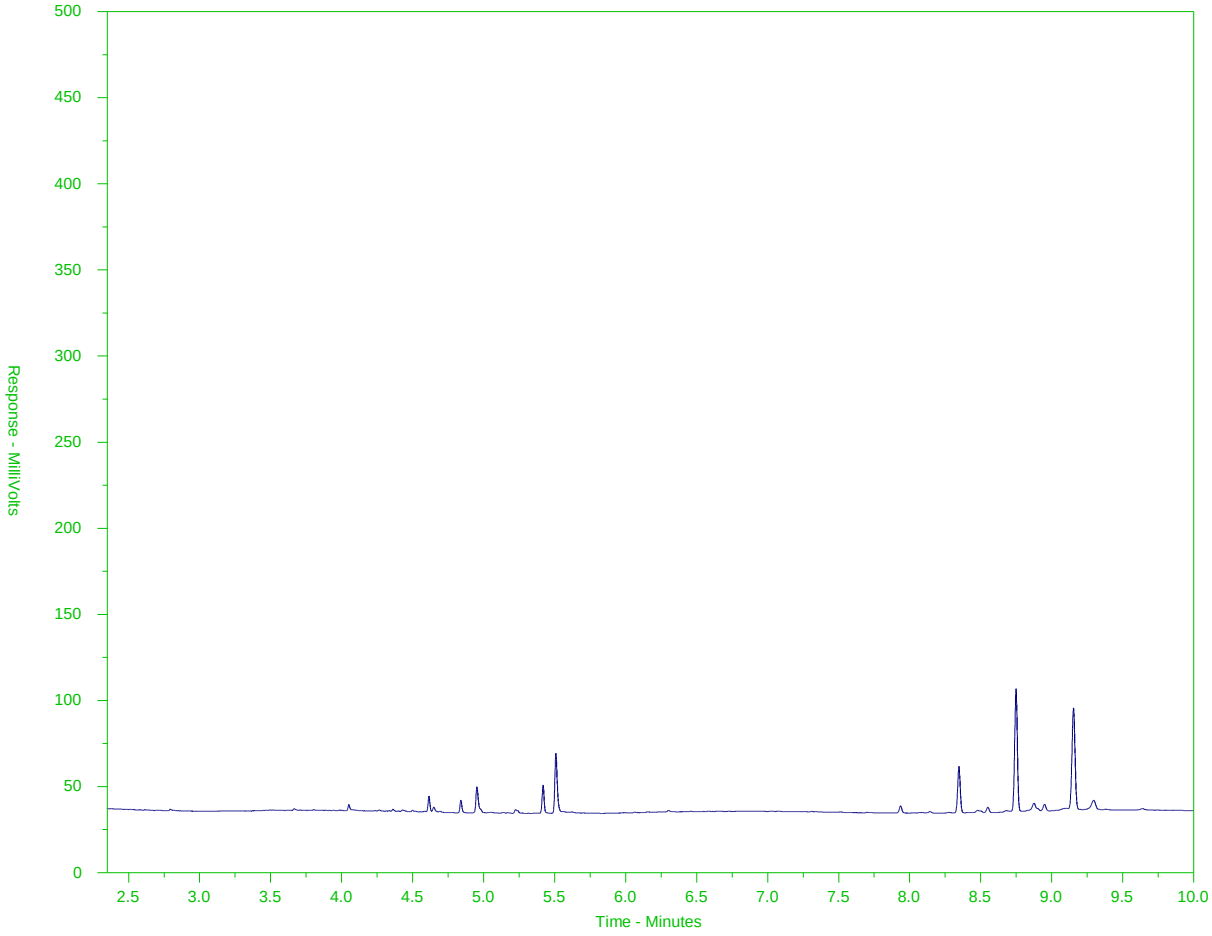
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-8
Client Sample ID: ESA-27



← 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.

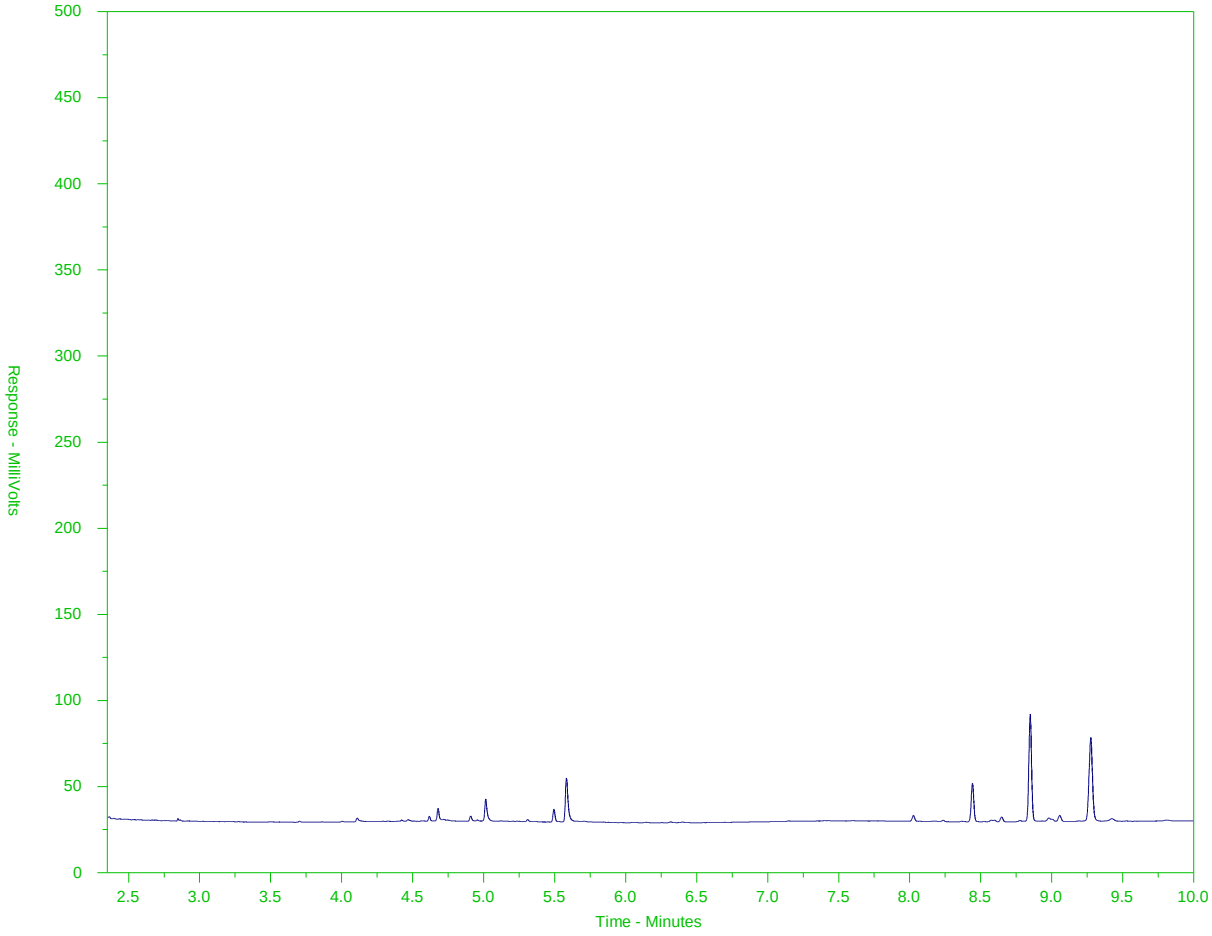
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: WG2580710-4#L1966071-8
Client Sample ID: ESA-27



← 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.

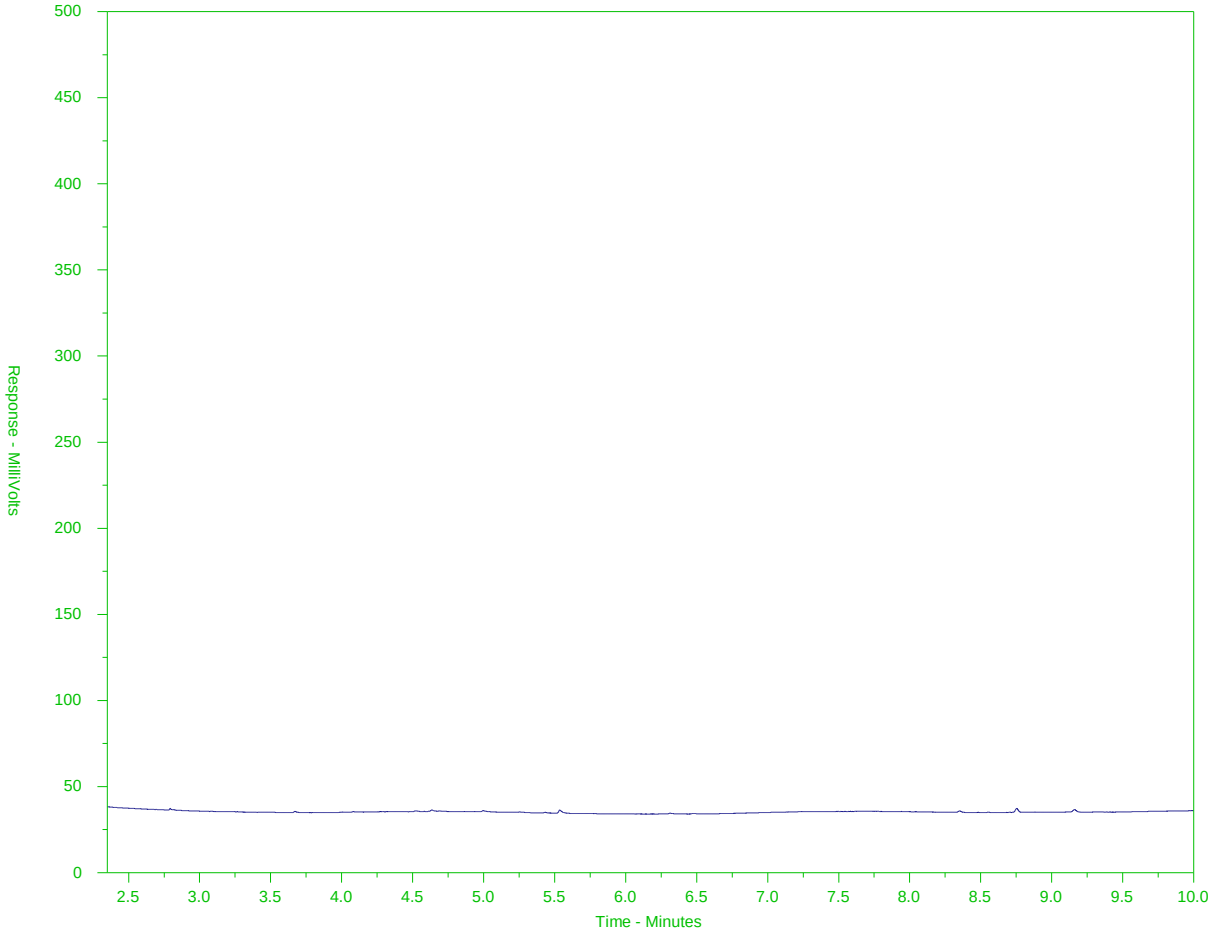
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1966071-9
Client Sample ID: ESA-28



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1966071-COFC

COC Number: 15 - 608373

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	all E&P TATs with your AM - surcharges will apply
Company:	AECOM	Select Report Format: PDF EXCEL EDD (DIGITAL)	Regular [R] Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report YES NO	PRIORITY (Business Days): 4 day [P4]; 3 day [P3]; 2 day [P2] — EMERGENCY: 1 Business day [E1]; Same Day, Weekend or Statutory holiday [E0]
Phone:	604 444 6400	Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: EMAIL MAIL FAX	Date and Time Required for all E&P TATs:
Street:	3292 Production Way	Email 1: michael.gill@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Burnaby	Email 2: Leslie.Southern@aecom.com	
Postal Code:		Email 3	Analysis Request
Invoice To	Same as Report To YES NO	Invoice Distribution	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report YES NO	Select Invoice Distribution: EMAIL MAIL FAX	
Company:	Chevron Canada Ltd.	Email 1 or Fax: Same as above	
Contact:	Chris Boys	Email 2	
Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center: PO#	
Job #:	60542455	Major/Minor Code: Routing Code:	
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt Sampler: EAP/JB	

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	ESA-18	27-Jul-17	15:00	Sediment		X	X	X	4
	ESA-19		15:10						
	ESA-20		15:15						
	ESA-24		15:40						
	ESA-25		15:45						
	DUP-4		PM						
	ESA-26		15:50						
	ESA-27		15:[illegible]20						
	ESA-28		15:[illegible]30						

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? YES NO	BC CSR	Frozen SIF Observations Yes No
Are samples for human drinking water use? YES NO		Ice Packs Ice Cubes Custody seal intact Yes No
		Cooling Initiated
		INITIAL COOLER TEMPERATURES °C: 23.1°C — FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Justin Beeler	Date: July 27, 2017	Time: 1440	Received by: AEG	Date: 27/07/2017	Time: 1940	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 01-AUG-17
Report Date: 03-AUG-17 14:37 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1967694

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609411
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1967694-1	L1967694-2			
	Description	SEDIMENT	SEDIMENT			
	Sampled Date	01-AUG-17	01-AUG-17			
	Sampled Time	08:15	08:15			
	Client ID	EIRA-25	DUP-5			
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	13.6	14.2			
	pH (1:2 soil:water) (pH)	8.38	8.44			
Metals	Antimony (Sb) (mg/kg)	0.18	0.17			
	Arsenic (As) (mg/kg)	2.57	2.86			
	Barium (Ba) (mg/kg)	33.4	43.7			
	Beryllium (Be) (mg/kg)	0.24	0.27			
	Cadmium (Cd) (mg/kg)	0.077	0.079			
	Chromium (Cr) (mg/kg)	10.4	16.4			
	Cobalt (Co) (mg/kg)	4.38	4.75			
	Copper (Cu) (mg/kg)	13.7	14.4			
	Lead (Pb) (mg/kg)	8.20	8.61			
	Mercury (Hg) (mg/kg)	<0.050	<0.050			
	Molybdenum (Mo) (mg/kg)	<0.50	<0.50			
	Nickel (Ni) (mg/kg)	10.9	15.3			
	Selenium (Se) (mg/kg)	<0.20	<0.20			
	Silver (Ag) (mg/kg)	<0.10	<0.10			
	Thallium (Tl) (mg/kg)	<0.050	<0.050			
	Tin (Sn) (mg/kg)	<2.0	<2.0			
	Uranium (U) (mg/kg)	0.893	0.917			
	Vanadium (V) (mg/kg)	32.1	34.3			
	Zinc (Zn) (mg/kg)	38.7	40.5			
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH			
	Benzene (mg/kg)	0.528	0.711			
	Ethylbenzene (mg/kg)	11.5	22.2			
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20			
	Styrene (mg/kg)	<0.050	<0.050			
	Toluene (mg/kg)	0.588	0.911			
	ortho-Xylene (mg/kg)	8.74	10.9			
	meta- & para-Xylene (mg/kg)	52.9	74.9			
	Xylenes (mg/kg)	61.6	85.7			
	Surrogate: 4-Bromofluorobenzene (SS) (%)	84.3	84.0			
	Surrogate: 1,4-Difluorobenzene (SS) (%)	75.1	70.2			
Hydrocarbons	EPH10-19 (mg/kg)	2260	1720			
	EPH19-32 (mg/kg)	1890	1660			
	LEPH (mg/kg)	2250	1710			
	HEPH (mg/kg)	1890	1660			
	Volatile Hydrocarbons (VH6-10) (mg/kg)	1230	870			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1967694-1	L1967694-2			
	Description	SEDIMENT	SEDIMENT			
	Sampled Date	01-AUG-17	01-AUG-17			
	Sampled Time	08:15	08:15			
	Client ID	EIRA-25	DUP-5			
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	1150	760			
	Surrogate: 2-Bromobenzotrifluoride (%)	126.3	123.7			
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	SMI Not Reportable	116.9			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	DLCI <0.50	DLCI <0.40			
	Acenaphthylene (mg/kg)	DLCI <0.20	DLCI <0.10			
	Anthracene (mg/kg)	DLCI <0.20	DLCI <0.20			
	Benz(a)anthracene (mg/kg)	DLCI <0.060	DLCI <0.070			
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050			
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050			
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050			
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050			
	Chrysene (mg/kg)	DLCI <0.090	DLCI <0.10			
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050			
	Fluoranthene (mg/kg)	DLCI <0.070	DLCI <0.20			
	Fluorene (mg/kg)	0.857	0.693			
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050			
	2-Methylnaphthalene (mg/kg)	16.8	14.0			
	Naphthalene (mg/kg)	9.27	7.89			
	Phenanthrene (mg/kg)	1.43	1.41			
	Pyrene (mg/kg)	0.547	0.651			
	Surrogate: Acenaphthene d10 (%)	117.4	125.5			
	Surrogate: Chrysene d12 (%)	92.7	105.3			
	Surrogate: Naphthalene d8 (%)	96.6	98.1			
	Surrogate: Phenanthrene d10 (%)	108.0	102.0			

* 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	Volatile Hydrocarbons (VH6-10)	LCS-ND	L1967694-1, -2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
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.

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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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

Reference Information

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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609411

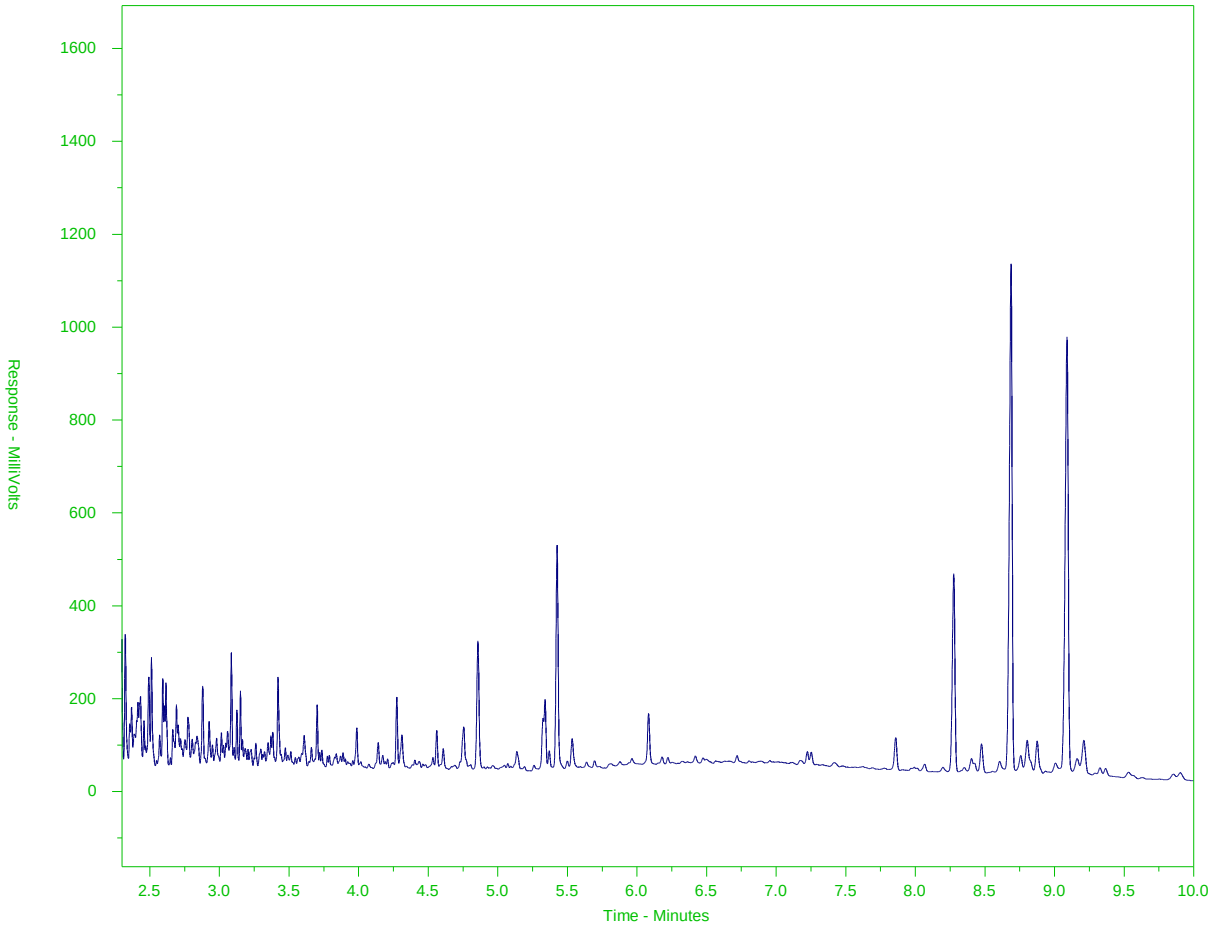
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1967694-1
Client Sample ID: EIRA-25



← 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.

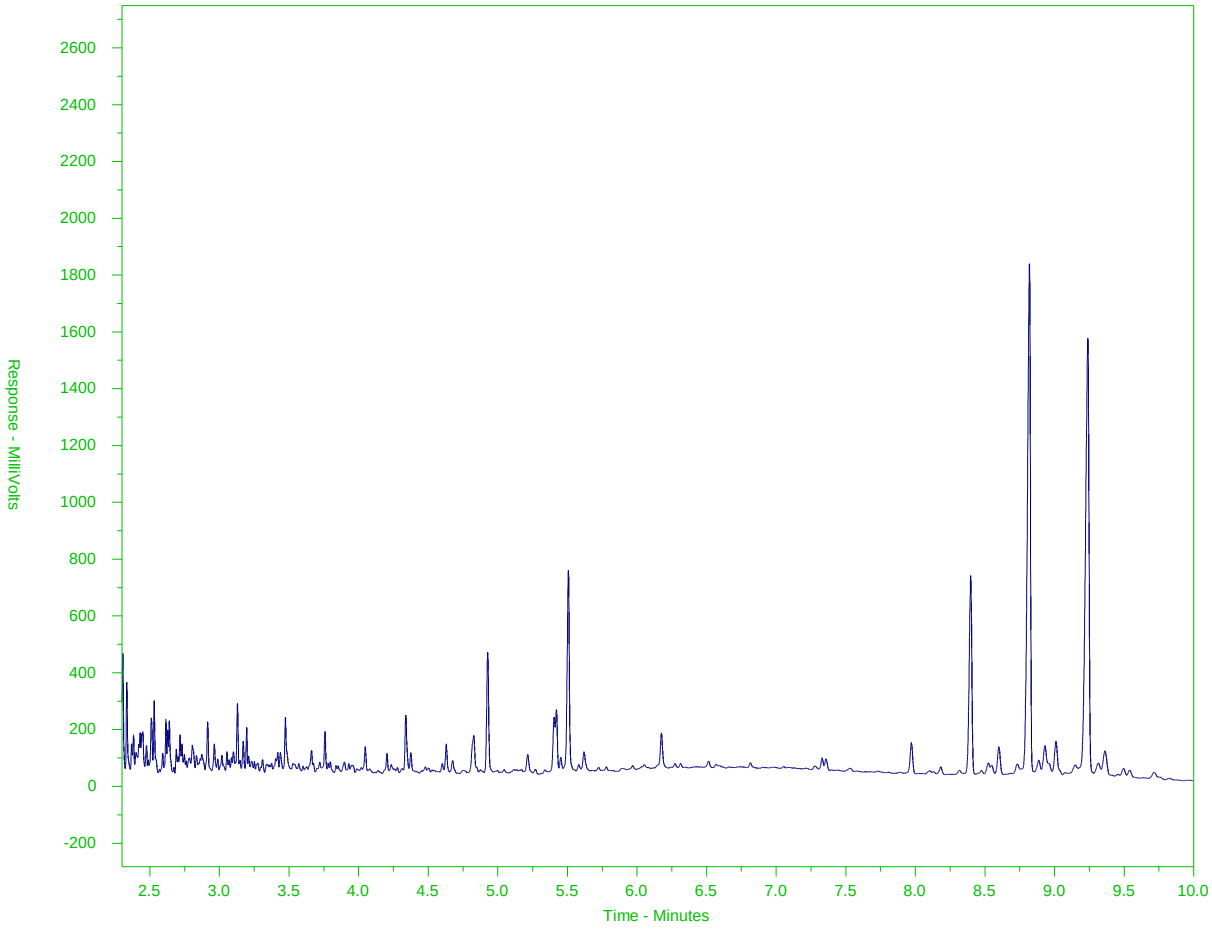
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1967694-2
Client Sample ID: DUP-5



← 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 →		

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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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1967694-COFC

COC Number: 15 - 609411

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	

Report Format / Distribution	
Select Report Format:	[X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[X] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply			
Regular [R]	[ ]	Standard TAT if received by 3 pm - business days - no surcharges apply	
PRIORITY (Business Days) 4 day [P4]	[ ]	EMERGENCY 1 Business day [E1]	[ ]
3 day [P3]	[ ]	Same Day, Weekend or Statutory holiday [E0]	[X]
2 day [P2]	[ ]		
Date and Time Required for all E&P TATs:		ASAP	
For tests that can not be performed according to the service level selected, you will be contacted.			

Invoice To		
	Same as Report To	[ ] YES [X] NO
	Copy of Invoice with Report	[X] YES [ ] NO
Company:	Chevron Canada Ltd.	
Contact:	Chris Boys	

Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Same as above
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore
ALS Lab Work Order # (lab use only)	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Dean Watt	Sampler: EAP / [redacted]AN

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX/VPH (P)	LEPH/HEPH (P)	Metals (P)	Number of Containers
	EIRA-25	1-Aug-17	8:15 [redacted]AM	Sediment	X	X	X	4
	DUP-5	↓	↓	↓	↓	↓	↓	↓

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? [ ] YES [X] NO	BC CSR
Are samples for human drinking water use? [ ] YES [X] NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	[ ]	SIF Observations	Yes [ ]	No [ ]	
Ice Packs	[ ] Ice Cubes [ ]	Custody seal intact	Yes [ ]	No [ ]	
Cooling Initiated	[ ]				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			23		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JC	Date: 8/1/17	Time: 10:54

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 02-AUG-17
Report Date: 02-AUG-17 22:22 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1968560

Project P.O. #:	NOT SUBMITTED
Job Reference:	60542455
C of C Numbers:	15-609420
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1968560-1				
	Description	Sediment				
	Sampled Date	02-AUG-17				
	Sampled Time	09:30				
	Client ID	EIRA-26				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	15.8				
	pH (1:2 soil:water) (pH)	8.21				
Metals	Antimony (Sb) (mg/kg)	0.13				
	Arsenic (As) (mg/kg)	2.23				
	Barium (Ba) (mg/kg)	45.5				
	Beryllium (Be) (mg/kg)	0.21				
	Cadmium (Cd) (mg/kg)	0.074				
	Chromium (Cr) (mg/kg)	14.9				
	Cobalt (Co) (mg/kg)	4.26				
	Copper (Cu) (mg/kg)	14.3				
	Lead (Pb) (mg/kg)	6.31				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	<0.50				
	Nickel (Ni) (mg/kg)	11.3				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.671				
	Vanadium (V) (mg/kg)	33.6				
	Zinc (Zn) (mg/kg)	32.8				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0070 DLQ				
	Ethylbenzene (mg/kg)	0.382				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	0.650				
	meta- & para-Xylene (mg/kg)	1.92				
	Xylenes (mg/kg)	2.57				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	79.9				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	77.7				
Hydrocarbons	EPH10-19 (mg/kg)	340				
	EPH19-32 (mg/kg)	690				
	LEPH (mg/kg)	340				
	HEPH (mg/kg)	690				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1968560-1				
	Description	Sediment				
	Sampled Date	02-AUG-17				
	Sampled Time	09:30				
	Client ID	EIRA-26				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	93.3				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	106.5				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.070 DLCI				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.20 DLCI				
	Fluorene (mg/kg)	0.114				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	1.47				
	Naphthalene (mg/kg)	0.661				
	Phenanthrene (mg/kg)	0.223				
	Pyrene (mg/kg)	0.153				
	Surrogate: Acenaphthene d10 (%)	107.1				
	Surrogate: Chrysene d12 (%)	126.1				
	Surrogate: Naphthalene d8 (%)	97.7				
	Surrogate: Phenanthrene d10 (%)	104.1				

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Copper (Cu)	DUP-H	L1968560-1

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.

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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PAH-TMB-D/A-MS-VA	Soil	PAH - Rotary Extraction (DCM/Acetone)	EPA 3570/8270

Polycyclic Aromatic Hydrocarbons in Sediment/Soil
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 DCM 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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)

Reference Information

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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609420

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).
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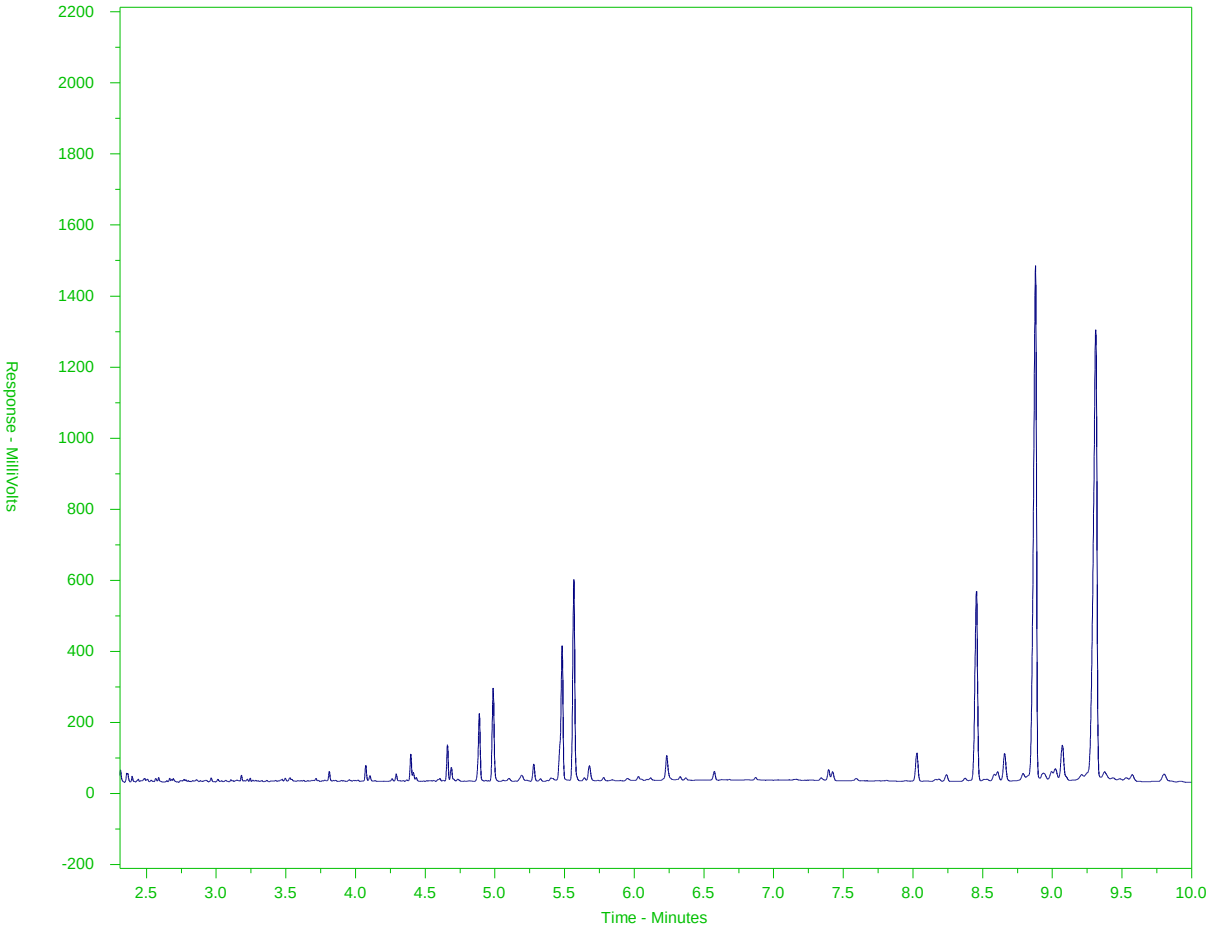
BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1968560-1
Client Sample ID: EIRA-26



← EPH10-19 →		← EPH19-32 →
nC10	nC19	nC32
174°C	330°C	467°C
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← Diesel/ Jet Fuels →		

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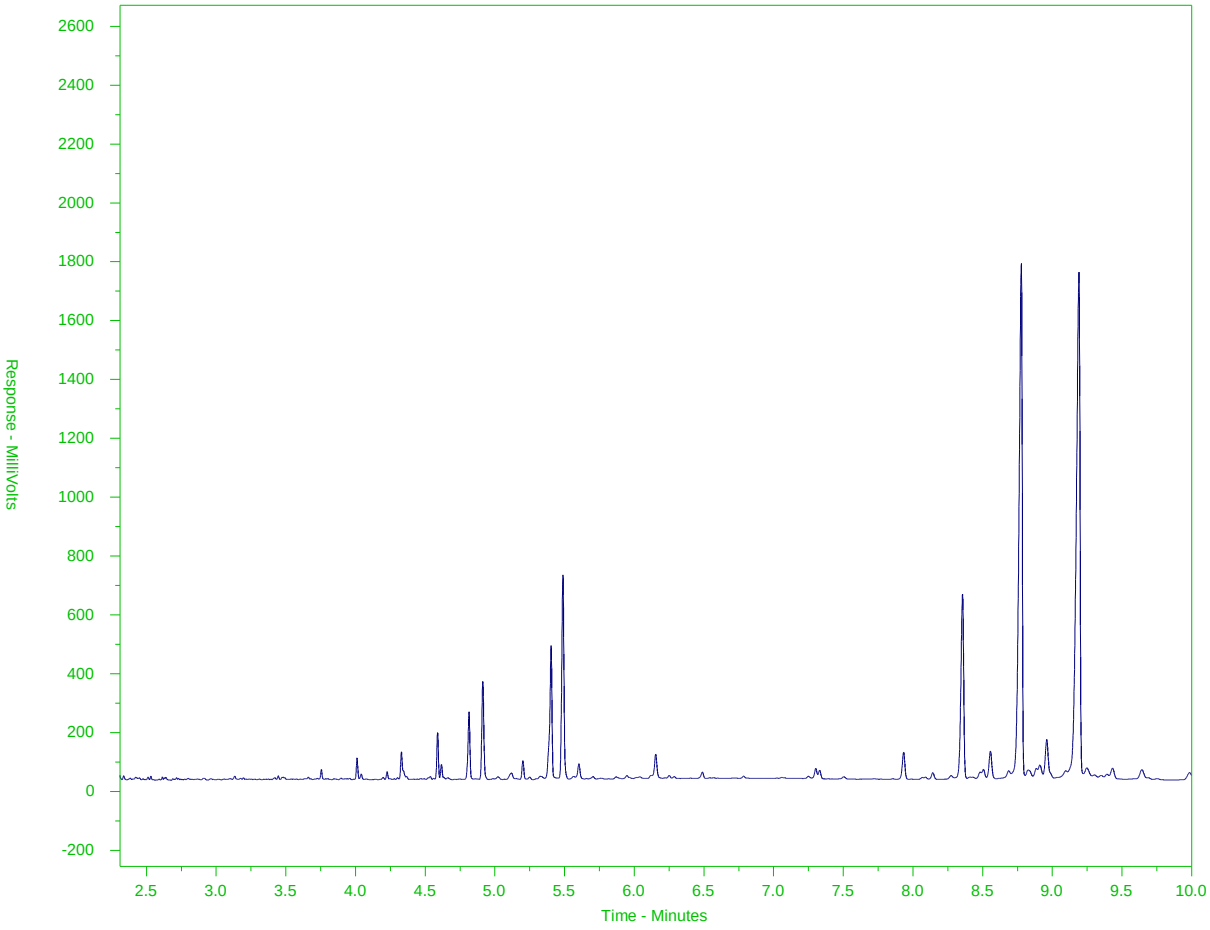
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

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: WG2583851-4#L1968560-1
Client Sample ID: EIRA-26



← EPH10-19 →		← EPH19-32 →
nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
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← Diesel/ Jet Fuels →		

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ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

L1968560-COFC

Canada Toll Free: 1 800 668 9878

COC Number: 15 - 609420

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604.444.6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	

Invoice To	
	Same as Report To: YES [X] NO [ ]
	Copy of Invoice with Report: [X] YES [ ] NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Report Format / Distribution

Select Report Format: [X] PDF [X] EXCEL [ ] EDD (DIGITAL)

Quality Control (QC) Report with Report: [X] YES [ ] NO

[X] Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: [X] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax: michael.gill@aecom.com

Email 2: leslie.southern@aecom.com

Email 3

Invoice Distribution

Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax: Same as above

Email 2

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R]: [ ] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] [ ] | 3 day [P3] [ ] | 2 day [P2] [ ]

EMERGENCY: 1 Business day [E1] [ ] | Same Day, Weekend or Statutory holiday [E0] [X]

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:

Job #: 60542455

PO / AFE:

LSD: Foreshore

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt | Sampler: EAP/AW

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P BTEX/VPH	P LEPH/HEPH	P Metals	Number of Containers
	EIRA-26	2-Aug-17	9:30	Sediment	X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human drinking water use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] | SIF Observations: Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] | Custody seal intact: Yes [ ] No [X]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	21

SHIPMENT RELEASE (client use)		
Released by:	Date:	Time:

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by: JC	Date: Aug 2/17	Time: 10:24

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

AM

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 03-AUG-17
Report Date: 04-AUG-17 14:05 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1969670

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609412
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1969670-1				
	Description	SEDIMENT				
	Sampled Date	03-AUG-17				
	Sampled Time	08:15				
	Client ID	EIRA-27				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	15.8				
	pH (1:2 soil:water) (pH)	7.45				
Metals	Antimony (Sb) (mg/kg)	0.15				
	Arsenic (As) (mg/kg)	2.93				
	Barium (Ba) (mg/kg)	38.6				
	Beryllium (Be) (mg/kg)	0.25				
	Cadmium (Cd) (mg/kg)	0.069				
	Chromium (Cr) (mg/kg)	21.3				
	Cobalt (Co) (mg/kg)	5.24				
	Copper (Cu) (mg/kg)	16.5				
	Lead (Pb) (mg/kg)	7.04				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.58				
	Nickel (Ni) (mg/kg)	18.7				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	12.8				
	Uranium (U) (mg/kg)	1.05				
	Vanadium (V) (mg/kg)	38.4				
	Zinc (Zn) (mg/kg)	33.7				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	79.1				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	85.8				
Hydrocarbons	EPH10-19 (mg/kg)	200				
	EPH19-32 (mg/kg)	640				
	LEPH (mg/kg)	200				
	HEPH (mg/kg)	640				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1969670-1				
	Description	SEDIMENT				
	Sampled Date	03-AUG-17				
	Sampled Time	08:15				
	Client ID	EIRA-27				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	92.4				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	77.6				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.40 DLCI				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	129.3				
	Surrogate: Chrysene d12 (%)	96.6				
	Surrogate: Naphthalene d8 (%)	99.7				
	Surrogate: Phenanthrene d10 (%)	95.4				

* 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	Tin (Sn)	DUP-H	L1969670-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PAH-TMB-D/A-MS-VA	Soil	PAH - Rotary Extraction (DCM/Acetone)	EPA 3570/8270

Polycyclic Aromatic Hydrocarbons in Sediment/Soil
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 DCM 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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

Reference Information

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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609412

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
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1969670-COFC

COC Number: 15 - 609412

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Report Format / Distribution

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☒ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: Michael.gill@aecom.com
Email 2: leslie.southern@aecom.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: same as above
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☒

Date and Time Required for all E&P TATs: ASAP
For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt | Sampler: EAP

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	EIBA-27	3-Aug-17	8:15	Sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO
Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☐ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
[illegible]	9.5				

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Albert Wong	Aug 3, 17	12:50	Cade P.	Aug 3	1250			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 03-AUG-17
Report Date: 11-AUG-17 17:12 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1969674

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609413
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1969674-1	L1969674-2	L1969674-3	L1969674-4	L1969674-5
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date	03-AUG-17	03-AUG-17	03-AUG-17	03-AUG-17	03-AUG-17
Sampled Time	08:25	08:35	08:45	10:00	10:10
Client ID	ESA-29	ESA-30	ESA-31	ESA-32	ESA-33
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	19.6	18.5	16.1	19.5	17.3
pH (1:2 soil:water) (pH)	7.29	7.86	8.39	7.54	8.27
Metals Antimony (Sb) (mg/kg)	0.16	0.12	0.18	0.14	0.14
Arsenic (As) (mg/kg)	1.07	0.80	1.91	2.01	0.67
Barium (Ba) (mg/kg)	146	345	46.0	86.2	73.7
Beryllium (Be) (mg/kg)	0.52	0.39	0.24	0.42	0.40
Cadmium (Cd) (mg/kg)	0.053	0.083	0.071	<0.050	0.061
Chromium (Cr) (mg/kg)	17.9	15.8	13.4	13.8	16.4
Cobalt (Co) (mg/kg)	10.5	7.27	6.77	9.73	8.76
Copper (Cu) (mg/kg)	48.8	26.5	19.6	30.2	31.5
Lead (Pb) (mg/kg)	5.51	4.49	7.56	4.97	4.11
Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum (Mo) (mg/kg)	0.19	0.11	0.33	0.12	<0.10
Nickel (Ni) (mg/kg)	10.3	8.21	8.67	7.40	8.47
Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (Tl) (mg/kg)	0.065	<0.050	<0.050	0.084	0.084
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U) (mg/kg)	0.523	0.480	0.401	0.348	0.444
Vanadium (V) (mg/kg)	101	67.3	52.0	65.5	76.2
Zinc (Zn) (mg/kg)	74.6	59.1	50.7	56.7	63.9
Volatile Organic Compounds VOC Sample Container	Field MeOH	Field MeOH	Field MeOH	Field MeOH	Field MeOH
Benzene (mg/kg)	<0.0050	<0.0090 DLQ	0.0053	<0.0050	<0.0050
Ethylbenzene (mg/kg)	<0.015	0.111	<0.015	<0.015	<0.015
Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
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	0.198	<0.050	<0.050	<0.050
meta- & para-Xylene (mg/kg)	<0.050	0.496	<0.050	<0.050	<0.050
Xylenes (mg/kg)	<0.075	0.694	<0.075	<0.075	<0.075
Surrogate: 4-Bromofluorobenzene (SS) (%)	97.1	104.9	97.6	97.2	98.4
Surrogate: 1,4-Difluorobenzene (SS) (%)	90.5	100.0	93.0	92.0	94.9
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

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1969674-6				
	Description	SEDIMENT				
	Sampled Date	03-AUG-17				
	Sampled Time	10:20				
	Client ID	ESA-34				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	18.9				
	pH (1:2 soil:water) (pH)	7.94				
Metals	Antimony (Sb) (mg/kg)	0.15				
	Arsenic (As) (mg/kg)	0.87				
	Barium (Ba) (mg/kg)	80.1				
	Beryllium (Be) (mg/kg)	0.48				
	Cadmium (Cd) (mg/kg)	0.197				
	Chromium (Cr) (mg/kg)	16.1				
	Cobalt (Co) (mg/kg)	11.4				
	Copper (Cu) (mg/kg)	31.0				
	Lead (Pb) (mg/kg)	8.02				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.12				
	Nickel (Ni) (mg/kg)	8.60				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	0.11				
	Thallium (Tl) (mg/kg)	0.079				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.508				
	Vanadium (V) (mg/kg)	88.1				
	Zinc (Zn) (mg/kg)	57.7				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	98.2				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	94.7				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	<200				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1969674-1 SEDIMENT 03-AUG-17 08:25 ESA-29	L1969674-2 SEDIMENT 03-AUG-17 08:35 ESA-30	L1969674-3 SEDIMENT 03-AUG-17 08:45 ESA-31	L1969674-4 SEDIMENT 03-AUG-17 10:00 ESA-32	L1969674-5 SEDIMENT 03-AUG-17 10:10 ESA-33
Sample ID		L1969674-1	L1969674-2	L1969674-3	L1969674-4	L1969674-5
Description		SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date		03-AUG-17	03-AUG-17	03-AUG-17	03-AUG-17	03-AUG-17
Sampled Time		08:25	08:35	08:45	10:00	10:10
Client ID		ESA-29	ESA-30	ESA-31	ESA-32	ESA-33
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100	<100	<100
	Surrogate: 2-Bromobenzotrifluoride (%)	83.2	85.4	82.1	84.2	81.6
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	108.0	Not Reportable SMI	104.0	111.1	104.5
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.060 DLCI	<0.050	<0.050
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chrysene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Fluorene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	2-Methylnaphthalene (mg/kg)	0.132	0.407	<0.050	<0.050	<0.050
	Naphthalene (mg/kg)	<0.050	0.198	<0.050	<0.050	<0.050
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Pyrene (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: Acenaphthene d10 (%)	94.4	100.5	93.7	99.4	89.4
	Surrogate: Chrysene d12 (%)	83.1	88.3	88.0	93.1	82.8
	Surrogate: Naphthalene d8 (%)	93.9	98.9	94.5	96.2	88.8
	Surrogate: Phenanthrene d10 (%)	95.1	93.6	93.8	93.8	87.9

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1969674-6				
	Description	SEDIMENT				
	Sampled Date	03-AUG-17				
	Sampled Time	10:20				
	Client ID	ESA-34				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	81.9				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	107.2				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	83.7				
	Surrogate: Chrysene d12 (%)	87.3				
	Surrogate: Naphthalene d8 (%)	83.5				
	Surrogate: Phenanthrene d10 (%)	81.7				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

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.
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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed

Reference Information

elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609413

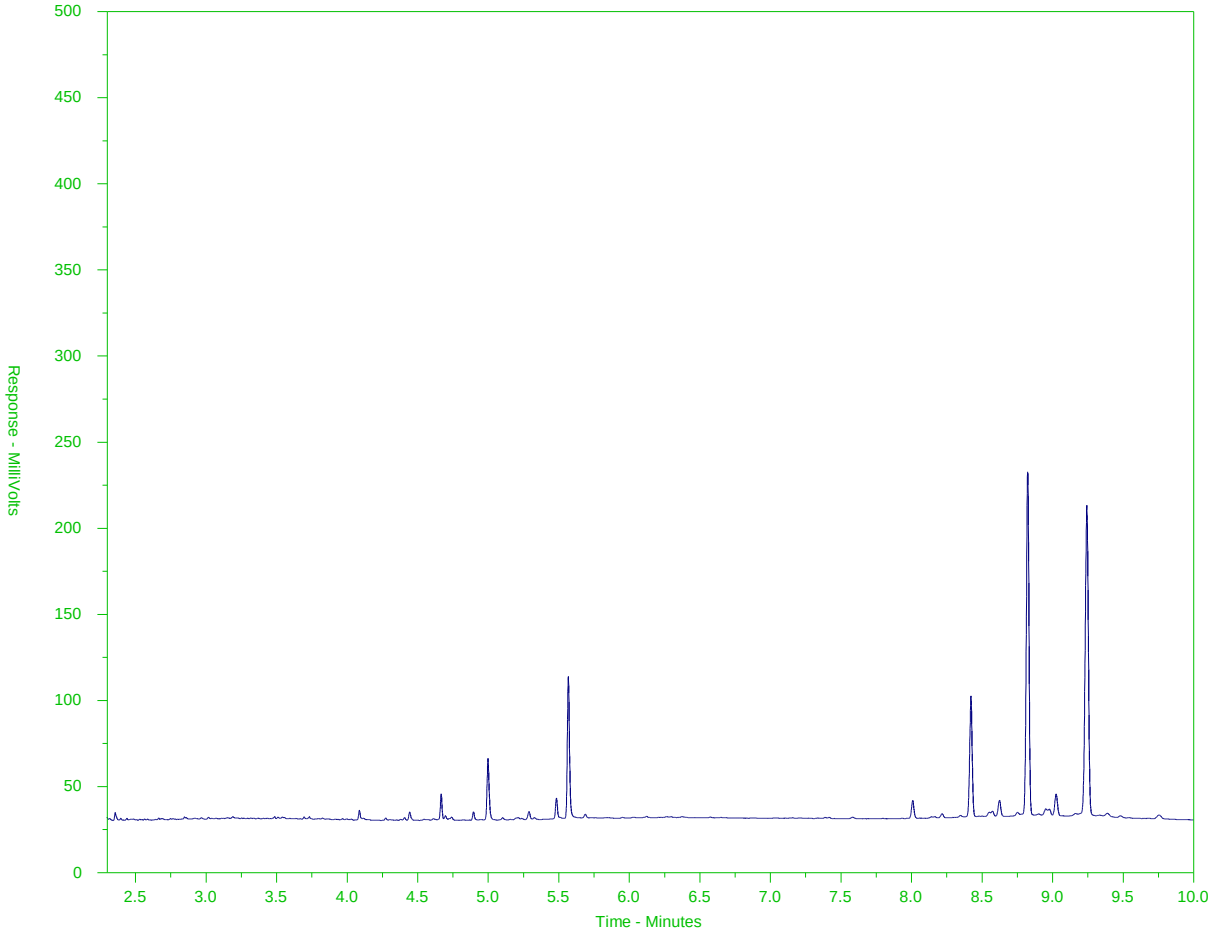
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1969674-1
Client Sample ID: ESA-29



← 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.

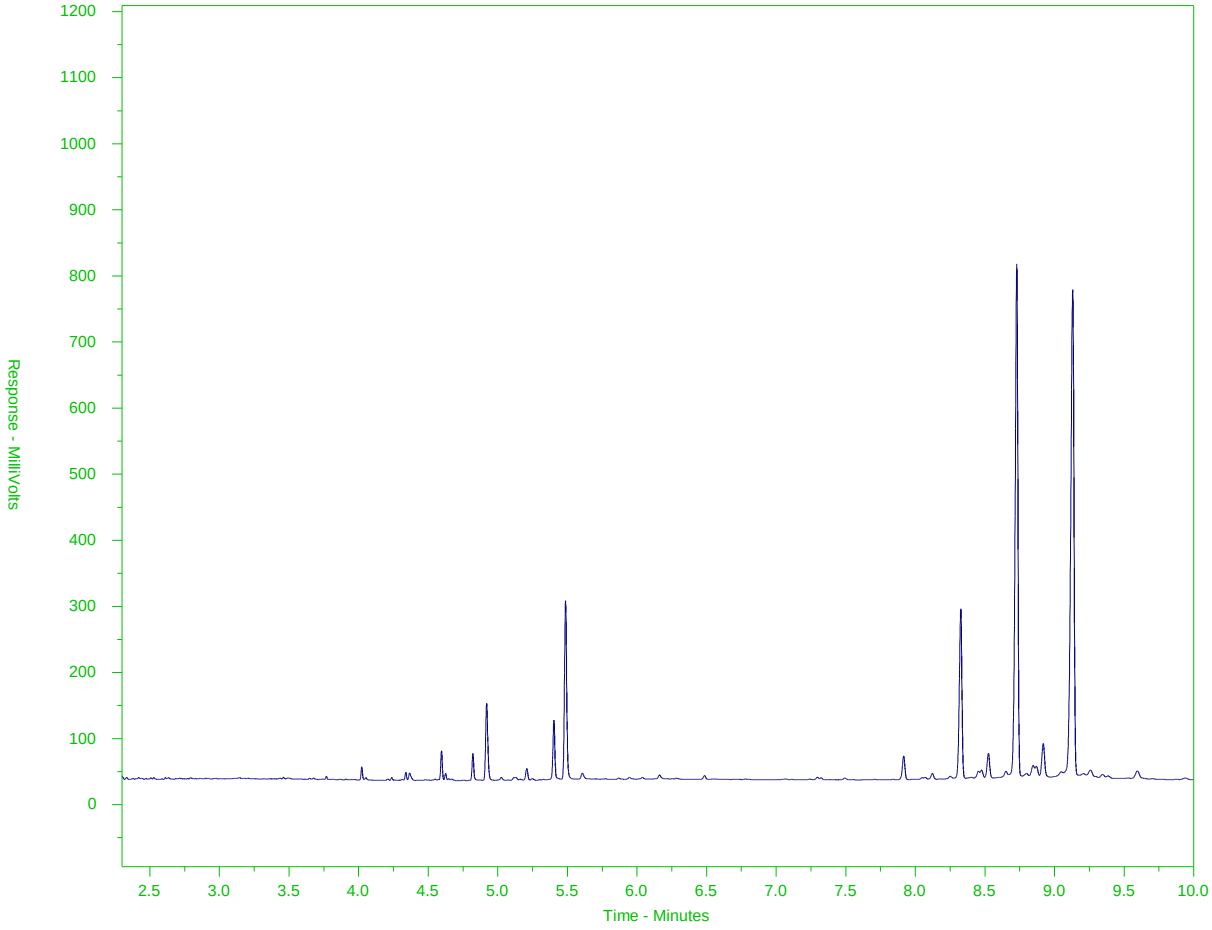
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1969674-2
Client Sample ID: ESA-30



← 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 →		

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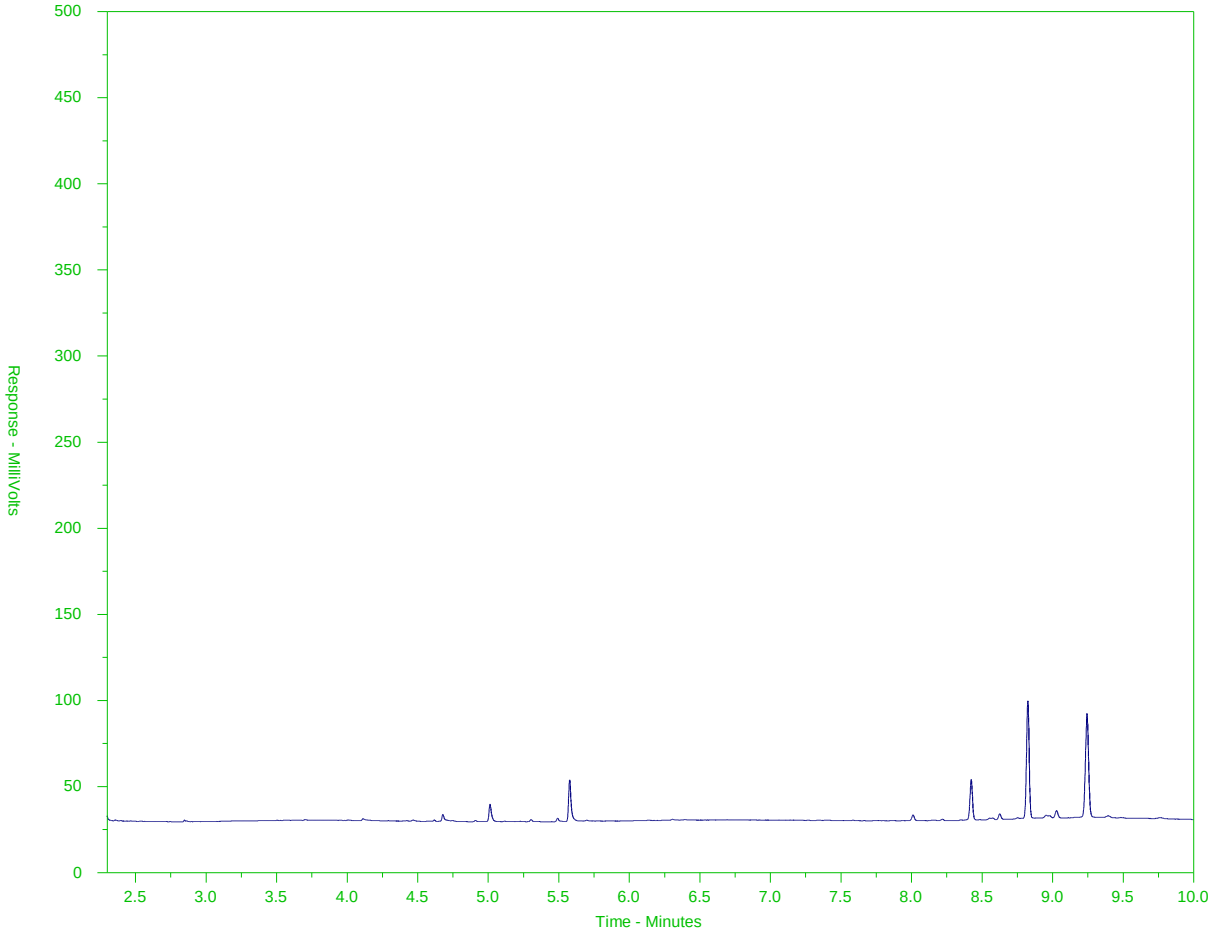
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1969674-3
Client Sample ID: ESA-31



← 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.

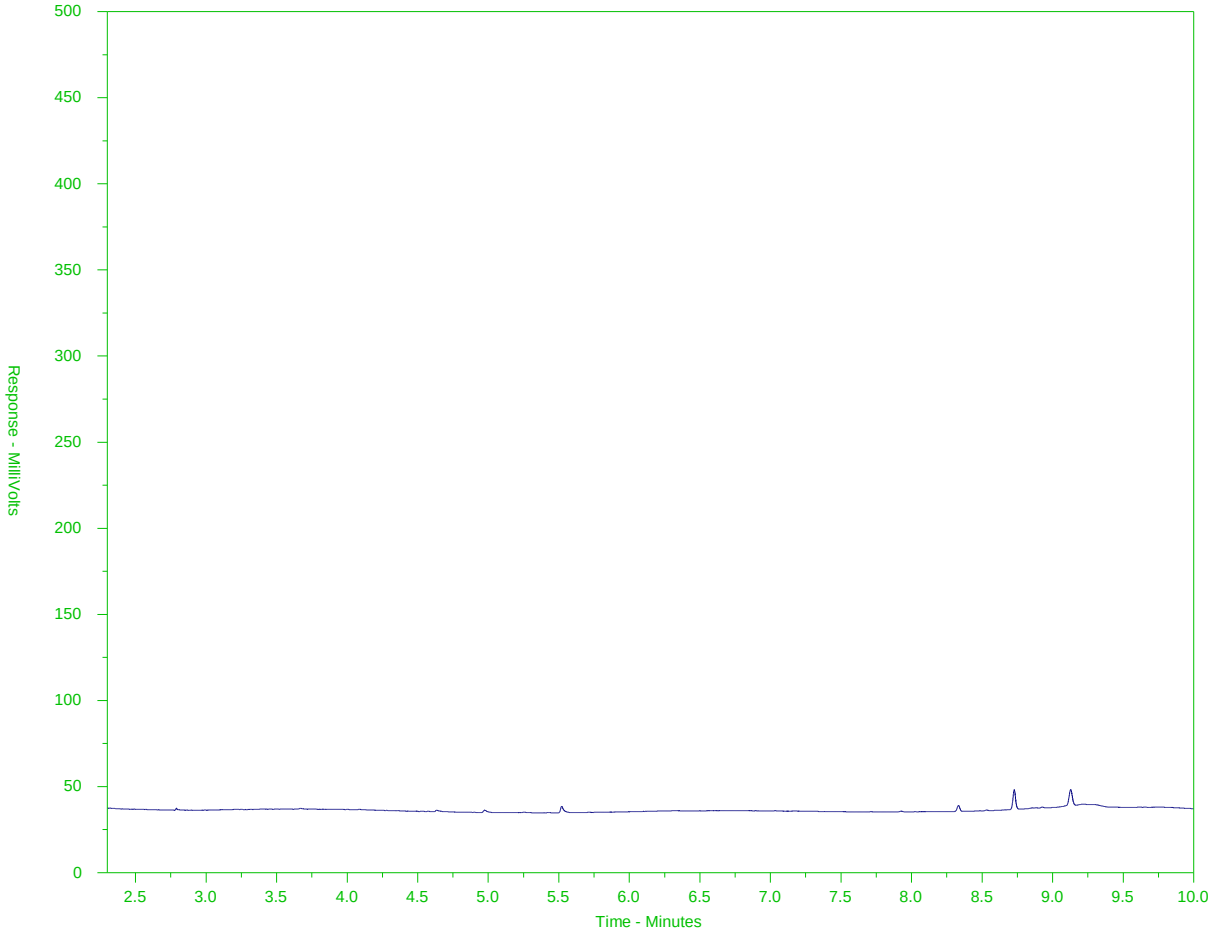
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1969674-4
Client Sample ID: ESA-32



← 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.

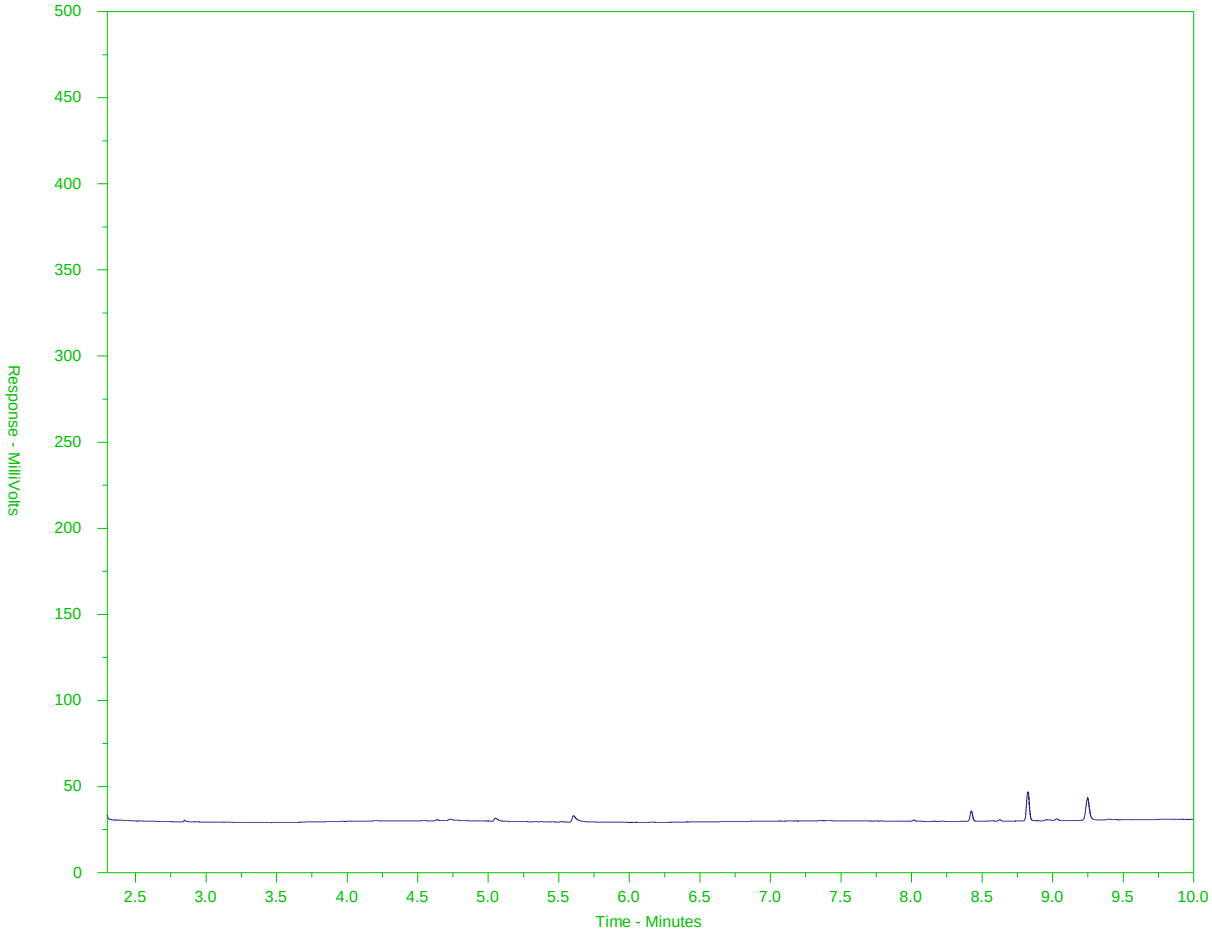
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1969674-5
Client Sample ID: ESA-33



← 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.

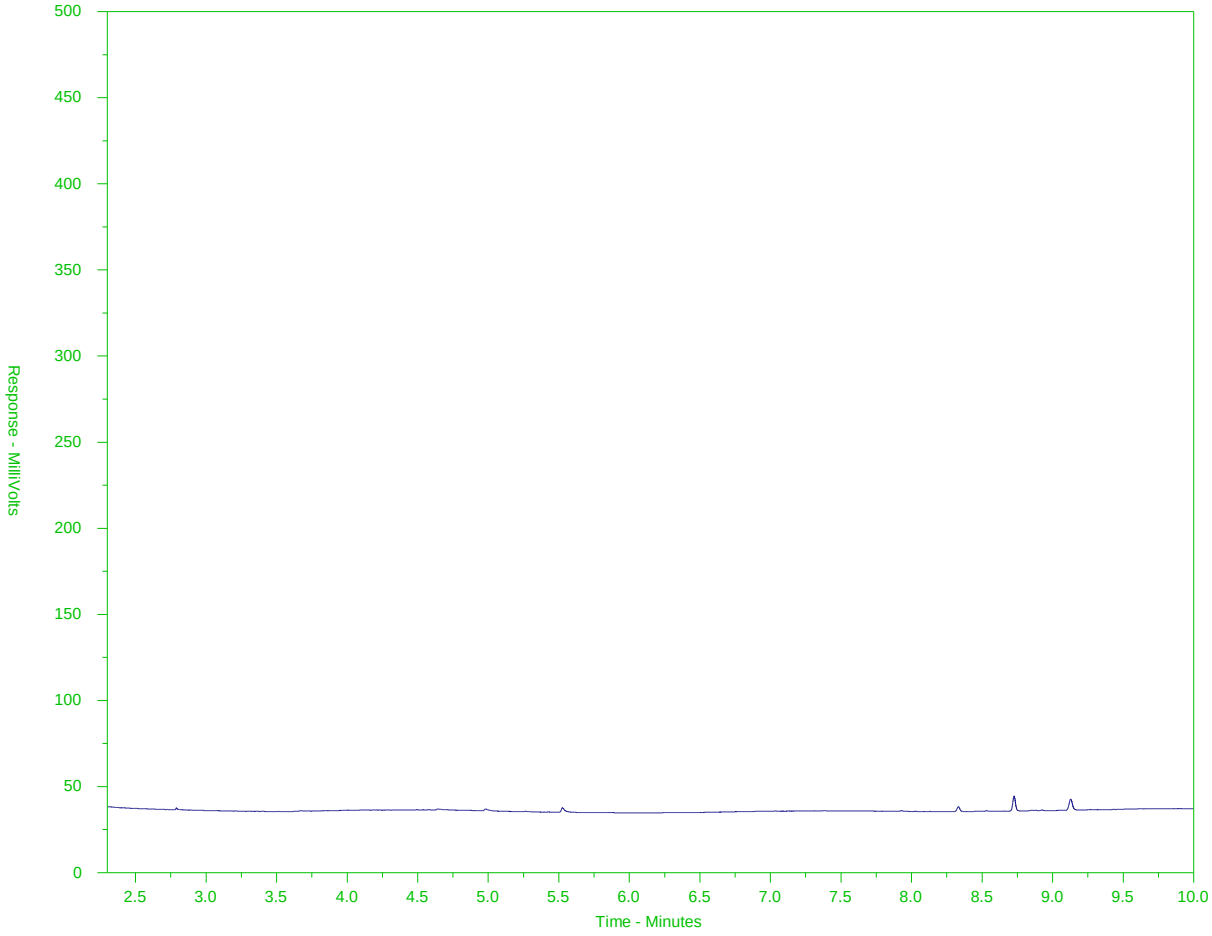
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1969674-6
Client Sample ID: ESA-34



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1969674-COFC

COC Number: 15 - 609413

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Report Format / Distribution	
Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☒ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	michael.gill@aecom.com
Email 2	leslie.southern@aecom.com
Email 3	

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	Same as above
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore
ALS Lab Work Order # (lab use only)	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Dean Watt	Sampler: EAP/

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	ESA-29	3-Aug-17	8:25	Sediment		X	X	X	4
	ESA-30		8:35						
	ESA-31		8:45						
	ESA-32		10:00						
	ESA-33		10:10						
	ESA-34		10:20						

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐	
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C		
~~18.9~~	9.5			

SHIPMENT RELEASE (client use)		
Released by: Albert Wong	Date: Aug 3, 17	Time: 12:50

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by: Cade W	Date: Aug 3	Time: 1250

FINAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 04-AUG-17
Report Date: 14-AUG-17 17:25 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1970498

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	15-609414
Legal Site Desc:	Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1970498-1				
	Description	Sediment				
	Sampled Date	04-AUG-17				
	Sampled Time	13:00				
	Client ID	ESA-35				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	15.1				
	pH (1:2 soil:water) (pH)	7.56				
Metals	Antimony (Sb) (mg/kg)	0.14				
	Arsenic (As) (mg/kg)	1.26				
	Barium (Ba) (mg/kg)	44.2				
	Beryllium (Be) (mg/kg)	0.36				
	Cadmium (Cd) (mg/kg)	<0.050				
	Chromium (Cr) (mg/kg)	12.9				
	Cobalt (Co) (mg/kg)	7.91				
	Copper (Cu) (mg/kg)	25.0				
	Lead (Pb) (mg/kg)	4.36				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	0.15				
	Nickel (Ni) (mg/kg)	6.44				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	0.060				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.465				
	Vanadium (V) (mg/kg)	62.4				
	Zinc (Zn) (mg/kg)	48.2				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl-tert-Butyl Ether (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	o-Xylene (mg/kg)	<0.050				
	m+p-Xylene (mg/kg)	<0.050				
	Xylenes (Total) (mg/kg)	<0.071				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<10				
	Surrogate: 4-Bromofluorobenzene (%)	81.6				
	Surrogate: 3,4-Dichlorotoluene (%)	95.1				
	Surrogate: 1,4-Difluorobenzene (%)	87.7				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	<200				

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1970498-1				
	Description	Sediment				
	Sampled Date	04-AUG-17				
	Sampled Time	13:00				
	Client ID	ESA-35				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	HEPH (mg/kg)	<200				
	VPH (C6-C10) (mg/kg)	<10				
	Surrogate: 2-Bromobenzotrifluoride (%)	86.9				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	100.1				
	Surrogate: Chrysene d12 (%)	97.7				
	Surrogate: Naphthalene d8 (%)	94.5				
	Surrogate: Phenanthrene d10 (%)	95.3				
	Total PAHs (mg/kg)	<0.21				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BTXSM-MEOH-HS-MS-CL	Soil	BTEX, Styrene and MTBE	EPA 8260C/5021A

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.

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PAH-SUM-CALC-VA	Soil	Sum of PAH's	CALCULATION

Total PAH represents the sum of all PAH analytes reported for a given sample. Note that regulatory agencies and criteria differ in their definitions of Total PAH in terms of the individual PAH analytes to be included.

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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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-MEOH-HS-FID-CL	Soil	VHs	BC Env. Lab Manual (VH in Solids)

The soil methanol extract is 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)

VPH-CALC-CL	Soil	VPH Calculation	BC MOE LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

XYLENES-SUM-CALC-CL	Soil	Sum of Xylene Isomer Concentrations	CALCULATED RESULT

Total xylenes represents the sum of o-xylene and m&p-xylene.

** 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:

Reference Information

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

15-609414

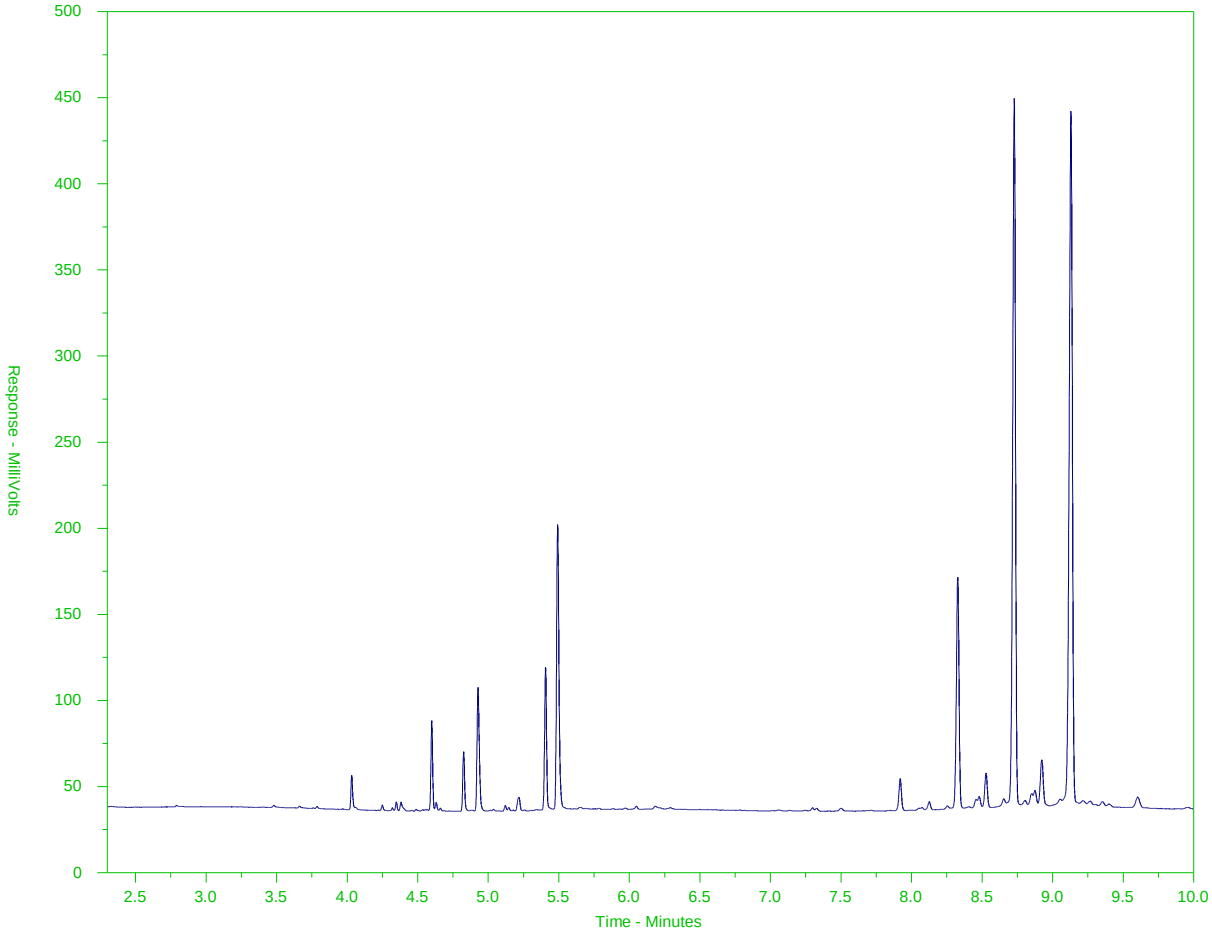
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1970498-1
Client Sample ID: ESA-35



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1970498-COFC

COC Number: 15 - 609414

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	
Company:	AECOM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Contact:	Michael Gill	Quality Control (QC) Report with Report	☒ YES ☐ NO
Phone:	604 444 6400	☒ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Street:	3292 Production Way	Email 1 or Fax	michael.gill@aecom.com
City/Province:	Burnaby	Email 2	leslie.southern@aecom.com
Postal Code:		Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO		
	Copy of Invoice with Report ☒ YES ☐ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Company:	Chevron Canada Ltd.	Email 1 or Fax	Same as above
Contact:	Chris Boys	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	

ALS Lab Work Order # (lab use only)		ALS Contact:	Dean Watt	Sampler:	EAP/

Select Service Level: ☐ AP TATs with your AM - surcharges will apply

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	ESA-35	4-Aug-17	13:00	Sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			25.6		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
							Aug 4	3PM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 08-AUG-17
Report Date: 09-AUG-17 09:23 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1971203

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-608374
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1971203-1				
	Description	SEDIMENT				
	Sampled Date	08-AUG-17				
	Sampled Time	11:30				
	Client ID	BF-SG2				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	6.76				
	pH (1:2 soil:water) (pH)	8.74				
Metals	Antimony (Sb) (mg/kg)	<0.10				
	Arsenic (As) (mg/kg)	1.57				
	Barium (Ba) (mg/kg)	29.1				
	Beryllium (Be) (mg/kg)	0.25				
	Cadmium (Cd) (mg/kg)	<0.050				
	Chromium (Cr) (mg/kg)	5.31				
	Cobalt (Co) (mg/kg)	3.45				
	Copper (Cu) (mg/kg)	3.74				
	Lead (Pb) (mg/kg)	1.22				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	2.45				
	Nickel (Ni) (mg/kg)	2.73				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	<2.0				
	Uranium (U) (mg/kg)	0.263				
	Vanadium (V) (mg/kg)	18.7				
	Zinc (Zn) (mg/kg)	32.4				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	90.2				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.0				
Hydrocarbons	EPH10-19 (mg/kg)	<200				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	<200				
	HEPH (mg/kg)	<200				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1971203-1				
	Description	SEDIMENT				
	Sampled Date	08-AUG-17				
	Sampled Time	11:30				
	Client ID	BF-SG2				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	89.5				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	113.1				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	105.0				
	Surrogate: Chrysene d12 (%)	80.4				
	Surrogate: Naphthalene d8 (%)	94.1				
	Surrogate: Phenanthrene d10 (%)	100.2				

Reference Information

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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PAH-TMB-D/A-MS-VA	Soil	PAH - Rotary Extraction (DCM/Acetone)	EPA 3570/8270

Polycyclic Aromatic Hydrocarbons in Sediment/Soil
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 DCM 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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)
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 LABORATORY MANUAL (2005)

Reference Information

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-608374

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
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1971203-COFC

COC Number: 15 - 608374

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
	Company address below will appear on the final report
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	

Invoice To		
	Same as Report To	☐ YES ☒ NO
	Copy of Invoice with Report	☒ YES ☐ NO
Company:	Chevron Canada Ltd.	
Contact:	Chris Boys	

Project Information

ALS Account # / Quote #:	
Job #:	60542455
PO / AFE:	
LSD:	Foreshore

ALS Lab Work Order # (lab use only)

Report Format

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☒ YES ☐ NO

☒ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1: michael.gill@aecom.com

Email 2: leslie.southern@aecom.com

Email 3

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Same as above

Email 2

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Contact: Dean Watt

Sampler: EAP/

Confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☒

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	BF-SG2	8-Aug-17	11:30	Sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
25					

SHIPMENT RELEASE (client use)		
Released by:	Date:	Time:

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date: Aug 8/17	Time: 1230 pm

FINAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 16-AUG-17
Report Date: 17-AUG-17 10:04 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1975749

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609415
Legal Site Desc: FORESHORE

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1975749-1				
	Description	SEDIMENT				
	Sampled Date	16-AUG-17				
	Sampled Time	09:00				
	Client ID	WIRA-3				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	20.5				
	pH (1:2 soil:water) (pH)	8.17				
Metals	Antimony (Sb) (mg/kg)	0.21				
	Arsenic (As) (mg/kg)	2.95				
	Barium (Ba) (mg/kg)	24.0				
	Beryllium (Be) (mg/kg)	<0.20				
	Cadmium (Cd) (mg/kg)	0.088				
	Chromium (Cr) (mg/kg)	10.5				
	Cobalt (Co) (mg/kg)	6.07				
	Copper (Cu) (mg/kg)	22.1				
	Lead (Pb) (mg/kg)	19.4				
	Mercury (Hg) (mg/kg)	<0.050				
	Molybdenum (Mo) (mg/kg)	<0.50				
	Nickel (Ni) (mg/kg)	8.46				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Thallium (Tl) (mg/kg)	<0.050				
	Tin (Sn) (mg/kg)	6.1				
	Uranium (U) (mg/kg)	0.422				
	Vanadium (V) (mg/kg)	46.4				
	Zinc (Zn) (mg/kg)	55.5				
Volatile Organic Compounds	VOC Sample Container	Field MeOH				
	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20				
	Styrene (mg/kg)	<0.050				
	Toluene (mg/kg)	<0.050				
	ortho-Xylene (mg/kg)	<0.050				
	meta- & para-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	100.5				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.8				
Hydrocarbons	EPH10-19 (mg/kg)	220				
	EPH19-32 (mg/kg)	<200				
	LEPH (mg/kg)	220				
	HEPH (mg/kg)	<200				
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1975749-1				
	Description	SEDIMENT				
	Sampled Date	16-AUG-17				
	Sampled Time	09:00				
	Client ID	WIRA-3				
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100				
	Surrogate: 2-Bromobenzotrifluoride (%)	103.1				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	Not reportable SMI				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050				
	Acenaphthylene (mg/kg)	<0.050				
	Anthracene (mg/kg)	<0.050				
	Benz(a)anthracene (mg/kg)	<0.050				
	Benzo(a)pyrene (mg/kg)	<0.050				
	Benzo(b)fluoranthene (mg/kg)	<0.050				
	Benzo(g,h,i)perylene (mg/kg)	<0.050				
	Benzo(k)fluoranthene (mg/kg)	<0.050				
	Chrysene (mg/kg)	<0.050				
	Dibenz(a,h)anthracene (mg/kg)	<0.050				
	Fluoranthene (mg/kg)	<0.050				
	Fluorene (mg/kg)	<0.050				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050				
	2-Methylnaphthalene (mg/kg)	<0.050				
	Naphthalene (mg/kg)	<0.050				
	Phenanthrene (mg/kg)	<0.050				
	Pyrene (mg/kg)	<0.050				
	Surrogate: Acenaphthene d10 (%)	108.9				
	Surrogate: Chrysene d12 (%)	103.9				
	Surrogate: Naphthalene d8 (%)	108.2				
	Surrogate: Phenanthrene d10 (%)	107.8				

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Tin (Sn)	DUP-H	L1975749-1
Method Blank	Arsenic (As)	MB-LOR	L1975749-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
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).

HG-WW-200.2-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, sieved (wet sample) through a 2 mm (10 mesh) sieve, and a representative subsample of the material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-WW-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-SIEVE-VA	Soil	Moisture for CSR Metals Calculations	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PAH-TMB-D/A-MS-VA	Soil	PAH - Rotary Extraction (DCM/Acetone)	EPA 3570/8270

Polycyclic Aromatic Hydrocarbons in Sediment/Soil
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 DCM 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.

PH-WW-1:2-DI-MAN-VA	Soil	pH in Soil (1:2 Soil:Water Ext.) (WET)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the wet sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water, where the samples moisture is accounted for. 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)

Reference Information

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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609415

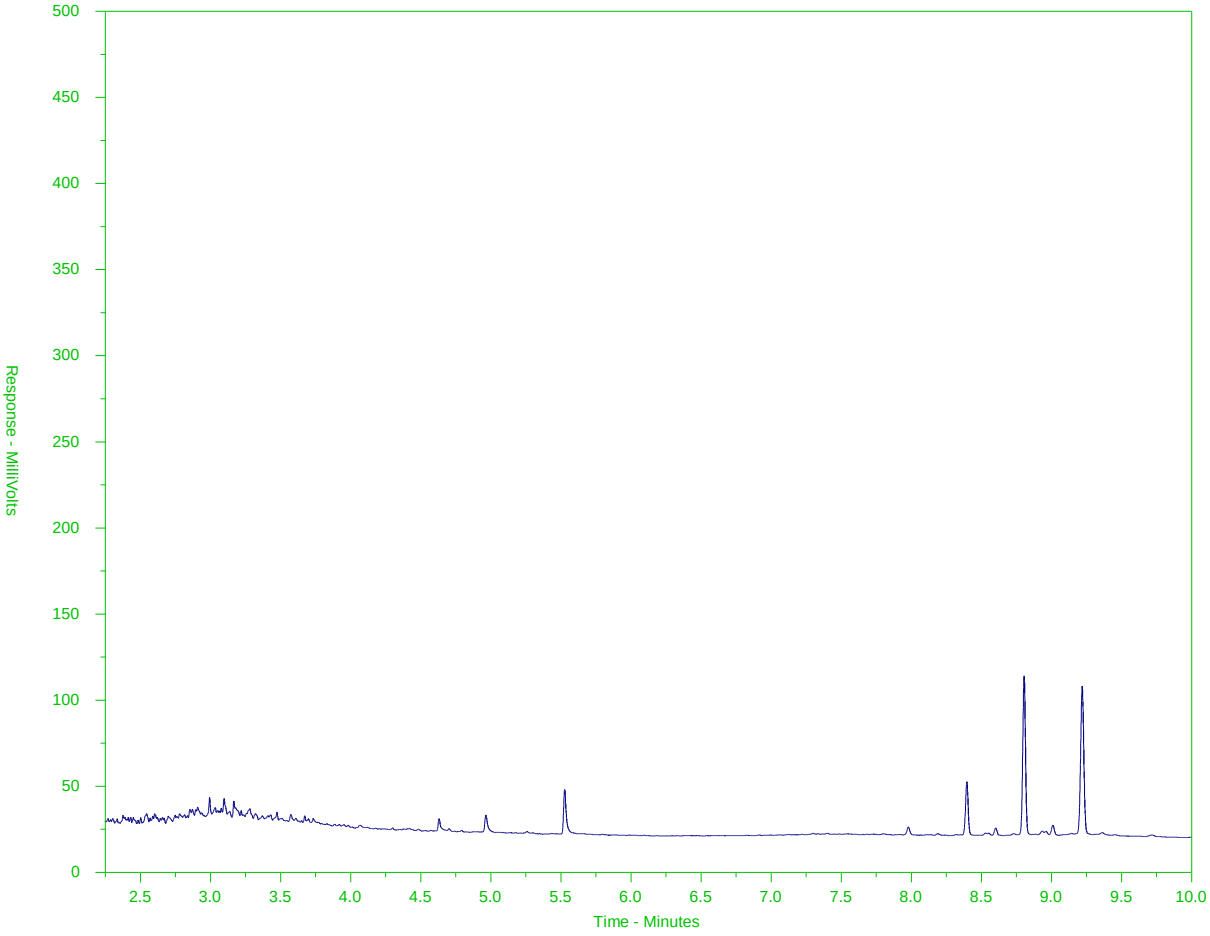
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1975749-1
Client Sample ID: WIRA-3



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1975749-COFC

COC Number: 15 - 609415

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	AECOM
Contact:	Michael Gill
Phone:	604 444 6400
Company address below will appear on the final report	
Street:	3292 Production Way
City/Province:	Burnaby
Postal Code:	
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Chevron Canada Ltd.
Contact:	Chris Boys

Report Format / Distribution

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☒ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: michael.gill@aecom.com
Email 2: leslie.southern@aecom.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: Same as above
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#:
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

Project Information

ALS Account # / Quote #:
Job #: 60542455
PO / AFE:
LSD: Foreshore

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt | Sampler: EAP/

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☒

Date and Time Required for all E&P TATs: ASAP

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	P	BTEX/VPH	LEPH/HEPH	Metals	Number of Containers
	WIBA-3	16-Aug-17	9:00	Sediment		X	X	X	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO
Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

BC CSR

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☐ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
21°					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by: Cade	Date: Aug 16	Time: 1105	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 01-SEP-17
Report Date: 28-NOV-17 17:58 (MT)
Version: FINAL REV. 2

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1985282

Project P.O. #:	0015243589
Job Reference:	60542455
C of C Numbers:	15-609422
Legal Site Desc:	Foreshore

Comments:
28-NOV-2017 Client ID update

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1985282-1	L1985282-2	L1985282-3		
	Description	Soil	Soil	Soil		
	Sampled Date	25-AUG-17	31-AUG-17	31-AUG-17		
	Sampled Time	14:15	08:30	10:45		
	Client ID	PW17-16 @0.7-0.9	PW17-26 @0.5-0.7	PW17-21 @0.5-0.7		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	12.6	14.5	13.4		
	pH (1:2 soil:water) (pH)	7.42	7.16	7.19		
Metals	Antimony (Sb) (mg/kg)	0.14	0.17	0.14		
	Arsenic (As) (mg/kg)	1.68	1.11	1.70		
	Barium (Ba) (mg/kg)	50.5	122	48.3		
	Beryllium (Be) (mg/kg)	0.27	0.49	0.26		
	Cadmium (Cd) (mg/kg)	<0.050	0.053	0.065		
	Chromium (Cr) (mg/kg)	14.9	17.1	16.4		
	Cobalt (Co) (mg/kg)	7.52	12.7	8.25		
	Copper (Cu) (mg/kg)	23.5	35.8	25.6		
	Lead (Pb) (mg/kg)	5.01	4.94	9.32		
	Mercury (Hg) (mg/kg)	<0.050	<0.050	<0.050		
	Molybdenum (Mo) (mg/kg)	0.22	0.15	0.20		
	Nickel (Ni) (mg/kg)	10.3	10.3	12.2		
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20		
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		
	Thallium (Tl) (mg/kg)	<0.050	0.069	<0.050		
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
	Uranium (U) (mg/kg)	0.494	0.433	0.533		
	Vanadium (V) (mg/kg)	57.1	89.1	60.7		
	Zinc (Zn) (mg/kg)	45.6	72.1	46.5		
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH	Field MeOH		
	Benzene (mg/kg)	<0.0050	0.0052	0.0074		
	Ethylbenzene (mg/kg)	<0.015	<0.015	<0.015		
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20	<0.20		
	Styrene (mg/kg)	<0.050	<0.050	<0.050		
	Toluene (mg/kg)	<0.050	<0.050	<0.050		
	ortho-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	meta- & para-Xylene (mg/kg)	<0.050	<0.050	<0.050		
	Xylenes (mg/kg)	<0.075	<0.075	<0.075		
	Surrogate: 4-Bromofluorobenzene (SS) (%)	91.6	87.6	90.1		
	Surrogate: 1,4-Difluorobenzene (SS) (%)	90.8	85.8	89.1		
Hydrocarbons	EPH10-19 (mg/kg)	<200	<200	<200		
	EPH19-32 (mg/kg)	<200	<200	<200		
	LEPH (mg/kg)	<200	<200	<200		
	HEPH (mg/kg)	<200	<200	<200		
	Volatile Hydrocarbons (VH6-10) (mg/kg)	<100	<100	<100		

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1985282-1	L1985282-2	L1985282-3		
	Description	Soil	Soil	Soil		
	Sampled Date	25-AUG-17	31-AUG-17	31-AUG-17		
	Sampled Time	14:15	08:30	10:45		
	Client ID	PW17-16 @0.7-0.9	PW17-26 @0.5-0.7	PW17-21 @0.5-0.7		
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100	<100		
	Surrogate: 2-Bromobenzotrifluoride (%)	93.2	92.1	92.2		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	91.8	83.8	87.4		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050	<0.050		
	Acenaphthylene (mg/kg)	<0.050	<0.050	<0.050		
	Anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benz(a)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050	<0.050		
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Chrysene (mg/kg)	<0.050	<0.050	<0.050		
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050	<0.050		
	Fluoranthene (mg/kg)	<0.050	<0.050	<0.050		
	Fluorene (mg/kg)	<0.050	<0.050	<0.050		
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050	<0.050		
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Naphthalene (mg/kg)	<0.050	<0.050	<0.050		
	Phenanthrene (mg/kg)	<0.050	<0.050	<0.050		
	Pyrene (mg/kg)	<0.050	<0.050	<0.050		
	Surrogate: Acenaphthene d10 (%)	97.9	91.9	93.1		
	Surrogate: Chrysene d12 (%)	100.9	95.8	98.1		
	Surrogate: Naphthalene d8 (%)	95.1	88.7	89.9		
	Surrogate: Phenanthrene d10 (%)	97.0	93.4	94.7		

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

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:

15-609422

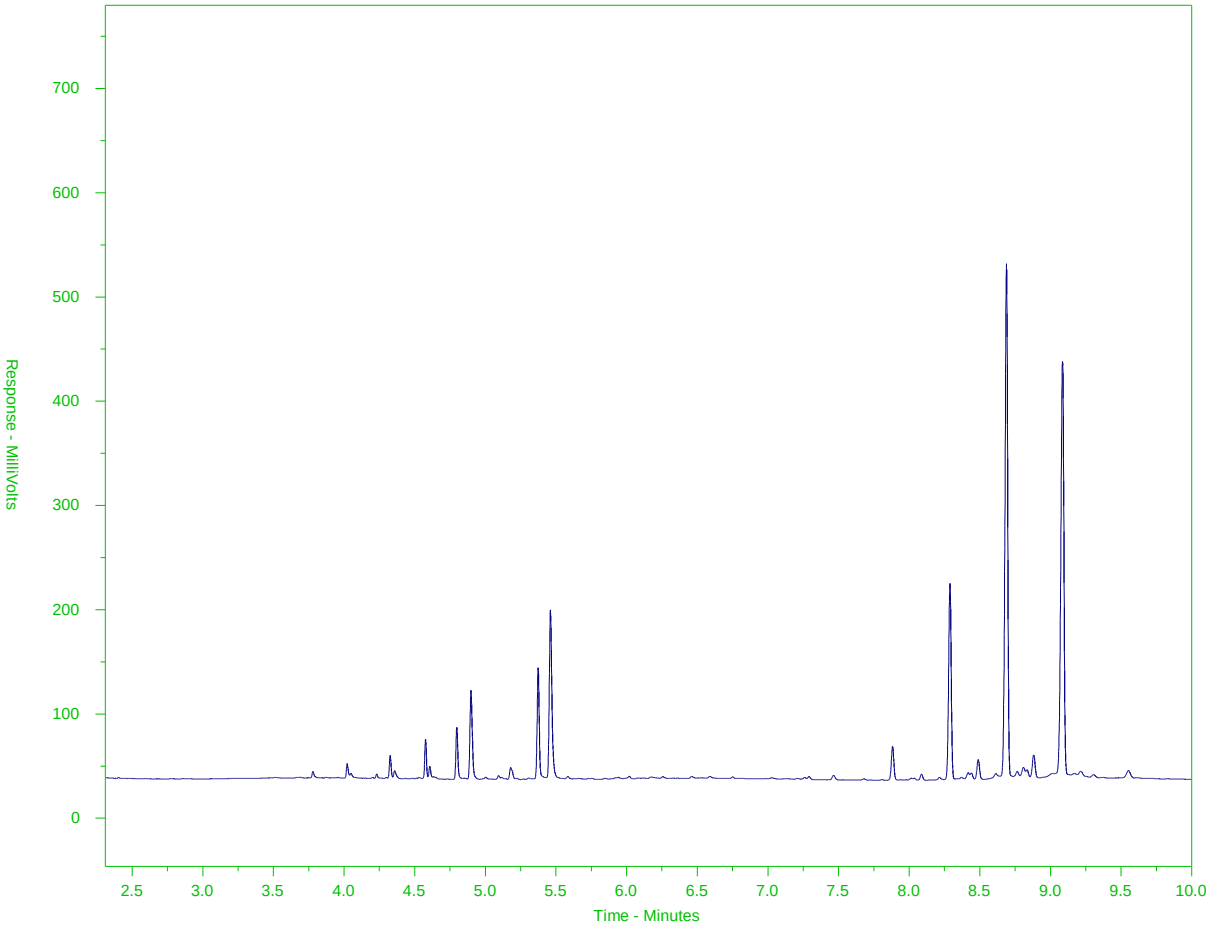
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1985282-1
Client Sample ID: MW17-16 @0.7-0.9



← 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.

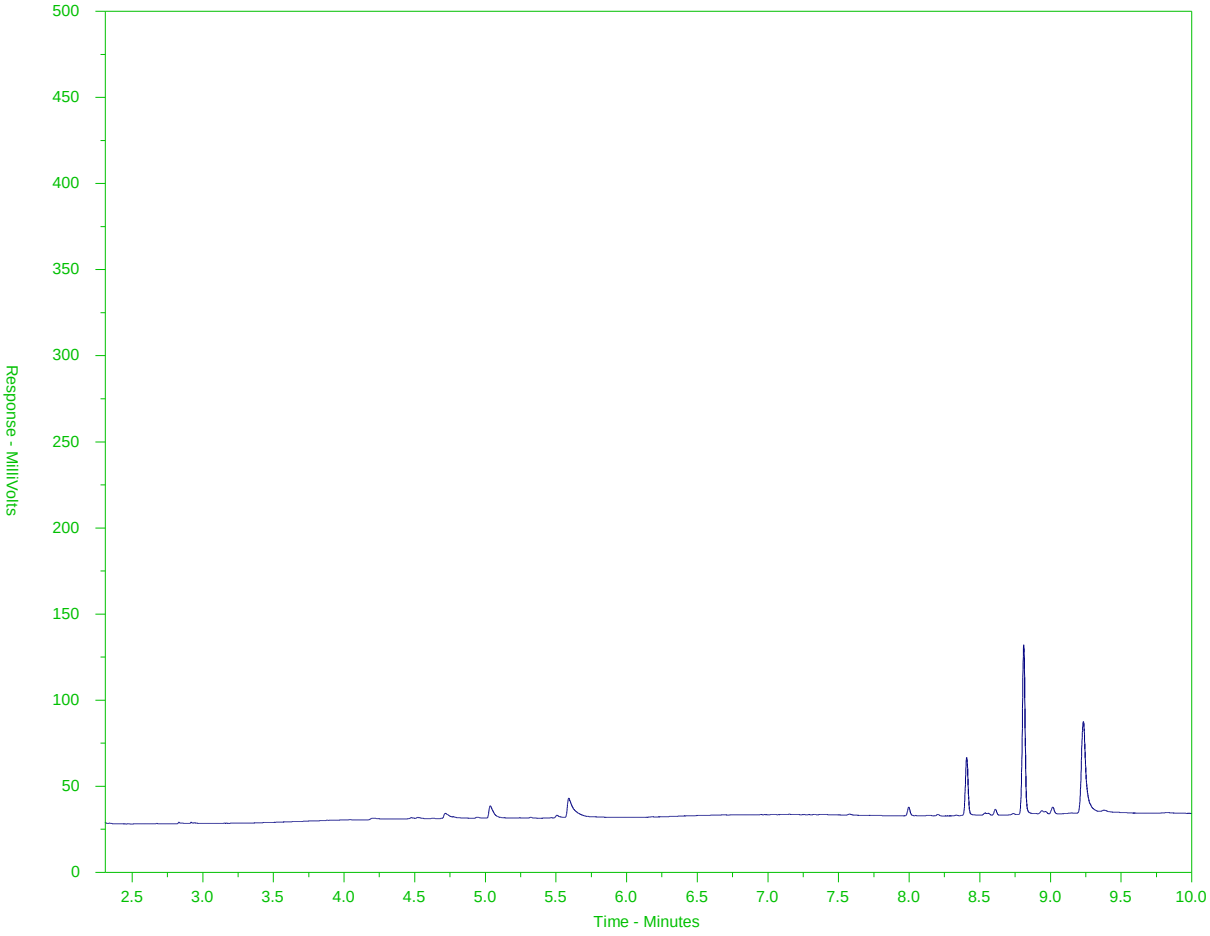
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1985282-2
Client Sample ID: MW17-26 @0.5-0.7



← 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.

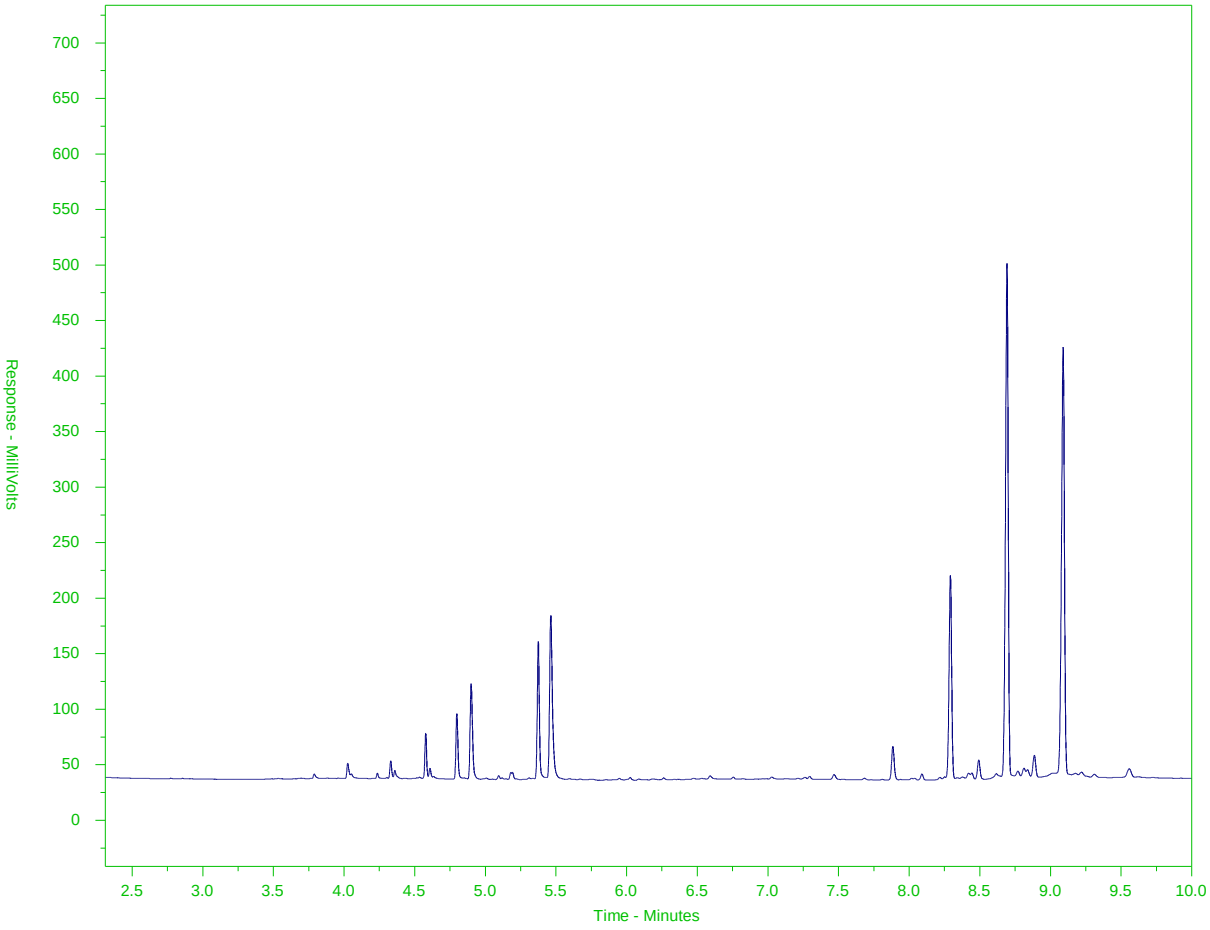
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1985282-3
Client Sample ID: MW17-21 @0.5-0.7



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1985282-COFC

COC Number: 15 - 609422

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Aecom	Select Report Format: ☐ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	604 444 6547	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs:
Street:	4th floor - 3292 Production Way,	Email 1 or Fax vicky.wirdatmadja@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Burnaby, BC	Email 2 leslie.southern@aecom.com	
Postal Code:	V5A 4R4	Email 3 michael.gill@aecom.com	
Invoice To	Same as Report To ☐ YES ☑ NO	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☑ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	Chevron	Email 1 or Fax cbys@chevron.com,	
Contact:	Chris Boys	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Dean Watt Sampler: Ken Gauthier

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX / VPH	LEPH / HEPH	metals	Number of Containers
	MW17-16@0.7-0.9	25-Aug-17	14:15	Soil	X	X	X	4
	MW17-26@0.5-0.7	31-Aug-17	8:30	Soil	X	X	X	4
	MW17-21@0.5-0.7	31-Aug-17	10:25	Soil	X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	
Are samples for human drinking water use? ☐ YES ☑ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
9.8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Ken Gauthier	Date: Sept 1/2017	Time: 14:25	Received by: Cude	Date: Sept 1	Time: 1425	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 06-OCT-17
Report Date: 28-NOV-17 17:56 (MT)
Version: FINAL REV. 2

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L2003518

Project P.O. #:	0015243589
Job Reference:	60542455 SOIL ANALYSIS
C of C Numbers:	15-609423
Legal Site Desc:	Foreshore

Comments:
28-NOV-2017 Client ID update

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2003518-1	L2003518-2			
	Description	Soil	Soil			
	Sampled Date	02-OCT-17	02-OCT-17			
	Sampled Time	09:00	09:10			
	Client ID	PW17-4@0.1-0.3	PW17-4@0.7-0.9			
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	16.2	18.5			
	pH (1:2 soil:water) (pH)	7.51	7.44			
Metals	Antimony (Sb) (mg/kg)	0.26	0.29			
	Arsenic (As) (mg/kg)	3.77	4.92			
	Barium (Ba) (mg/kg)	25.5	24.1			
	Beryllium (Be) (mg/kg)	0.25	0.22			
	Cadmium (Cd) (mg/kg)	0.129	0.166			
	Chromium (Cr) (mg/kg)	18.5	16.9			
	Cobalt (Co) (mg/kg)	7.66	10.7			
	Copper (Cu) (mg/kg)	19.7	21.0			
	Lead (Pb) (mg/kg)	5.43	5.21			
	Mercury (Hg) (mg/kg)	<0.050	<0.050			
	Molybdenum (Mo) (mg/kg)	1.01	0.89			
	Nickel (Ni) (mg/kg)	11.6	8.74			
	Selenium (Se) (mg/kg)	0.29	0.28			
	Silver (Ag) (mg/kg)	<0.10	<0.10			
	Thallium (Tl) (mg/kg)	<0.050	0.070			
	Tin (Sn) (mg/kg)	<2.0	<2.0			
	Uranium (U) (mg/kg)	3.24	3.56			
	Vanadium (V) (mg/kg)	61.9	72.2			
	Zinc (Zn) (mg/kg)	43.2	48.0			
Volatile Organic Compounds	VOC Sample Container	Field MeOH	Field MeOH			
	Benzene (mg/kg)	0.0123	0.0341			
	Ethylbenzene (mg/kg)	<0.015	0.020			
	Methyl t-butyl ether (MTBE) (mg/kg)	<0.20	<0.20			
	Styrene (mg/kg)	<0.050	<0.050			
	Toluene (mg/kg)	0.056	0.145			
	ortho-Xylene (mg/kg)	<0.050	<0.050			
	meta- & para-Xylene (mg/kg)	<0.050	0.063			
	Xylenes (mg/kg)	<0.075	<0.075			
	Surrogate: 4-Bromofluorobenzene (SS) (%)	89.9	89.8			
	Surrogate: 1,4-Difluorobenzene (SS) (%)	91.4	91.5			
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			

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2003518-1	L2003518-2			
	Description	Soil	Soil			
	Sampled Date	02-OCT-17	02-OCT-17			
	Sampled Time	09:00	09:10			
	Client ID	PW17-4@0.1-0.3	PW17-4@0.7-0.9			
Grouping	**Analyte**					
SOIL						
Hydrocarbons	VPH (C6-C10) (mg/kg)	<100	<100			
	Surrogate: 2-Bromobenzotrifluoride (%)	91.6	88.6			
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	106.1	127.5			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.050	<0.050			
	Acenaphthylene (mg/kg)	<0.050	<0.050			
	Anthracene (mg/kg)	<0.050	<0.050			
	Benz(a)anthracene (mg/kg)	<0.050	<0.050			
	Benzo(a)pyrene (mg/kg)	<0.050	<0.050			
	Benzo(b)fluoranthene (mg/kg)	<0.050	<0.050			
	Benzo(g,h,i)perylene (mg/kg)	<0.050	<0.050			
	Benzo(k)fluoranthene (mg/kg)	<0.050	<0.050			
	Chrysene (mg/kg)	<0.050	<0.050			
	Dibenz(a,h)anthracene (mg/kg)	<0.050	<0.050			
	Fluoranthene (mg/kg)	<0.050	<0.050			
	Fluorene (mg/kg)	<0.050	<0.050			
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.050	<0.050			
	2-Methylnaphthalene (mg/kg)	<0.050	<0.050			
	Naphthalene (mg/kg)	<0.050	<0.050			
	Phenanthrene (mg/kg)	<0.050	<0.050			
	Pyrene (mg/kg)	<0.050	<0.050			
	Surrogate: Acenaphthene d10 (%)	89.6	92.0			
	Surrogate: Chrysene d12 (%)	90.2	90.1			
	Surrogate: Naphthalene d8 (%)	84.6	87.8			
	Surrogate: Phenanthrene d10 (%)	88.2	91.0			

Reference Information

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).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and 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.

MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six 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.

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 the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. 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)
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 LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

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.

Reference Information

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:

15-609423

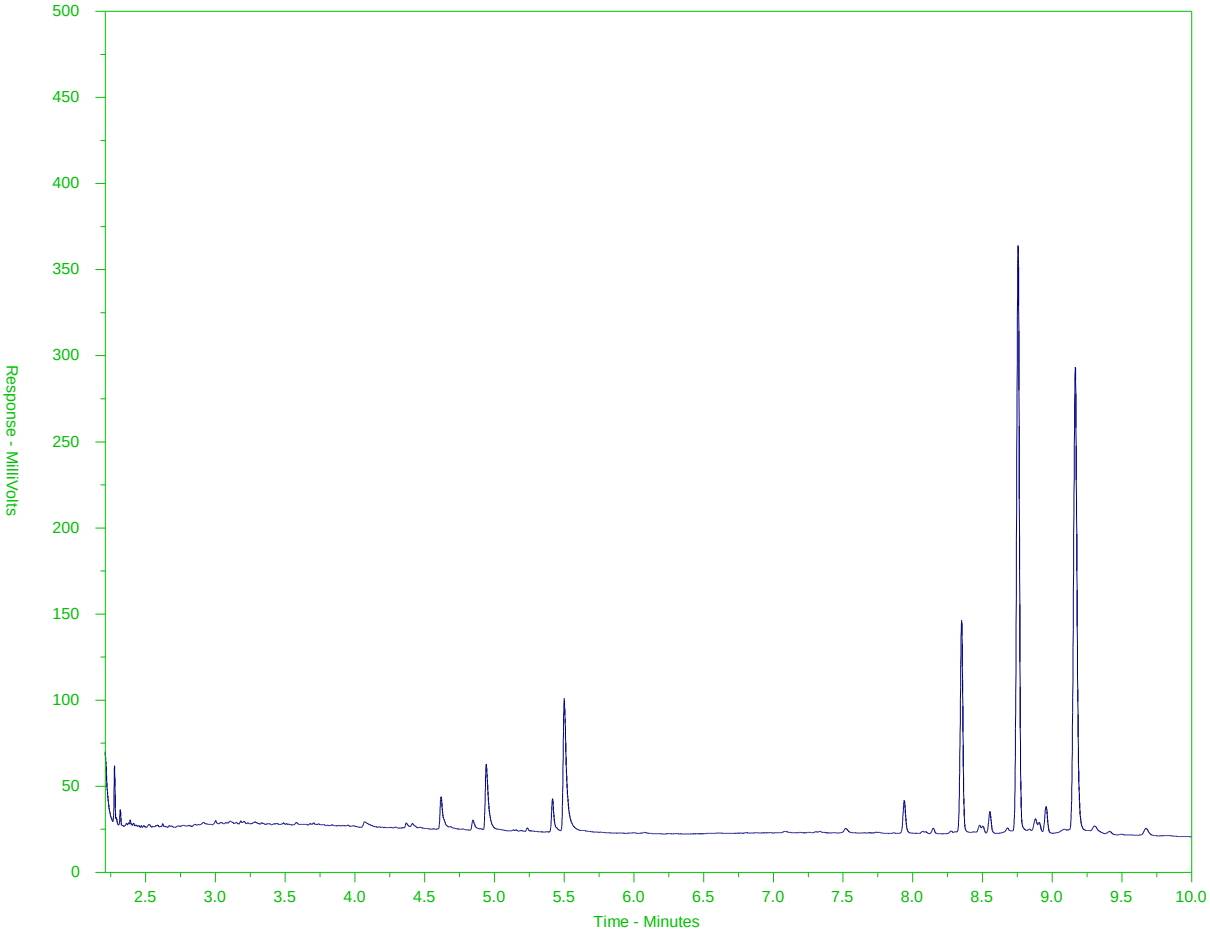
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2003518-1
Client Sample ID: MW17-4@0.1-0.3



← 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.

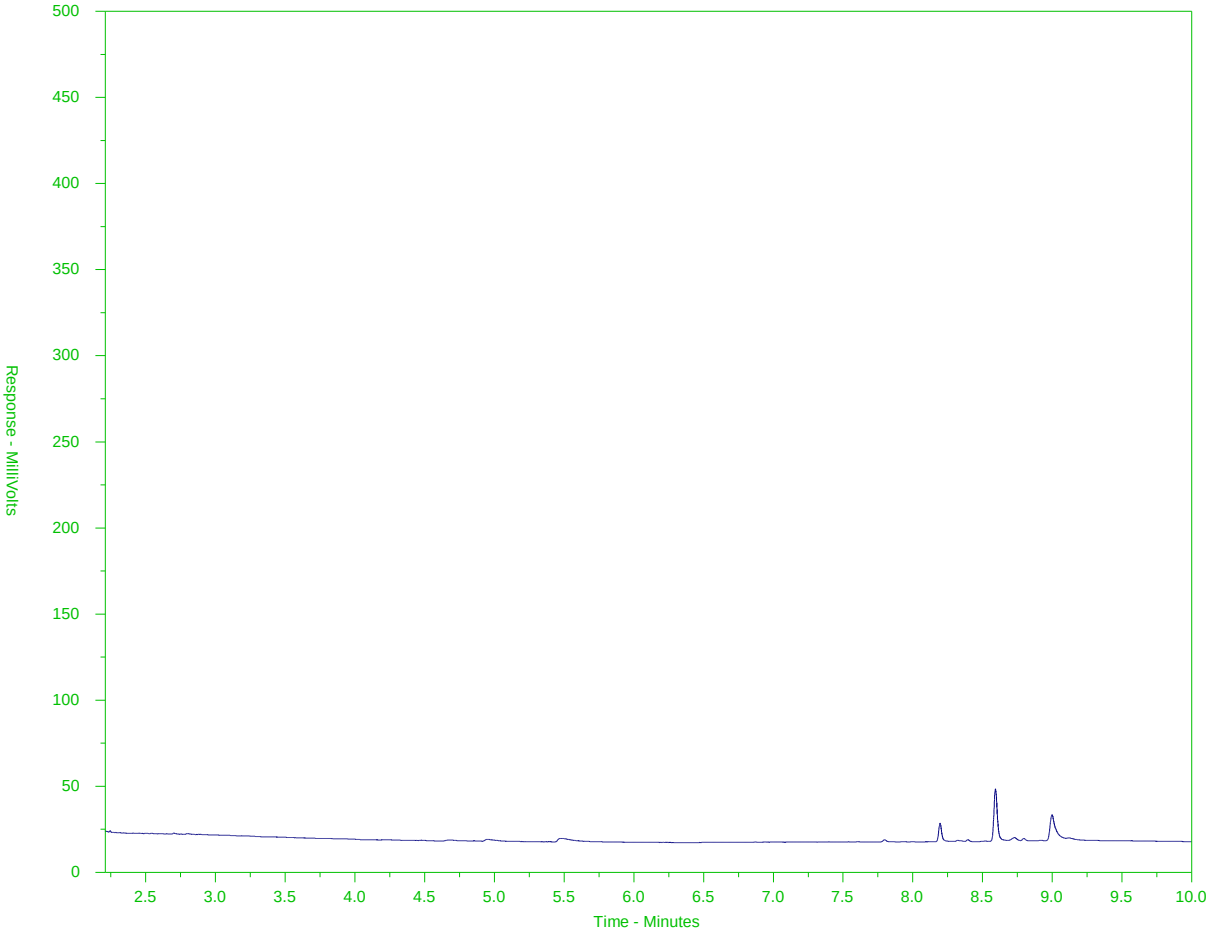
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L2003518-2
Client Sample ID: MW17-4@0.7-0.9



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2003518-COFC

COC Number: 15 - 609423

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Aecom	Select Report Format: ☐ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report ☐ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	604 444 6547	☐ Compare Results to Criteria on Report - provide details below if box checked	[redacted] Date and Time Required for all E&P TATs: [redacted]
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	For tests that can not be performed according to the service level selected, you will be contacted.
Street:	4th Floor - 3292 Production Way.	Email 1 or Fax: leslie.southern@aecom.com	
City/Province:	Burnaby BC.	Email 2: michael.gill@aecom.com.	
Postal Code:	V5A 4R4	Email 3: danny.lee@aecom.com	
Invoice To	Same as Report To ☐ YES ☑ NO	Invoice Distribution	
	Copy of Invoice with Report ☑ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	Chevron	Email 1 or Fax: clys@chevron.com.	
Contact:	Chris Boys	Email 2:	

Project Information		Oil and Gas Required Fields (client use) [redacted]	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore.	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: Ken Gauthier

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BTEX / VPH	LEPH / HEPH	Metals	Number of Containers
	MW17-4 @ 0.1-0.3	02-Oct-17	9:00	Soil	X	X	X	
	MW17-4 @ 0.7-0.9	02-Oct-17	9:10	Soil	X	X	X	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO		Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human drinking water use? ☐ YES ☑ NO		Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
		Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: Oct 6 2017	Time: 16:00	Received by: Shayan	Date: Oct. 6	Time: 1000	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

AECOM CANADA LTD.
ATTN: Michael Gill
3292 Production Way
Suite 330
Burnaby BC V5A 4R4

Date Received: 26-JUL-17
Report Date: 03-AUG-17 20:37 (MT)
Version: FINAL

Client Phone: 604-444-6608

Certificate of Analysis

Lab Work Order #: L1965282

Project P.O. #: 0015243589
Job Reference: 60542455
C of C Numbers: 15-609418
Legal Site Desc: Foreshore

Dean Watt, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1965282-1				
	Description	Water				
	Sampled Date	26-JUL-17				
	Sampled Time	11:50				
	Client ID	EIRA-WATER-1|REG|GW				
Grouping	**Analyte**					
WATER						
Volatile Organic Compounds	Benzene (mg/L)	<0.00050				
	Ethylbenzene (mg/L)	0.00127				
	Styrene (mg/L)	<0.00050				
	Toluene (mg/L)	<0.00050				
	ortho-Xylene (mg/L)	0.00333				
	meta- & para-Xylene (mg/L)	0.00447				
	Xylenes (mg/L)	0.00780				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	93.0				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	101.0				
Hydrocarbons	EPH10-19 (mg/L)	<0.25				
	EPH19-32 (mg/L)	<0.25				
	LEPH (mg/L)	<0.25				
	HEPH (mg/L)	<0.25				
	Volatile Hydrocarbons (VH6-10) (mg/L)	<0.10				
	VPH (C6-C10) (mg/L)	<0.10				
	Surrogate: 2-Bromobenzotrifluoride (%)	90.4				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	102.6				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000050				
	Acenaphthylene (mg/L)	<0.000050				
	Acridine (mg/L)	<0.000050				
	Anthracene (mg/L)	<0.000050				
	Benz(a)anthracene (mg/L)	<0.000050				
	Benzo(a)pyrene (mg/L)	<0.0000050				
	Benzo(b)fluoranthene (mg/L)	<0.000050				
	Benzo(g,h,i)perylene (mg/L)	<0.000050				
	Benzo(k)fluoranthene (mg/L)	<0.000050				
	Chrysene (mg/L)	<0.000050				
	Dibenz(a,h)anthracene (mg/L)	<0.0000050				
	Fluoranthene (mg/L)	<0.000050				
	Fluorene (mg/L)	<0.000050				
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000050				
	Naphthalene (mg/L)	<0.00080 DLQ				
	Phenanthrene (mg/L)	<0.000050				
	Pyrene (mg/L)	<0.000050				
	Quinoline (mg/L)	<0.000050				
	Surrogate: Acridine d9 (%)	106.0				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1965282-1				
	Description	Water				
	Sampled Date	26-JUL-17				
	Sampled Time	11:50				
	Client ID	EIRA-WATER-1|REG|GW				
Grouping	**Analyte**					
WATER						
Polycyclic Aromatic Hydrocarbons	Surrogate: Chrysene d12 (%)	78.7				
	Surrogate: Naphthalene d8 (%)	102.5				
	Surrogate: Phenanthrene d10 (%)	107.4				

* 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	Acridine	LCS-ND	L1965282-1
Laboratory Control Sample	Anthracene	LCS-ND	L1965282-1
Laboratory Control Sample	Benzo(g,h,i)perylene	LCS-ND	L1965282-1
Laboratory Control Sample	Dibenz(a,h)anthracene	LCS-ND	L1965282-1
Laboratory Control Sample	Indeno(1,2,3-c,d)pyrene	LCS-ND	L1965282-1
Laboratory Control Sample	Phenanthrene	LCS-ND	L1965282-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLQ	Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.
LCS-ND	Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
EPH-ME-FID-VA	Water	EPH in Water	BC Lab Manual
EPH is extracted from water using a hexane micro-extraction technique, with analysis by GC-FID, as per the BC Lab Manual. EPH results include PAHs and are therefore not equivalent to LEPH or HEPH.			
LEPH/HEPH-CALC-VA	Water	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)
Light and Heavy Extractable Petroleum Hydrocarbons in water. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).			
PAH-ME-MS-VA	Water	PAHs in Water	EPA 3511/8270D (mod)
PAHs are extracted from water using a hexane micro-extraction technique, with analysis by GC/MS. Because the two isomers cannot be readily separated chromatographically, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.			
VH-HSFID-VA	Water	VH in Water by Headspace GCFID	BC Env. Lab Manual (VH in Water)
The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Compounds eluting between n-hexane and n-decane are measured and summed together using flame-ionization detection.			
VH-SURR-FID-VA	Water	VH Surrogates for Waters	BC Env. Lab Manual (VH in Solids)
VOC7-HSMS-VA	Water	BTEX/MTBE/Styrene by Headspace GCMS	EPA 5021A/8260C
The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.			
VOC7/VOC-SURR-MS-VA	Water	VOC7 and/or VOC Surrogates for Waters	EPA 5035A/5021A/8260C
VPH-CALC-VA	Water	VPH is VH minus select aromatics	BC MOE LABORATORY MANUAL (2005)
These results are determined according to the British Columbia Ministry of Environment Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water". The concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and, in solids, Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10).			
XYLENES-CALC-VA	Water	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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-609418

Reference Information

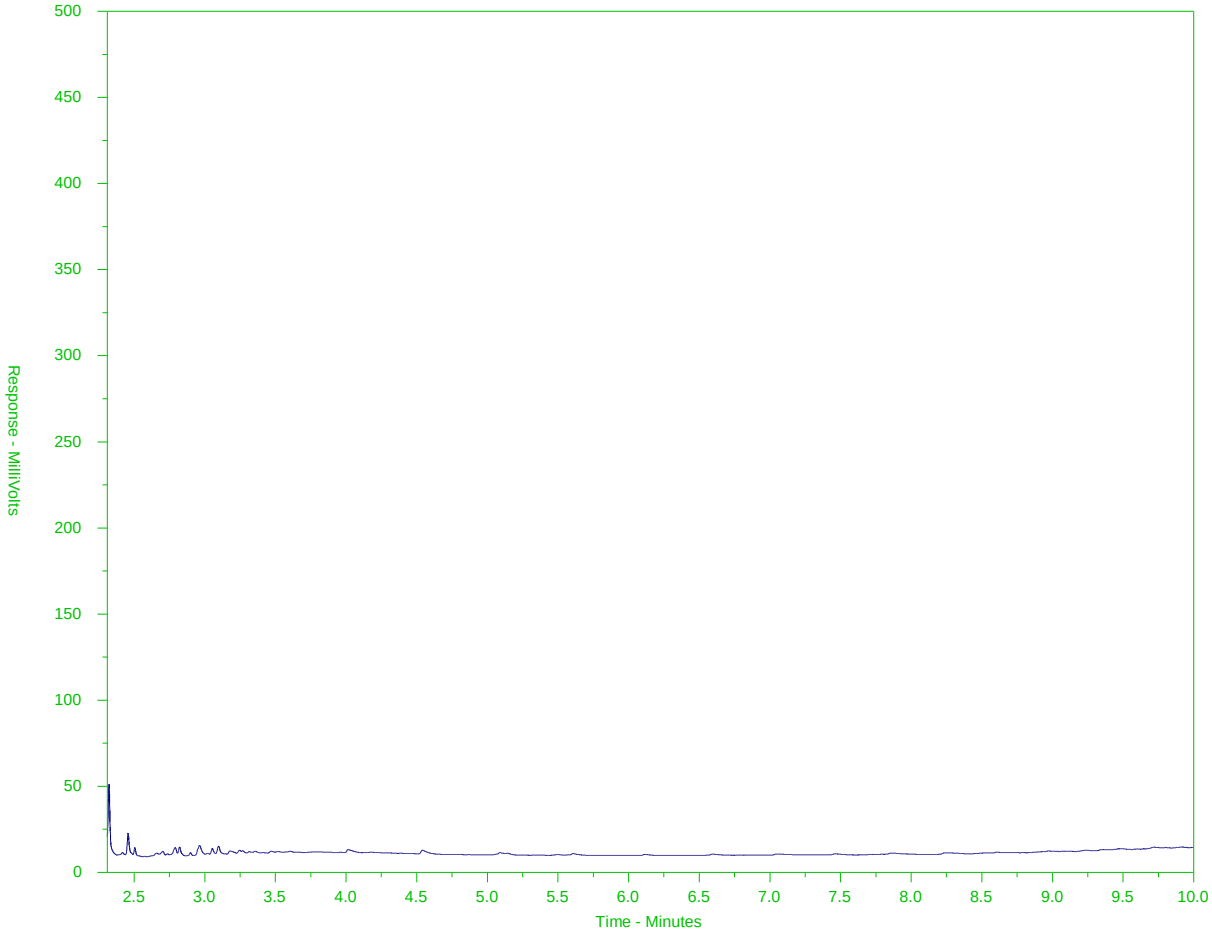
GLOSSARY OF REPORT TERMS

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1965282-1
Client Sample ID: |REG|GWEIRA-WATER-1



← 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1965282-COFC

COC Number: 15 - 609418

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please ... all E&P TATs with your AM - surcharges will apply
Company:	AECOM	Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Michael Gill	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	604 444 6400	☒ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Street:	3292 Production Way	Email 1 or Fax: michael.gill@aecom.com	Date and Time Required for all E&P TATs:
City/Province:	Burnaby	Email 2: Leslie.Southern@aecom.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:		Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☒ YES ☐ NO	Email 1 or Fax: same as above	
Company:	Chevron Canada Ltd.	Email 2	
Contact:	Chris Boys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	60542455	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	Foreshore	Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean Watt	Sampler: EAP/JB

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Analysis Request: Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below — BTEX/VPH (P)	LEPH/HEPH (P)	Brackish	Number of Containers
	EIRA-Water-1	26-Jul-17	11:50	Water	X	X	X	4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	BC CSR
Are samples for human drinking water use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐			
Ice Packs	☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐		
Cooling Initiated	☐						

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			25		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Justin Beeler	July 26, 2017	18:35				[illegible]	7/26/17	18:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Appendix I - Tervita Manifests and Bill of Lading

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508 Chevron — WR#: 888

DATE: 20-Jul-2017 — MP#:

CONT: CL+ BTEX/VPH, EPH, Supersacks

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT	BAGS
1	7:10	HB8386	CL+	12	9.940	8
2	10:02	HN6555	CL+	12	17.628	8
3	10:06	HB8386	CL+	12	8.590	8
4	13:17	HN6555	CL+	12	10.718	8
					46.876	**32**

Listing of Tickets
For Jul 21,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1546949	Jul 21	07:10	HB8386	Tervita - 20 yd3	20	23600	13660	9940
1547068	Jul 21	10:02	HN6555	Southdale/Pup	28	35280	17652	17628
1547070	Jul 21	10:06	HB8386	Tervita - 20 yd3	20	22250	13660	8590
1547210	Jul 21	13:17	HN6555	Southdale/Pup	28	28370	17652	10718
SubSubTotal:					96			46876

6

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC

BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
July 20 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ✓ / Truck&Pony / Truck & Transfer

Tailgate Se and Dum BM

Name: Tervita
Address: 3511 Vulcan Way Richmond BC
Driver Name/Title: Brent Helly
Phone No. 604-214-1000 Truck No: WHT002
Vehicle License No./Prov.: HB838620 BC
Acknowledgment of Receipt of Materials.

Driver Signature
July 21 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1546949

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HB838620 Tervita - 20 yd
Date Jul 21,17 07:10 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross 23,600 kg
Tare 13,660 kg File
NET 9,940 kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (60

Cell 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Marca — Name of Authorized Agent
Signature
July 21 17 — Receipt Date

8 BAGS

7

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC	
BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name | Signature | July 20 2017 — Shipment Date

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ✓ Truck & Transfer ☐

Tailgate S and Dur ☒

Name: Zak
Address: Langley BC
Driver Name/Title: K Lall
Phone No.: Truck No: 2213
Vehicle License No./Prov.: HN6555
Acknowledgment of Receipt of Materials.

Driver Signature | Shipment Date: July 20 17

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547068

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HN6555P Southdale/Pup
Date Jul 21,17 10:03 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	35,280 kg	
Tare	17,652 kg	File
NET	17,628 kg	

X
Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (6

Cell 17 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Pat Dupre — Name of Authorized Agent | Signature | July 21 17 — Receipt Date

8

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC

BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name | Signature | July 20 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ✓ | Truck&Pony | Truck & Transfer

Tailgate and Du ✓

Name: Tervita
Address: 3511 Viscount Way, Richmond BC
Driver Name/Title: Brent Kelly
Phone No.: 604-214-7006 Truck No: WHT002
Vehicle License No./Prov.: HB838620 BC
Acknowledgment of Receipt of Materials.

Kelly — Driver Signature | July 21 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547070

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HB838620 Tervita - 20 yd
Date Jul 21,17 10:06 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	22,250 kg	
Tare	13,660 kg	File
NET	8,590 kg	

X _____ Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (

Cell 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Pat Dupre — Name of Authorized Agent | Signature | July 21 17 — Receipt Date

4

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC	
BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
July 20 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem [ ] Truck&Pony [✓] Truck & Transfer [ ]

Tailgate and Du [ ]

Name: ZR Environmental Ltd
Address: Langley, BC

Driver Name/Title: K. Gill
Phone No.: Truck No: ZR13
Vehicle License No./Prov.: HN6555
Acknowledgment of Receipt of Materials.

Driver Signature
Shipment Date: July 20 17

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547210

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HN6555P Southdale/Pup
Date Jul 21,17 13:18 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	28,370	kg
Tare	17,652	kg File
NET	10,718	kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (

Cell [ ] 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Pat Dupre — Name of Authorized Agent
Signature
July 21 17 — Receipt Date

Z & R Trucking & Construction Contracting Co Ltd.

*Transporation of Dangerous Goods *Sand & Gravel
*Washed Aggregates *Top Soil
23302- 70 A Avenue - Langley - BC - V2Y 2H9
*OFFICE: 604-318-7929 *FAX:604-888-7927 *Email:zrtrucking@shaw.ca

Job # 20010508 Date: July 21/17

IN ACCOUNT WITH: Tervita

JOB LOCATION: 65 Rodger Pl
Vancouver, Port

G.S.T. NO. R105795041 TRUCK NO. ZR. 13

4. AXLE TRANSFER	TRIDEM & TRIDEM PONY	TRUCK & TRIDEM PONY	TRUCK & PONY	TANDEM
☐	☐	☐	☑	☐

TICKET NO.	PIT NO.	MATERIAL	NET WEIGHT	RECEIVED BY
1547068	RBF	CL+	17,608 kg	
1547210	RBF	CL+	10,718 kg	
	Loading By Fork Lift at site			
	with Bags			
	Light Bags Full			
		7 Trips		

START TIME: _____ FINISH: _____

INVOICE

NET 30 DAYS 2% INTEREST PER MONTH CHARGED ON OVERDUE ACCOUNTS
CUSTOMER IS RESPONSIBLE FOR OVER WEIGHT FINES

017096

SIGNED _____

WHITE - CUSTOMER YELLOW - Z & R PINK - DRIVER

SHAN PRINTING & SINGS LTD. • PH: 778-885-5164, 604-593-5070

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508	Chevron	WR#:	888
DATE:	20-Jul-2017	MP#:	
CONT:	CL+ BTEX/VPH, EPH, Supersacks		

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT	BAGS
1	10:23	HB8386	CL+	12	11.590	8
2	12:35	JM8155	CL+	12	11.520	8
3	12:39	HB8386	CL+	12	11.660	8
4	14:54	JM8155	CL+	12	9.566	8
5	15:08	HB8386	CL+	12	11.520	8
					55.856	**40**

RL Ecowaste Industries Ltd.
Listing of Tickets
For Jul 20,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1546679	Jul 20	10:23	HB8386	Tervita - 20 yd3	20	25250	13660	11590
1546780	Jul 20	12:35	JM8155	Southdale Trucking	16	23890	12370	11520
1546786	Jul 20	12:39	HB8386	Tervita - 20 yd3	20	25320	13660	11660
1546903	Jul 20	14:54	JM8155	Southdale Trucking	16	21900	12334	9566
1546910	Jul 20	15:08	HB8386	Tervita - 20 yd3	20	25180	13660	11520
SubSubTotal:					92			55856

1

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC	
BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name | Signature | July 20 2017 — Shipment Date

Section II TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem ☑ Truck&Pony ☐ Truck & Transfer ☐

Tailgate Secured (Pinned or Chained) and Dumped ☑

Name: Tervita
Address: 3511 Vulcan Way Richmond BC
Driver Name/Title: Brent Hellyer
Phone No: 604 290-5119 Truck No: WHF002
Vehicle License No./Prov.:
Acknowledgment of Receipt of Materials.

Driver Signature | July 20 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1546679

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HB838620 Tervita - 20 yd
Date Jul 20,17 10:23 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	25,250 kg	
Tare	13,660 kg	File
NET	11,590 kg	

X
Signature

Section III DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: ((

Cell 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

PAT DUPRE — Name of Authorized Agent | Signature | July 20 17 — Receipt Date

8 BAGS

Getting Weigh Slip NEXT Round

(2)

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC

BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
July 20 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ☐ Truck & Transfer ☐

Name: Southdale
Address:

Driver Name/Title: Sokhi
Phone No.: 354 0307 Truck No: 10
Vehicle License No./Prov.: JM8155

Acknowledgment of Receipt of Materials.

Driver Signature
JUN 20 17 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1546780

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: JM8155 Southdale Truckin
Date Jul 20,17 12:49 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	23,890 kg
Tare	12,370 kg
NET	11,520 kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone

Cell 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

PAT DARE — Name of Authorized Agent
Signature
July 20 17 — Receipt Date

(8) BAGS

3

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC	
BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name | Signature | July 20 2017 — Shipment Date

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem [ ] Truck&Pony [ ] Truck & Transfer [ ]

Tailgate S and Dum [BH]

Name: Tervita
Address: 13511 Vulcan Way, Richmond BC
Driver Name/Title: Brent Hellyer
Phone No: 604-214-2[illegible] Truck No: WHTOO2
Vehicle License No./Prov.: HB8386

Acknowledgment of Receipt of Materials.

Hellyer — Driver Signature | July 20 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1546786

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HB838620 Tervita - 20 yd
Date Jul 20,17 12:39 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	25,320 kg
Tare	13,660 kg File
NET	11,660 kg

X _____ Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (6C

Cell [ ] 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

PAT DUPRE — Name of Authorized Agent | Signature | July 20 17 — Receipt Date

8 BAGS

(4)

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC	
BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
July 20 2017

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ✓ / Truck&Pony / Truck & Transfer

Tai a

Name: Southdale
Address:

Driver Name/Title: Sukhi
Phone No.: 3541030 Truck No: 10
Vehicle License No./Prov.: JM8155
Acknowledgment of Receipt of Materials.

Driver Signature
JUN 20 17 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1546903

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: JM8155 Southdale Truckin
Date Jul 20,17 14:55 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	21,900 kg
Tare	12,334 kg File
NET	9,566 kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone N

Cell 12

WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

PAT DUPRE — Name of Authorized Agent
Signature
July 20 17 — Receipt Date

(8) BAGS

5

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

CL+	X	**FOR STORAGE OR SUSPECT QUALITY**

PCOC	
BTEX/VPH	X
EPH	X
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name; Signature; July 20 2017 — Shipment Date

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem ✓ / Truck&Pony / Truck & Transfer

Tailgate and Du

Name: Tervita
Address: 13511 Vulcan Way, Richmond BC
Driver Name/Title: Grant Hellyer
Phone No: 604-214-7001 Truck No: WHTCC2
Vehicle License No./Prov.: HB83862
Acknowledgment of Receipt of Materials.

Driver Signature; July 20 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1546910

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HB838620 Tervita - 20 yd
Date Jul 20,17 15:09 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross 25,180 kg
Tare 13,660 kg File
NET 11,520 kg

x _____ Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (

Cell 12 WR # 888

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Pat Dupre — Name of Authorized Agent; Signature; July 20 17 — Receipt Date

8 BAGS

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508	Chevron	WR#:	889
DATE:	25-Jul-2017	MP#:	
CONT:	RL+, Supersacks		

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT	BAGS
1	9:16	HN6555	RL+	12	15.968	8
2	9:22	DB7778	RL+	12	15.102	8
3	12:54	DB7778	RL+	12	15.952	8
4	12:56	HN6555	RL+	12	16.968	8
					63.990	**32**

Listing of Tickets
For Jul 25,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1547847	Jul 25	09:16	HN6555	Southdale/Pup	28	33620	17652	15968
1547852	Jul 25	09:22	DB7778	Z & R Enviro/Pup #5	28	31940	16838	15102
1547990	Jul 25	12:53	DB7778	Z & R Enviro/Pup #5	28	32790	16838	15952
1547993	Jul 25	12:56	HN6555	Southdale/Pup	28	34620	17652	16968
					112			63990

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT

PCOC

Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name; Signature; July 25 2017 — Shipment Date

Section II TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem [ ] Truck&Pony [✓] Truck & Transfer [ ]

Tailgate S… and Dum… [ ]

Name: Zel Environmental Ltd
Address: Langley BC
Driver Name/Title: K Ladd
Phone No.: Truck No: 2213
Vehicle License No./Prov.: HN6555
Acknowledgment of Receipt of Materials.

Driver Signature; July 25 17 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547847

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HN6555P Southdale/Pup
Date Jul 25,17 09:16 AK

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	33,620 kg
Tare	17,652 kg File
NET	15,968 kg

X
Signature

Section III DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (60…

Cell: 12 WR #: 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Marura — Name of Authorized Agent; Signature

July 25 17 — Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT

PCOC	
Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
Jul. 25 2017 — Shipment Date

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ☑ Truck & Transfer ☐

Tailgate and Du

Name: Z & R ENVIRO HAUL
Address: Langley

Driver Name/Title: NAVPAL SIT
Phone No.: Truck No: #1
Vehicle License No./Prov.: DB-7778

Acknowledgment of Receipt of Materials.

Driver Signature
July 25 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547852

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: DB7778P Z & R Enviro/Pup
Date Jul 25,17 09:22 AK

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	31,940 kg
Tare	16,838 kg File
NET	15,102 kg

X
Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell 12

WR # 8864

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Marucci — Name of Authorized Agent
Signature
July 25 17 — Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X	**PCOC**

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
July 25 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem [ ] Truck&Pony [✓] Truck & Transfer [ ]

Name: Z&R ENVIRO HAUL
Address: Langley
Driver Name/Title: NAVPREET
Phone No.: 778-246-4443 Truck No: # 1
Vehicle License No./Prov.: DB-7778
Acknowledgment of Receipt of Materials.

Driver Signature
25 July 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547990

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: DB7778P Z & R Enviro/Pup
Date Jul 25,17 12:54 AK

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	32,790 kg
Tare	16,838 kg File
NET	15,952 kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone

Cell 12 WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maraca — Name of Authorized Agent
Signature
July 25 17 — Receipt Date

Z & R Trucking & Construction Contracting Co Ltd.

*Transporation of Dangerous Goods *Sand & Gravel
*Washed Aggregates *Top Soil
23302- 70 A Avenue - Langley - BC - V2Y 2H9
*OFFICE: 604-318-7929 *FAX:604-888-7927 *Email:zrtrucking@shaw.ca

Job #

Date: 25 - July - 2017

IN ACCOUNT WITH: TERVITA

JOB LOCATION: 65 Rogers AVE VAN

G.S.T. NO. R105795041

TRUCK NO. 22 #1

4. AXLE TRANSFER ☐ TRIDEM & TRIDEM PONY ☐ TRUCK & TRIDEM PONY ☐ TRUCK & PONY ☑ TANDEM ☐

	TICKET NO.	PIT NO.	MATERIAL	NET WEIGHT	RECEIVED BY
1	1547852			15.102	Tervita
2	1547990			15.952	4
			Job time -	7 HRS	

START TIME: _____ FINISH: _____

INVOICE

NET 30 DAYS 2% INTEREST PER MONTH CHARGED ON OVERDUE ACCOUNTS
CUSTOMER IS RESPONSIBLE FOR OVER WEIGHT FINES

004980

SIGNED _____

WHITE - CUSTOMER YELLOW - Z & R PINK - DRIVER

SHAN PRINTING & SINGS LTD. • PH: 778-885-5164, 604-593-5070

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X

PCOC

Project Number: **S20010508** **Expiry date:** **September 30, 2017**

Section I **GENERATOR**

Generator Name: Chevron

Site Location: Foreshore N of 5201 Penzance Dr

Generator Address: 5201 Penzance Drive
Burnaby, BC

Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC

Generator Phone No: 604-257-4012 (Chris Boys)

Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece
Generator's Representative Name

Signature

July 25 2017

Section II **TRANSPORTER**

TRANSPORTER
LOAD SIZE: Tandem [ ] Truck&Pony [✓] Truck & Transfer [ ]

Tailgat and D

Name:

Address: Langley BC

Driver Name/Title:

Phone No.: Truck No: 2213

Vehicle License No./Prov.: HN6555

Acknowledgment of Receipt of Materials.

Driver Signature

Jul 25 17
Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1547993

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HN6555P Southdale/Pup
Date Jul 25,17 12:56 AK

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	34,620 kg	
Tare	17,652 kg	File
NET	16,968 kg	

x
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca
Name of Authorized Agent

July 25 17
Receipt Date

Z & R Trucking & Construction Contracting Co Ltd.

*Transporation of Dangerous Goods *Sand & Gravel
*Washed Aggregates *Top Soil
23302- 70 A Avenue - Langley - BC - V2Y 2H9
*OFFICE: 604-318-7929 *FAX:604-888-7927 *Email:zrtrucking@shaw.ca

Job # 20010508 Date: July 25/17

IN ACCOUNT WITH: Teevan

JOB LOCATION: Rodger Rd. Port of Vancouver

G.S.T. NO. R105795041 TRUCK NO. ZR 13

4. AXLE TRANSFER ☐ TRIDEM & TRIDEM PONY ☐ TRUCK & TRIDEM PONY ☐ TRUCK & PONY ☑ TANDEM ☐

TICKET NO.	PIT NO.	MATERIAL	NET WEIGHT	RECEIVED BY
154784	RBP	RCT	15,968	
154799	RBP	RCT	16,968	
		7 hrs		

START TIME: _____ FINISH: _____

INVOICE

NET 30 DAYS 2% INTEREST PER MONTH CHARGED ON OVERDUE ACCOUNTS
CUSTOMER IS RESPONSIBLE FOR OVER WEIGHT FINES

018801

SIGNED _____

WHITE - CUSTOMER YELLOW - Z & R PINK - DRIVER

SHAN PRINTING & SINGS LTD. • PH: 778-885-5164, 604-593-5070

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508 Chevron — WR#: 889

DATE: 28-Jul-2017 — MP#:

CONT: RL+, Supersacks

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT	BAGS
1	9:09	JJ5451	RL+	12	15.560	8
2	9:40	KM9539	RL+	12	16.860	8
3	12:55	JJ5451	RL+	12	15.416	8
4	13:03	KM9539	RL+	12	13.930	8
					61.766	**32**

RL Ecowaste Industries Ltd.
Listing of Tickets
For Jul 28,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: D Demolition Refuse								
1548854	Jul 28	08:00	HB8386	Tervita - 40 yd3	40	21310	14420	6890
Material: S20010508 5201 Penzance Dr Bby (2945)								
1548895	Jul 28	09:09	JJ5451	H Hans/Pup	28	32650	17090	15560
1548912	Jul 28	09:40	KM9539	Z & R/Pup	28	33290	16430	16860
1549042	Jul 28	12:55	JJ5451	H Hans/Pup	28	32580	17164	15416
1549050	Jul 28	13:03	KM9539	Z & R/Pup	28	30360	16430	13930
SubSubTotal:					112			61766

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X	**PCOC**

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name; Signature; July 25 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ☑ Truck & Transfer ☐ **Tailgat and I** ☑

Name: H. Hans Trucking
Address: Abbotsford, BC
Driver Name/Title: Raj Sandhu
Phone No.: Truck No: 11
Vehicle License No./Prov.: JJ5451

Acknowledgment of Receipt of Materials.

Driver Signature; July 28 2017 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1548895

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: JJ5451P H Hans/Pup
Date Jul 28,17 09:29 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	32,650 kg
Tare	17,090 kg
NET	15,560 kg

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

x
Signature

Cell 12

WR # 884

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Marucca — Name of Authorized Agent; Signature

July 28 17 — Receipt Date

Z & R Trucking & Construction Contracting Co Ltd.

*Transporation of Dangerous Goods *Sand & Gravel
*Washed Aggregates *Top Soil
23302- 70 A Avenue - Langley - BC - V2Y 2H9
*OFFICE: 604-318-7929 *FAX:604-888-7927 *Email:zrtrucking@shaw.ca

Job #

Date: July 28/2017

IN ACCOUNT WITH: Tenrita

JOB LOCATION: 65 Rogers Ave, Vancouver

G.S.T. NO. R105795041

TRUCK NO. H/H Hans Trucking

4. AXLE TRANSFER	TRIDEM & TRIDEM PONY	TRUCK & TRIDEM PONY	TRUCK & PONY	TANDEM
☐	☐	☐	☑	☐

TICKET NO.	PIT NO.	MATERIAL	NET WEIGHT	RECEIVED BY
1548895	RBF Tenrita	RL+	15,560 kg	
1549042	" "	" "	15,416 kg	
		Total Loads - (2)		
		P Hann Tolls - (1)		

START TIME: [redacted] FINISH: 7 HRS

INVOICE

NET 30 DAYS 2% INTEREST PER MONTH CHARGED ON OVERDUE ACCOUNTS
CUSTOMER IS RESPONSIBLE FOR OVER WEIGHT FINES

SIGNED

004254

WHITE - CUSTOMER YELLOW - Z & R PINK - DRIVER

SHAN PRINTING & SINGS LTD. • PH: 778-885-5164, 604-593-5070

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

			PCOC	
RL+	X	FOR STORAGE OR SUSPECT QUALIT	Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name; Signature; July 25 2017 — Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ✓ Truck & Transfer ☐ **Tailgat and D** ☐

Name: 2+R
Address: SAY

Driver Name/Title: Sonia
Phone No.: 7105272 Truck No: 110
Vehicle License No./Prov.: KM9539

Acknowledgment of Receipt of Materials.

Driver Signature; 28 7 17 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1548912

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: KM9539P Z & R/Pup
Date Jul 28,17 10:01 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	33,290 kg
Tare	16,430 kg
NET	16,860 kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell 12 WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maraca — Name of Authorized Agent; Signature

July 28 17 — Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT

PCOC

Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece
Generator's Representative Name

Signature

July 25 2017

Section II TRANSPORTER

TRANSPORTER LOAD SIZE:

Tandem	
Truck&Pony	✓
Truck & Transfer	

Tailgate S and Dur

PB

Name: H. Hans Trucking
Address: Aldergrove

Driver Name/Title: Raj Sandhu
Phone No.: Truck No: 11
Vehicle License No./Prov.: JJ5451

Acknowledgment of Receipt of Materials.

Driver Signature

July 28 2017
Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1549042

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: JJ5451P H Hans/Pup
Date Jul 28,17 12:55 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	32,580 kg
Tare	17,164 kg File
NET	15,416 kg

X
Signature

Section III DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (6

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca
Name of Authorized Agent

July 28 17
Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

			PCOC
RL+	X	FOR STORAGE OR SUSPECT QUALIT	Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece
Generator's Representative Name

Signature

July 25 2017

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ✓ Truck & Transfer ☐

Tailgate and D ☐

Name: 2+R
Address: SURREY

Driver Name/Title: Sonia
Phone No.: 710-5972 Truck No: 110
Vehicle License No./Prov.: KM 9539
Acknowledgment of Receipt of Materials.

Driver Signature

28 7 17
Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1549050

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: KM9539P Z & R/Pup
Date Jul 28,17 13:03 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	30,360 kg
Tare	16,430 kg File
NET	13,930 kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

C. Machacha
Name of Authorized Agent

28 07 17
Receipt Date

Z & R Trucking & Construction Contracting Co Ltd.

*Transporation of Dangerous Goods *Sand & Gravel
*Washed Aggregates *Top Soil
23302- 70 A Avenue - Langley - BC - V2Y 2H9
*OFFICE: 604-318-7929 *FAX:604-888-7927 *Email:zrtrucking@shaw.ca

Job #

Date: 28-7-17

IN ACCOUNT WITH: TERVITA

JOB LOCATION: 65 Roger AVE VAN

G.S.T. NO. R105795041 TRUCK NO. KM9539

4. AXLE TRANSFER ☐ TRIDEM & TRIDEM PONY ☐ TRUCK & TRIDEM PONY ☐ TRUCK & PONY ☑ TANDEM ☐

TICKET NO.	PIT NO.	MATERIAL	NET WEIGHT	RECEIVED BY
1548912		dirt veg	16,860	
1549055		" "	13,930	
		Load for dirt dump		
		to Tervita Delta Landfill 7 HK		

START TIME: _____ FINISH: _____

INVOICE

NET 30 DAYS 2% INTEREST PER MONTH CHARGED ON OVERDUE ACCOUNTS
CUSTOMER IS RESPONSIBLE FOR OVER WEIGHT FINES

015739

SIGNED _____

WHITE - CUSTOMER YELLOW - Z & R PINK - DRIVER

SHAN PRINTING & SINGS LTD. • PH: 778-885-5164, 604-593-5070

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508 Chevron — WR#: 889

DATE: 31-Jul-2017 — MP#:

CONT: RL+, Supersacks

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT	BAGS
1	9:06	LM330	RL+	12	21.100	8
2	11:43	LM330	RL+	12	27.530	8
					48.630	**16**

Listing of Tickets
For Jul 31,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1549322	Jul 31	09:06	LM3300	Z & R/Tri Pup	30	39970	18870	21100
1549436	Jul 31	11:43	LM3300	Z & R/Tri Pup	30	46400	18870	27530
SubSubTotal:					60			48630

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X	**PCOC**

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)
Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)
Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name; Signature; July 31 2017 — Shipment Date

Section II TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem; Truck&Pony (V); Truck & Transfer

Tailgate S and Du

Name: Z&R ENVIRO HAUL LTD
Address: 23302-70A AVE, LANGLEY B.C. V2Y 2H9
Driver Name/Title: G. RAI
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM 3300
Acknowledgment of Receipt of Materials.

Driver Signature; Shipment Date: 2017 07 31

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1549322

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Jul 31,17 09:07 GS

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	39,970 kg
Tare	18,870 kg File
NET	21,100 kg

X Signature

Section III DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (6

Cell: 12 WR #: 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca — Name of Authorized Agent; Signature

July 31 17 — Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT	PCOC: Supersacks X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
July 31 2017 — Shipment Date

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem / Truck&Pony (TRI) X / Truck & Transfer

Tailgate Secured (Pinned or Chain) and Di X

Name: Z&R ENVIRO HAUL LTD
Address: 23302-70A AVE LANGLEY B.C. V2Y 2H9
Driver Name/Title: G. RAI
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM 33017
Acknowledgment of Receipt of Materials.

Driver Signature
2017 07 31 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1549436

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Jul 31,17 11:44 GS

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	46,400 kg
Tare	18,870 kg File
NET	27,530 kg

X
Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Marucca
Name of Authorized Agent

July 31 17
Receipt Date

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508 Chevron — WR#: 889

DATE: 1-Aug-2017 — MP#:

CONT: RL+, Supersacks

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT
1	8:50	LM330	RL+	12	15.770
2	11:52	LM330	RL+	12	15.510
					31.280

Listing of Tickets
For Aug 01,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1549692	Aug 01	08:50	LM3300	Z & R/Tri Pup	30	34640	18870	15770
1549820	Aug 01	11:52	LM3300	Z & R/Tri Pup	30	34380	18870	15510
SubSubTotal:					60			31280

BLUE BAGS

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X

PCOC

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
01 - 03 - 2017

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ~~Truck&Pony~~ TRIDEM X, Truck & Transfer

Tailgat and D

Name: Z & R Enviro Haul Ltd.
Address: 23302-70 A Ave
Langley B.C. V2Y 2H9
Driver Name/Title: G.RAI
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM3300
Acknowledgment of Receipt of Materials.

Driver Signature — Shipment Date: 01 08 2017

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1549692

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 01,17 08:50 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	34,640	kg
Tare	18,870	kg File
NET	15,770	kg

X
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca — Name of Authorized Agent
Signature
Aug 1 17 — Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT	Supersacks	X

PCOC

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)
Description of Waste: Contaminated Soil

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

01-08-SP
~~Date~~ ~~Mo~~ 2017

Edward Preece
Generator's Representative Name

Signature

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE:

Tandem	
Truck&~~Pony~~ TANDEM Pony	X
Truck & Transfer	

Tailgate S and Dum

Name: Z&R ENVIRO HAUL LTD
Address: 23302-70A AVE
LANGLEY BC V2Y 2H9
Driver Name/Title: G. RAI
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM3300
Acknowledgment of Receipt of Materials.

01 08 2017
Driver Signature Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1549820

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 01,17 11:53 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	34,380 kg
Tare	18,870 kg File
NET	15,510 kg

X
Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (60

Cell 1 2

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca
Name of Authorized Agent

Aug 1 17
Receipt Date

Z & R Trucking & Construction Contracting Co Ltd.

*Transporation of Dangerous Goods *Sand & Gravel
*Washed Aggregates *Top Soil
23302- 70 A Avenue - Langley - BC - V2Y 2H9
*OFFICE: 604-318-7929 *FAX:604-888-7927 *Email:zrtrucking@shaw.ca

Job# S20010508

Date: AUG 1, 2017

IN ACCOUNT WITH: TERVITA CORPORATION

JOB LOCATION: 65 ROGERS AVE VANCOUVER. (PORTS)

G.S.T. NO. R105795041 TRUCK NO. 203

4. AXLE TRANSFER [ ] TRIDEM & TRIDEM PONY [ ] TRUCK & TRIDEM PONY [X] TRUCK & PONY [ ] TANDEM [ ]

TICKET NO.	PIT NO.	MATERIAL	NET WEIGHT	RECEIVED BY
Hauling BAGS TO RBF			RL	
RL1549692		RL	15,770 KG	
RL1549820		V	15,510 KG	
		6 1/2 HRS.		
1 Bridge to el.				

START TIME: _____ FINISH: _____

INVOICE

NET 30 DAYS 2% INTEREST PER MONTH CHARGED ON OVERDUE ACCOUNTS
CUSTOMER IS RESPONSIBLE FOR OVER WEIGHT FINES

012861

SIGNED _____

WHITE - CUSTOMER YELLOW - Z & R PINK - DRIVER

SHAN PRINTING & SINGS LTD. • PH: 778-885-5164, 604-593-5070

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508	**Chevron**	**WR#:**	**889**
DATE:	**4-Aug-2017**	**MP#:**	
CONT:	**RL+, Supersacks**		

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT
1	9:23	LM3300	RL+		24.580
2	13:14	LM3300	RL+		22.820
					47.400

RL Ecowaste Industries Ltd.
Listing of Tickets
For Aug 04,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1550825	Aug 04	09:23	LM3300	Z & R/Tri Pup	30	43450	18870	24580
1550985	Aug 04	13:14	LM3300	Z & R/Tri Pup	30	41690	18870	22820
					60			47400

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X	**PCOC**

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece
Generator's Representative Name

Signature

04 08 2017
Shipment Date

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ☒ Truck & Transfer ☐ TRIDEM

Tailgate Se and Dum ☐

Name: Z&R
Address: 23302 - 70 A Ave
Langley BC. V2Y 2H9
Driver Name/Title: G Rai
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM 3300
Acknowledgment of Receipt of Materials.

Driver Signature

2017 08 04
Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1550825

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 04,17 09:23 GS

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross 43,450 kg
Tare 18,870 kg File
NET 24,580 kg

X

Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (60

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Matrica
Name of Authorized Agent

Aug 4 17
Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT	PCOC: Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)
Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)
Description of Waste: Contaminated Soil

DH - 08

Edward Preece
Generator's Representative Name

Signature

Shipment Date: [redacted] 2017

Section II TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem / Truck&Pony / Truck & Transfer — X

Tailgate and Du

Name: Z & R ENVIRO HAUL LTD
Address: 23302-70A AVE LANGLEY B.C. V2Y 2H9
Driver Name/Title: G. RAI
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM3300
Acknowledgment of Receipt of Materials.

Driver Signature

Shipment Date: 2017 08 04

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1550985

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 04,17 13:15 GS

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	41,690 kg	
Tare	18,870 kg	File
NET	22,820 kg	

X

Signature

Section III DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell: 12

WR #: 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca
Name of Authorized Agent

Signature

Receipt Date: Aug 4 17

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508 Chevron — WR#: 889

DATE: 9-Aug-2017 — MP#:

CONT: RL+, Supersacks

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT
1	9:12	LM3300	RL+	12	26.650
2	12:55	LM3300	RL+	12	26.810
					53.460

Listing of Tickets
For Aug 09,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1551628	Aug 09	09:12	LM3300	Z & R/Tri Pup	30	45520	18870	26650
1551781	Aug 09	12:55	LM3300	Z & R/Tri Pup	30	45680	18870	26810
SubSubTotal:					60			53460

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT		PCOC Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I GENERATOR

Generator Name: Chevron
Site Location: Foreshore N of 5201 Penzance Dr
Generator Address: 5201 Penzance Drive, Burnaby, BC
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)
Site Phone No: 778-232-8533 (Edward Preece AECOM)
Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
Aug 9 2017 — Shipment Date

Section II TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem [ ] Truck&Pony [X] Truck & Transfer [ ]

Tailgate S... and Dun [ ]

Name: Z&R ENVIRO HAUL LTD
Address: 23302-70A AVE LANGLEY B.C. V2Y 2H5
Driver Name/Title: G. Rai
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM 3300
Acknowledgment of Receipt of Materials.

Driver Signature
Shipment Date: 2017 08 09

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1551628

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 09,17 09:13 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	45,520 kg
Tare	18,870 kg File
NET	26,650 kg

X
Signature

Section III DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (

Cell: 12
WR #: 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Marucca
Name of Authorized Agent

Aug 9 17
Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT	PCOC: Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name; Signature; Shipment Date: 09-08-17

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem ☐ / Truck&Pony ☒ TRI / Truck & Transfer ☐

Tailgate Se... and Du...

Name: Z&R ENVIRO HAUL LTD
Address:

Driver Name/Title: G. RAI
Phone No.: Truck No: 203
Vehicle License No./Prov.: LM3300
Acknowledgment of Receipt of Materials.

Driver Signature; Shipment Date: 2017 08 09

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1551781

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 09,17 12:55 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross 45,680 kg
Tare 18,870 kg File
NET 26,810 kg

X Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No:

Cell: 12 WR #: 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

Anthony Maruca — Name of Authorized Agent; Signature

Receipt Date: Aug 9 17

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

S20010508 Chevron — WR#: 889

DATE: 22-Aug-2017 — MP#:

CONT: RL+, Supersacks

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT
1	8:17	LM3300	RL+	12	26.110
2	11:13	LM3300	RL+	12	24.530
3	13:21	LM3300	RL+	12	10.020
					60.660

RL Ecowaste Industries Ltd.
Listing of Tickets
For Aug 22,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: S20010508 5201 Penzance Dr Bby (2945)								
1555143	Aug 22	08:37	LM3300	Z & R/Tri Pup	30	44980	18870	26110
1555247	Aug 22	11:13	LM3300	Z & R/Tri Pup	30	43400	18870	24530
1555348	Aug 22	13:21	LM3300	Z & R/Tri Pup	30	28890	18870	10020
SubSubTotal:					90			60660

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	Supersacks	X	**PCOC**

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I — GENERATOR

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name
Signature
Aug 22 2017 — Shipment Date

Section II — TRANSPORTER

TRANSPORTER LOAD SIZE: Tandem [ ] Truck&Pony [X] Truck & Transfer [ ]

Tailgate Se and Dum [ ]

Name: 240
Address:
Driver Name/Title:
Phone No.: Truck No: 240
Vehicle License No./Prov.: LM 3300
Acknowledgment of Receipt of Materials.

Driver Signature
08 22 17 — Shipment Date

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1555143

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 22,17 08:37 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	44,980	kg
Tare	18,870	kg File
NET	26,110	kg

X
Signature

Section III — DESTINATION

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (604) [illegible]

Cell 12 — WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

C. [illegible]
Name of Authorized Agent

Signature

Aug 22 2017 — Receipt Date

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	FOR STORAGE OR SUSPECT QUALIT	Supersacks	X	PCOC

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive, Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)
Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr, Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)
Description of Waste: Contaminated Soil

Edward Preece — Generator's Representative Name | Signature | Shipment Date: Aug 22 2017

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ☒ Truck & Transfer ☐

Tailgate Secured (Pinned or Chained) and Dump ☒

Name: Zap
Address:
Driver Name/Title: Rich Lacey
Phone No.: Truck No: # 103
Vehicle License No./Prov.: LM3300
Acknowledgment of Receipt of Materials.

Driver Signature | Shipment Date: 08 22 17

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1555247

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 22,17 11:14 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	43,400 kg
Tare	18,870 kg File
NET	24,530 kg

x
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (604

Cell: 12 WR #: 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

C. Parker — Name of Authorized Agent | Signature | Receipt Date: Aug 22 17

RICHMOND BIOREMEDIATION FACILITY

SOIL MANIFEST

Classification:

RL+	X	**FOR STORAGE OR SUSPECT QUALIT**	**PCOC**
		Supersacks	X

Project Number: S20010508 **Expiry date:** September 30, 2017

Section I **GENERATOR**

Generator Name: Chevron
Generator Address: 5201 Penzance Drive
Burnaby, BC
Generator Phone No: 604-257-4012 (Chris Boys)

Site Location: Foreshore N of 5201 Penzance Dr
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 778-232-8533 (Edward Preece AECOM)

Description of Waste: Contaminated Soil 08 22 17

Edward Preece
Generator's Representative Name

Signature

Shipment Date 2017

Section II **TRANSPORTER**

TRANSPORTER LOAD SIZE: Tandem ☐ Truck&Pony ☐ Truck & Transfer ☐

Tailgate S and Du ☐

Name: ZIP
Address:

Driver Name/Title:
Phone No.: Truck No: 105
Vehicle License No./Prov.: LM 3300
Acknowledgment of Receipt of Materials.

Driver Signature

Shipment Date 08 22 17

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1555348

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LM3300P3 Z & R/Tri Pup
Date Aug 22,17 13:21 SM

Material: S20010508
5201 Penzance Dr Bby (2945)
Area: H - Tervita - General

Gross	28,890 kg
Tare	18,870 kg File
NET	10,020 kg

x
Signature

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.

Phone No: (60

Cell 12

WR # 889

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate

C. GARCIA
Name of Authorized Agent

Aug 22 17
Receipt Date

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

Z20010508 Chevron WR#:

DATE: 28-Jul-2017 MP#:

CONT: Demolition Debris

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT
1	8:00	HB8386			6.890
					6.890

RL Ecowaste Industries Ltd.
Listing of Tickets
For Jul 28,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: D Demolition Refuse								
1548854	Jul 28	08:00	HB8386	Tervita - 40 yd3	40	21310	14420	6890
Material: S20010508 5201 Penzance Dr Bby (2945)								
1548895	Jul 28	09:09	JJ5451	H Hans/Pup	28	32650	17090	15560
1548912	Jul 28	09:40	KM9539	Z & R/Pup	28	33290	16430	16860
1549042	Jul 28	12:55	JJ5451	H Hans/Pup	28	32580	17164	15416
1549050	Jul 28	13:03	KM9539	Z & R/Pup	28	30360	16430	13930
SubSubTotal:					112			61766

RICHMOND BIOREMEDIATION FAC.
REFUSE MANIFEST

REFUSE F(

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1548854

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: HB838640 Tervita - 40 yd
Date Jul 28,17 08:00 SM

Material: D - Demolition Refuse
Area: D - Demo

Gross 21,310 kg
Tare 14,420 kg File
NET 6,890 kg

20010508
x
Signature

Classification: (check one)

CONSTRUCTION REFUSE	
DEMOLITION DEBRIS	X
CONCRETE	
ASPHALT	
TREATED LUMBER	
OTHER(describe)	

Project Number:	20010508

Section I **GENERATOR**

Generator Name: Chevron Canada Ltd
Generator Address: 5201 Penzance Dr
Burnaby, BC
Generator Phone No: 604-257-4012

Site Location: Chevron Foreshore
Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC
Site Phone No: 604-444-6547

Generator's Representative Name | Signature | Shipment Date

Section II **TRANSPORTER**

TRANSPORTER

Name: Tervita
Address 13511 Vulcan Way
Richmond BC
Driver Name/Title: Brent Hellyer
Phone No. 604-214-7000 Truck No: WHTC02
Vehicle License No./Prov.: HBE826 BC
Acknowledgment of Receipt of Materials.

Driver Signature | Shipment Date: July 28 2017

LOAD SIZE:

Tandem	
Truck&Pony	
Truck & Transfer	
End Dump	
Roll Off	X

Section III **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Phone No: (604) 214-7000
Receiver Comments: To Demo

Anthony Mancca

July 28 17

RICHMOND BIOREMEDIATION FACILITY

DAILY LOADS LOG SHEET

Z20010508 Chevron — WR#:

DATE: 14-Aug-2017 — MP#:

CONT: Demolition Refuse

LOAD#	TIME	TRUCK	CLASS	CELL#	WEIGHT
1	15:25	LJ2595	Z - NCL		9.380
					9.380

RL Ecowaste Industries Ltd.
Listing of Tickets
For Aug 14,17
All Tickets
Both Posted & Unposted
Customer ID=2945 Tervita Corporation(Environmental)

Ticket #	Date	Tm In	License	Vehicle Desc	Yds	GVW(kg)	Tare kg	Net Wgt
Customer: 2945 Tervita Corporation(Environmental)								
Material: D Demolition Refuse								
1553108	Aug 14	15:25	LJ2595	Alchemist (all bins)	40	22760	13380	9380

RICHMOND BIOREMEDIATION FACILITY

REFUSE MANIFEST

REFUSE FOR DIRECT DISPOSAL

Classification:	(check one)
CONSTRUCTION REFUSE	
DEMOLITION DEBRIS	X
CONCRETE	
ASPHALT	
TREATED LUMBER	
OTHER(describe)	

Project Number:	20010508

Section I — **GENERATOR**

Generator Name: Chevron Canada Ltd

Generator Address: 5201 Penzance Dr
Burnaby, BC

Generator Phone No: 604-257-4012

Site Location: Chevron Foreshore

Site Address: Foreshore N of 5201 Penzance Dr
Burnaby, BC

Site Phone No: 604-444-6547

Edward Preece
Generator's Representative Name

Signature

17 | 08 | 17
Shipment Date

Section II — **TRANSPORTER**

TRANSPORTER

Name: ALCHEMIST SERVICES
Address 19402 54 AVE
LANGLEY BC
Driver Name/Title: JON
Phone No.: LJ 2595 Truck No: 100
Vehicle License No./Prov.:

LOAD SIZE:

Tandem	
Truck&Pony	
Truck & Transfer	
End Dump	
Roll Off	XX

Acknowledgment of Receipt of Materials.

Driver Signature

14 | 08 | 17
Shipment Date

Section III — **DESTINATION**

Tervita Richmond Bioremediation Facility
15111 Williams Road, Richmond, B.C.
Receiver Comments:

Anthony Marcia

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1553108

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LJ2595 Alchemist (all b
Date Aug 14,17 15:52 SM

Material: D - Demolition Refuse
Area: D - Demo

Gross	22,760 kg
Tare	13,380 kg
NET	9,380 kg

20010508
X

Signature

ALCHEMIST SPECIALTY CARRIERS INC.

24 HOUR CONTACT NUMBER 604-882-1518

BILL OF LADING - NOT NEGOTIABLE

CUSTOMER BOL #	JOB # 28940	CUSTOMER	ORDER #
POINT OF ORIGIN		DATE AUG 14 2017	PUMP REQUIRED ☐ YES ☐ NO
SHIPPER MERCURY [illegible]		CONSIGNEE TERVITA	
STREET ADDRESS [illegible]		STREET ADDRESS [illegible]	
CITY VANCOUVER BC		CITY RICHMOND BC	

Received at the point of origin on the date specified, from the consignor mentioned herein, the property herein described in apparent good order except as noted (contents and conditions of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver the consignee at the said destination, if on its own authorized route or otherwise to cause to be carried by another carrier on the route to said destination, subject to the rates and classification in effect on the date of shipment.

It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time ... subject to all the conditions not prohibited by law, whether printed or written, including conditions on back hereof, which are here agreed by the cons...

COMMODITY	LITRES	COMP #
		1.
BIN	28940	2.
		3.
CONST	WASTE	4.
		5.
		6.
		7.
		8.
GROSS LITRES		DRIVER
NET LITRES		

INITIALS

DATE

CHARGEABLE TIME

PURCHASE ORDER NO.

Ecowaste Industries Ltd.
100 - 3031 Viking Way
Richmond, BC V6V 1W1
Phone (604) 276-9511 GST R#: 87228 2165
Richmond Landfill RL
Ticket: RL 1553108

Acct#: 2945
Tervita Corporation(Environmen
Vehicle: LJ2595 Alchemist (all b
Date Aug 14,17 15:52 SM

Material: D - Demolition Refuse
Area: D - Demo

Gross	22,760 kg
Tare	13,380 kg
NET	9,380 kg

30010508

Signature

UN: PROPER SHIPPING NAME: CLASS:

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the Transportation of Dangerous Goods Regulations.

SHIPPER: ____________________

COMMENTS [illegible]
604 834 1668

#1	START	________ cm	
	FINISH	________ cm	
#2	START	________ cm	
	FINISH	________ cm	
#3	START	________ cm	
	FINISH	________ cm	
#4	START	________ cm	
	FINISH	________ cm	

LOADING TIME [illegible] - 12:30

UNLOADING TIME [illegible] AT [illegible] - 6:30

PAVEMENT TIME [illegible] RETURN [illegible] - 6 HRS

GRAVEL TIME [illegible] TO [illegible]

STANDBY TIME

TOTAL HOURS

RESIDUE LAST CONTAINED: ________

PRINT NAME IN FULL: CONSIGNEE SIGNATURE:

PLACARDS ________ UN ________ CLASS ________

PRELOADED BY: TOM UNLOADED BY: TOM

DECLARED VALUATION $ ________
Maximum liability of $2.00 per pound unless declared valuation states otherwise.

TRUCK NO. 100 TRAILER NO. 28940

FREIGHT CHARGES

☐ Collect ☐ Prepaid

Freight charges will be collect unless marked prepaid.

a) No carrier is liable for loss, damage or delay to any goods under the Bill of Lading unless notice there of setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or, in the case of failure to make delivery, within nine (9) months from the date of shipment.
b) The final statement of the claim must be filled within nine (9) months from the date of shipment together with a copy of the paid freight bill.
c) All accounts due & payable within 10 days.

C.O.D. SHIPMENT

Amount	$
Collection Charge	$
☐ Collect ☐ Prepaid TOTAL	

REGULATED DANGEROUS GOODS FOR ALL EMERGENCY ASSISTANCE - ________

ASC – "ACHIEVING SAFETY BY CHOICE"

Chevron Foreshore Project - 20010508

Water Disposal Summary

Date	WO No.	Volume (L)	Total Volume
25-Jul	99839	7660	7660
25-Jul	99840	7140	14800
25-Jul	99841	6810	21610
26-Jul	99837	7410	29020
26-Jul	99838	7810	36830
28-Jul	99831	12910	49740
28-Jul	99832	11850	61590
28-Jul	99835	2047	63637
29-Jul	99833	11870	75507
29-Jul	99836	7290	82797

Inbound Ticket

Ticket #	89754	**Date**	7/29/2017
Work Order #	99839		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	7,660 kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	101294		405903

...and GFL Truck.

TERRITA CORPORATION

12:31:58 25/07/2017

GROSS WT: 24040 kg

MANUAL TARE: 00 kg

NET WT: 24040 kg

TERRITA CORPORATION

12:56:19 25/07/2017

GROSS WT: 16350 kg

MANUAL TARE: 00 kg

NET WT: 16350 kg

Inbound Ticket

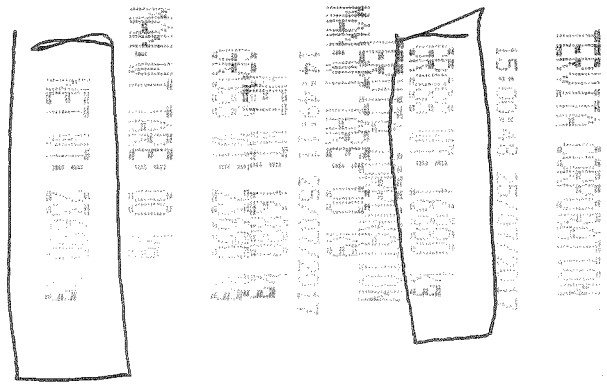
Ticket #	89753	**Date**	7/29/2017
Work Order #	99840		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	7,140 kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	100995		405904

Inbound Ticket

Ticket #	89752	**Date**	7/29/2017
Work Order #	99841		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	6,810kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	101295		405905



Inbound Ticket

Ticket #	89757	**Date**	7/29/2017
Work Order #	99837		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	7,410kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	101296		405901

GFL

TERVITTA CORPORATION

14:43:06 26/07/2017

GROSS WT: 24280 kg

MAN.WT TARE: 50 kg

NET WT: 24230 kg

TERVITTA CORPORATION

14:54:39 26/07/2017

GROSS WT: 16880 kg

MAN.WT TARE: 30 kg

NET WT: 16850 kg

Inbound Ticket

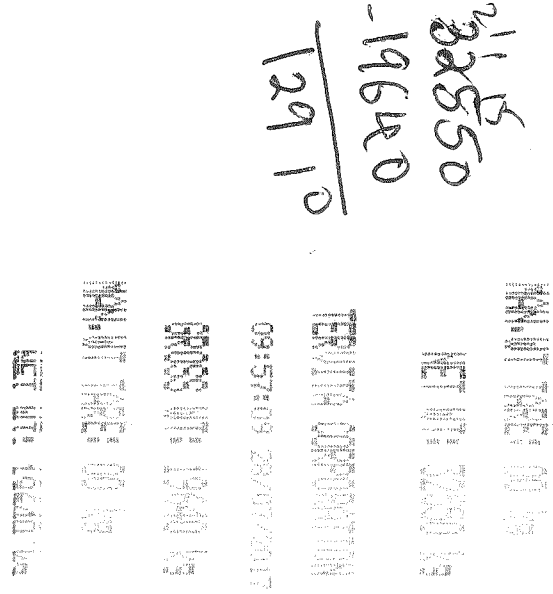
Ticket #	89756	**Date**	7/29/2017
Work Order #	99838		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	7,810 kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	100275		405902

Inbound Ticket

Ticket #	89762	**Date**	7/29/2017
Work Order #	99831		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	12,910Kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	102608		405896



Inbound Ticket

Ticket #	89761	**Date**	7/29/2017
Work Order #	99832		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	11,850 Kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	102609		405897

TERVITA CORPORATION

12:39:43 28/07/2017

GROSS WT: 31400 kg

MAN.WT TARE: 00 kg

NET WT: 31400 kg

weight = 11850 kg

TERVITA CORPORATION

12:58:59 28/07/2017

GROSS WT: 19550 kg

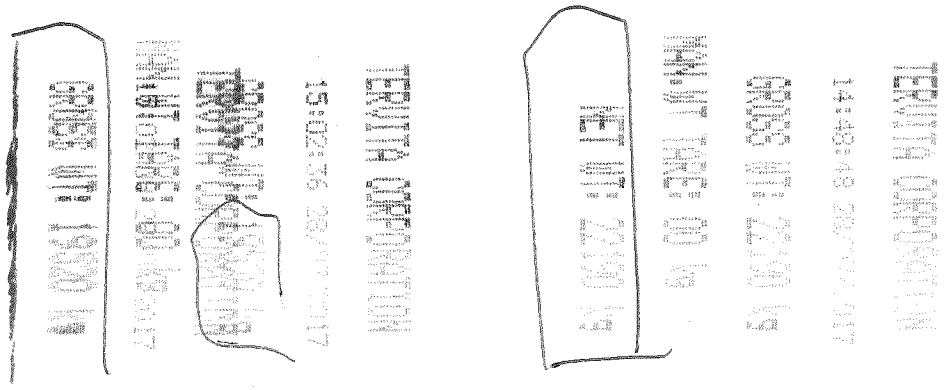
MAN.WT TARE: 00 kg

NET WT: 19550 kg

Inbound Ticket

Ticket #	89759	**Date**	7/29/2017
Work Order #	99835		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	2,047 kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	102611		405899



Inbound Ticket

Ticket #	89760	**Date**	7/29/2017
Work Order #	99833		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	11,870Kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	102612		405898

TERUTTA CORPORATION

09:19:08 29/07/2017

GROSS WT: 19610 kg

MAN.WT TARE: 00 kg

NET WT: 19610 kg

TERUTTA CORPORATION

09:07:46 29/07/2017

GROSS WT: 31380 kg

MAN.WT TARE: 00 kg

NET WT: 31380 kg

weight = 11870kg

Inbound Ticket

Ticket #	89758	**Date**	7/29/2017
Work Order #	99836		
Location	CHEVRON REFINERY BURNABY		
Company	CHEVRON CANADA LIMITED		
Province	BC		

Profile	Container Type	Qty	NOS	Waste Notes	Final Destination	Manifest	Status	Waste #
WATER NR TRACE BTEX	VACTRUCK	7,290 kg	Ground Water with trace BTEX		Metro Vancouver Sanitary Sewer Richmond	102613		405900

TERVITA CORPORATION

11:00:25 29/07/2017

GROSS WT: 19530 kg

TARE: 00 kg

NET WT: 19530 kg

TERVITA CORPORATION

10:51:23 29/07/2017

GROSS WT: 26720 kg

UNIT TARE: 00 kg

NET WT: 26720 kg

Weight = 7290 kg

Chevron Foreshore Project - 20010508

Water Disposal Summary

Date	WO No.	Volume (L)	Total Volume
2-Aug	100316	9999	92796
2-Aug	100317	4500	97296
3-Aug	100313	9900	107196
3-Aug	100315	5560	112756
3-Aug	100432	12100	124856
4-Aug	100433	8140	132996
4-Aug	100434	10480	143476
9-Aug	100560	11620	155096
9-Aug	100561	5290	160386
22-Aug	101159	6030	166416

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102618

Date	PO #	Profile #	Job #
17/08/02			2632

Generator Name (From)	Consignee (To)
Tervita Corp.	Tervita Corp
Street	**Street**
85 Rogers St	13511 Vulcan Way
City / Province / Postal Code	**City / Province / Postal Code**
Vancouver, B.C	Richmond, B.C
Billing Address, if Different	**Email Address**

Time Dispatched	Arrival Time	Departure Time	Time Unloaded

Special Instructions / Notes
* Chevron Job

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS			WEIGHT (KGs)
			CLASS	P.I.N.	PKG/GRP	
9,999	L	Salt Water	NA	NR	NA	9,999
actual. 10180 KG						

Work Performed
off-load at Tervita Corp

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604-451-4578	/	/	/

Dimensions	Total Cubic Feet
/	/

Per:	Driver:	Truck:	Date:
John 2	John 2	68	17/08/02

Shipper / Generator:	Carrier:
Tervita Corp.	GFL Environmental Inc.

Received by: Norm Weber

At: RHWF

Date: Aug 2/17 07:15 am

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102619

Date	PO #	Profile #	Job #
17/08/02			2632

Generator Name (From)	Consignee (To)
Tervita Corp.	Tervita Cop.
Street 85 Rogers St	**Street** 13511 Vulcan Way
City / Province / Postal Code Vancouver, BC	**City / Province / Postal Code** Richmond, B.C
Billing Address, if Different	**Email Address**

Time Dispatched	Arrival Time	Departure Time	Time Unloaded

Special Instructions / Notes
* Chevron Job.

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS CLASS	DANGEROUS GOODS P.I.N.	DANGEROUS GOODS PKG/GRP	WEIGHT (KGs)
2632	4271	Salt Water	NA	NA	NA	4271
						4500KG

Work Performed
off-load at Tervita Corp

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604-451-4578			

Dimensions	Total Cubic Feet

Per:	Driver: John Z	Truck: 68	Date: 17/08/02
Shipper / Generator: Tervita Corp.	**Carrier:** GFL Environmental Inc.		

Received by: Norman Weber
At: RHWF
Date: Aug 2/17 9:00 am

BILL OF LADING
LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102652

Date	PO #	Profile #	Job #
AUG 3 2017		EXCAVATION / GROUND WATER	2637

Generator Name (From)	Consignee (To)
TERVITA CORPORATION	TERVITA
Street: 68 ROGERS	Street: 13511 VULCAN WAY
City / Province / Postal Code: VANCOUVER BC	City / Province / Postal Code: RICHMOND BC
Billing Address, if Different	Email Address

Time Dispatched	Arrival Time	Departure Time	Time Unloaded
930		11 09 AM	

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS CLASS	DANGEROUS GOODS P.I.N.	DANGEROUS GOODS PKG/GRP	WEIGHT (KGs)
1 LOAD	N	EXCAVATION / GROUND WATER	N/A	N/A	N/A	9900 KG

Work Performed

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
	0	0	

Dimensions	Total Cubic Feet

Per:	Driver: KONRAD.	Truck: 71	Date: AUG 3 2017
Shipper / Generator:	Carrier: GFL Environmental Inc.		

Received by:	
At:	Tervita Corp.
Date:	Aug. 3/17

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102651

Date	PO #	Profile #	Job #
AUG 3. 2017		EXCAVATION/GROUND WATER	2637

Generator Name (From)	Consignee (To)
TERVITA CORP	TERVITA
Street: 68 ROGERS	Street: 13511 VULCAN WAY
City / Province / Postal Code: VANCOUVER BC.	City / Province / Postal Code: RICHMOND
Billing Address, if Different	Email Address

Time Dispatched	Arrival Time	Departure Time	Time Unloaded
12 10 pm	12 55 pm	1 20 pm	2 25 pm

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS CLASS	DANGEROUS GOODS P.I.N.	DANGEROUS GOODS PKG/GRP	WEIGHT (KGs)
1 LOAD	L	EXCAVATION/GROUNDWATER	N/A	N/A	N/A	5560

Work Performed

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.

Dimensions	Total Cubic Feet

Per:	Driver: LOWRAD	Truck: 71	Date: 8/8/17
Shipper / Generator:	Carrier: GFL Environmental Inc.		

Received by:
At:
Date:

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 101276

Date	PO #	Profile #	Job #
AUG 8/17			2654

Generator Name (From)	Consignee (To)
GFL	TERVITA. CORP
Street: 7890 VANTAGE WAY	Street: 135 IRELAND WAY
City / Province / Postal Code: DELTA	City / Province / Postal Code: RICHMOND
Billing Address, if Different	Email Address

Time Dispatched	Arrival Time	Departure Time	Time Unloaded

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS			WEIGHT (KGs)
			CLASS	P.I.N.	PKG/GRP	
12901 LITRES		WATER CONTAM	N/A	N/A	N/A	12901 KG
		FROM 68 BOXES.				
						12100 KG

Work Performed

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604-451-4578			

Dimensions	Total Cubic Feet

Per:	Driver: JAT	Truck: 64	Date: AUG 8/17
Shipper / Generator:	Carrier: GFL Environmental Inc.		

Received by:
At:
Date:

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102643

Date	PO #	Profile #	Job #
Aug 4 2017			2644

Generator Name (From)	Consignee (To)
Teruta Corp	Trevita
Street	**Street**
68 Rogers	13511 Vulcan Way
City / Province / Postal Code	**City / Province / Postal Code**
Vancouver BC	Richmond BC
Billing Address, if Different	**Email Address**

Time Dispatched	Arrival Time	Departure Time	Time Unloaded
1:45	2:45	3:30	5:00

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS			WEIGHT (KGs)
			CLASS	P.I.N.	PKG/GRP	
8173	Liters	Water				8140 kg

Work Performed

Vac Water From Holding Tank on Pier

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.

Dimensions	Total Cubic Feet

Per:	Driver:	Truck:	Date:
x Joey McGill	Jeff	1123	Aug 4 2017
Shipper / Generator:	**Carrier:**		
x	GFL Environmental Inc.		

Received by:
At: Teruta Corp
Date: Aug 4/17

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102622

Date	PO #	Profile #	Job #
17/08/04			2649

Generator Name (From)	Consignee (To)
Tervita Corp	Tervita Corp.
Street	**Street**
85 Rogers St	13511 Vulcan Way
City / Province / Postal Code	**City / Province / Postal Code**
Vancouver, B.C	Richmond, BC
Billing Address, if Different	**Email Address**

Time Dispatched	Arrival Time	Departure Time	Time Unloaded

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS			WEIGHT (KGs)
			CLASS	P.I.N.	PKG/GRP	
09871	L	Salt Water	NA	NR	NA	9871
						10480 kg Actual

Work Performed: off load at Tervita Corp

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604-451-4578			

Dimensions	Total Cubic Feet

Per:	Driver: John Z	Truck: 71	Date: 17/08/04
Shipper / Generator: Tervita Corp.	Carrier: GFL Environmental Inc.		

Received by: Norm Weber

At: RIWF

Date: Aug 4/17

BILL OF LADING
LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 100873

Date	PO #	Profile #	Job #
AUG 9/17			2660

Generator Name (From)	Consignee (To)
GFL	TERVITA CORP
Street: 7390 VANTAGE WAY	Street: 135 VULCAN WAY
City / Province / Postal Code: DELTA	City / Province / Postal Code: RICHMOND
Billing Address, if Different	Email Address

Time Dispatched	Arrival Time	Departure Time	Time Unloaded

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS CLASS	DANGEROUS GOODS P.I.N.	DANGEROUS GOODS PKG/GRP	WEIGHT (KGs)
12728 Litres		SPLIT WATER FROM 68 BOXES	N/A	N/A	N/A	12728 kgs
						11620kg

Work Performed

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604-451-4578			

Dimensions	Total Cubic Feet

Per:	Driver: JAT	Truck: 64	Date: AUG 9/17
Shipper / Generator:	Carrier: GFL Environmental Inc.		

Received by: Vladimir Stankovic
At: RHWF
Date: Aug 9, 2017

BILL OF LADING
LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 100874

Date	PO #	Profile #	Job #
AUG 9/17			2660

Generator Name (From)	Consignee (To)
GFL	TERVITA CORP
Street: 7890 VANTAGE WAY	Street: 135 VERSATILE
City / Province / Postal Code: DELTA	City / Province / Postal Code: RICHMOND
Billing Address, if Different	Email Address

Time Dispatched	Arrival Time	Departure Time	Time Unloaded

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS CLASS	DANGEROUS GOODS P.I.N.	DANGEROUS GOODS PKG/GRP	WEIGHT (KGs)
5194 LITRES		~~SOIL~~ SALT WATER	N/A	N/A	N/A	5194 KGS.
		from 88 Rodgers				5290kg

Work Performed

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604 451 4578			

Dimensions	Total Cubic Feet

Per:	Driver:	Truck:	Date:
	JOJ	64	AUG 9/17

Shipper / Generator:	Carrier:
	GFL Environmental Inc.

Received by:
Vladimir Stankovic
At: RHWF
Date: Aug 9, 2017

BILL OF LADING

LT# 1029

GFL Environmental Inc.
7890 Vantage Way, Delta BC V4G 1A7
Bus: 604 946 0506 or 604 451 4578
Fax: 604 946 0575

GST # 84188 4893

BL # 102776

Date	PO #	Profile #	Job #
AUG 22/17			2722

Generator Name (From)	Consignee (To)
TERVITA CORP	GFL
Street: Re: 65 ROGER ST	Street: 7890 VANTAGE WAY
City / Province / Postal Code: VANCOUVER	City / Province / Postal Code: DELTA
Billing Address, if Different	Email Address

Time Dispatched	Arrival Time	Departure Time	Time Unloaded
7:15	8:00	9:15	

Special Instructions / Notes

PIECES / VOLUME	UNIT	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	DANGEROUS GOODS CLASS	DANGEROUS GOODS P.I.N.	DANGEROUS GOODS PKG/GRP	WEIGHT (KGs)
5994 Litres		PUMPED OUT OF	n/a	n/a	n/a	6030 Kgs
		3 POLY TANKS				
		SALT WATER				

Work Performed

Emergency Response Telephone No.	Type of Placard	Quantity	Emergency Response Plan No.
604 451 4578			

Dimensions	Total Cubic Feet

Per:	Driver: JAT	Truck: 70	Date: AUG 22/17
Shipper / Generator:	Carrier: GFL Environmental Inc.		

Received by:	Chris Yorke
At:	Tervita
Date:	8/22/17

Appendix J - Quality Assurance / Quality Control

1. QUALITY ASSURANCE AND QUALITY CONTROL PROTOCOLS

1.1. DATA QA/QC

In order to assure the integrity and defensibility of the data collected, rigorous QA/QC protocols were observed. These protocols ensured that all samples were properly collected, identified, stored, shipped, and documented. Standard operating procedures (SOPs) for sample collection and storage, equipment decontamination, and sample chain of custody protocols were followed. Sediment samples were collected using sampling techniques discussed above. The use of these methods ensured the quality, soundness, and defensibility of the data obtained. The laboratory analytical data, once generated, was also proofed for inconsistencies and anomalies. Field duplicates were collected for QA/QC purposes.

Laboratory QC reports for sediment were reviewed prior to accepting analytical data. All QC limits were met for internal laboratory QC samples with the exception of the qualifiers for individual parameters listed below:

- Approximate result - may be biased low;
- Detection limit raised - chromatographic interference due to co-elution;
- Detection limit raised - analyte detected at comparable level in method blank;
- Detection limit adjusted for required dilution;
- Detection limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria;
- Low surrogate recovery observed due to adsorptive material in sample (e.g. charcoal). Associated results represent solvent extractable concentrations;
- Surrogate recovery could not be measured due to sample matrix interference;
- Surrogate diluted out, percent recovery not available;
- Surrogate recovery marginally exceeded ALS data quality objective (DQO). Reported non-detect results for associated samples were deemed to be unaffected;
- Lab control sample (LCS) recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified; and
- Duplicate results outside ALS DQO, due to sample heterogeneity.

In addition to the above, twelve laboratory reports were flagged with discrepancies pertaining to quality control samples which are summarized below:

- Laboratory report L1959111 listed six samples analyzed for selenium in which LCS recovery was above ALS DQO;
- Laboratory report L1957480 listed one sample analyzed for copper and molybdenum in which duplicate results were outside ALS DQO, due to sample heterogeneity;
- Laboratory report L1961329 listed one sample analyzed for copper in which the method blank exceeded ALS DQO. The same sample for chromium had duplicate results outside ALS DQO, due to sample heterogeneity;
- Laboratory report L1962063 listed six samples analyzed for silver in which DQO was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan;
- Laboratory report L1964330 listed three samples analyzed for lead in which duplicate results were outside ALS DQO, due to sample heterogeneity;
- Laboratory report L1965280 listed two samples analyzed for uranium in which duplicate results were outside ALS DQO, due to sample heterogeneity;
- Laboratory report L1966071 listed nine samples analyzed for lead in which duplicate results were outside ALS DQO, due to sample heterogeneity. This same report also listed six samples analyzed for VH(6-10) in which the LCS recovery was slightly outside ALS DQO.

- Laboratory report L1967694 listed two samples analyzed for VH(6-10) in which the LCS recovery was slightly outside ALS DQO.
- Laboratory report L1968560 listed one sample analyzed for copper in which duplicate results were outside ALS DQO, due to sample heterogeneity;
- Laboratory report L1969670 listed one sample analyzed for tin in which duplicate results were outside ALS DQO, due to sample heterogeneity;
- Laboratory report L1975749 listed one sample analyzed for tin in which duplicate results were outside ALS DQO, due to sample heterogeneity. The same sample analyzed for arsenic had method blank exceed the ALS DQO; and,
- Laboratory report L1965282 listed one sample analyzed for PAH constituents (acridine, anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and phenanthrene) in which LCS recovery was slightly outside ALS DQO.

For the laboratory reports noted above in which “the method blank exceeded the ALS DQO”, generally all affected sample results were at least five times the blank levels; therefore, the results are all considered reliable. Otherwise, limits of reporting were adjusted for samples with positive hits below five times the blank level.

For the reports above in which the “LCS recovery was slightly outside the ALS DQO”; reported non-detect results for associated samples were unaffected (other results if reported, were qualified).

For the report above in which the DQO was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan. This is considered acceptable as per Ontario Ministry of Environment (OMOE) and Canadian Council of Ministers of the Environment (CCME); therefore the results are considered reliable.

For all other affected reports noted above in which the “duplicate results were outside the ALS DQO, due to sample heterogeneity”. This was likely due to the “nugget effect”, where a concentration was present in the parent sample, but not the duplicate, resulting in sample heterogeneity in the field being difficult to achieve.

The results of the laboratory analyses are considered to be of good quality and acceptable for the purposes of this investigation.

1.1.1. Field Duplicate Samples

Field duplicate samples are two identical samples that are submitted to the laboratory with no indication that they are the same. The analysis of field duplicate samples provides an indication of the total precision of the sampling and analysis process. Field duplicate samples were collected and analyzed at a rate of approximately 10% of samples for a given analytical suite.

1.2. QUALITY ASSURANCE/QUALITY CONTROL

1.2.1. Precision

Precision measures the reproducibility of repetitive measurements and is usually expressed in terms of imprecision. It is strictly defined as the degree of mutual agreement among multiple independent measurements as the result of repeated application of the same process under similar conditions.

Analytical precision is a measurement of the variability associated with the duplicate (i.e., two) or replicate (i.e., more than two) analyses of the same sample in the laboratory, and is determined by the analysis of matrix spike duplicate or laboratory duplicate samples.

Total precision is a measurement of the variability associated with the entire sampling and analysis process. It is determined by the analysis of duplicate or replicate field samples and incorporates any variability introduced by the analytical procedure, sample collection and handling procedures, and matrix factors. Precision data must be interpreted by taking into consideration these possible sources of variability.

Duplicate field samples were collected, and duplicate spiked or unspiked samples were analyzed to assess analytical precision. The results were assessed using the relative percent difference (RPD) between duplicate measurements. The equation used to calculate RPD for duplicate samples is:

$$RPD = \frac{(A - B)}{((A + B)/2)} \times 100$$

where:

A = analytical result

B = duplicate result.

Note that for RPDs the result can be a positive or a negative value. RPDs are often presented as absolute RPDs, in which case the absolute value of the RPD is reported, always resulting in a positive number. Reporting the absolute RPD results in a reduction in information, since, for instance, if a duplicate sample consistently returned higher results than the original sample, all RPD values would be negative and it may be an indication of a precision problem. In this case, if absolute RPD was reported, no indication would be forthcoming.

Total precision was determined by collecting field duplicate samples. These samples were collected and analyzed at a rate of approximately 10% of total samples for each analytical suite.

Analytical precision will be determined in the laboratory by running matrix spike/matrix spike duplicate (MS/MSD) pairs, or by running laboratory duplicate analyses. These samples will beanalyzed at a rate of approximately 5% for each analytical suite.

1.3. ACCURACY

Accuracy is a statistical measurement of correctness and includes components of random error (e.g., variability due to imprecision) and systematic error (e.g., bias). Therefore, accuracy reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ beyond acceptable limits from the true value or known concentration of the spike or standard. Acceptance criteria are indicated in the individual standardized analytical methods.

Analytical accuracy is typically measured by determining the percent recovery of known target analytes that are spiked into a field sample (i.e., a surrogate or matrix spike), or reagent water (i.e., laboratory control sample [LCS] or blank spike) before extraction at known concentrations. Percent recovery is calculated as:

$$\%REC = \frac{A}{B} \times 100$$

where:

A = obtained value

B = true value.

Analytical accuracy was determined in the laboratory by the running of MS samples or laboratory control samples. These samples were analyzed at a minimum rate of 5% for each analytical suite.

1.4. COMPLETENESS

Completeness for this investigation was defined as the percentage of valid analytical results. Results made uncertain due to missed hold times, improper calibration, blank contamination, or poor calibration verification results would be deemed invalid. Results that may be flagged due to matrix effects are not considered invalid. Completeness for projects should exceed 90%. Completeness is calculated by:

$$completeness = \frac{A}{B} \times 100$$

where:

A = number of valid analytical results

B = total number of analytical results

1.5. QA/QC MIXING ASSESSMENT

Prior to backfilling the treatment cells with the premixed materials, a QA/QC sieve analysis (ASTM E-11 Standard – Sieve No.8) was implemented to verify that Tervita was appropriately mixing the materials consistent with the RAP and IFC drawings. The backfill materials in the up slope treatment cells were designed to consist of a mixture of 75% Lafarge washed sand and 25% Aquagate with Organoclay (AG+OC). The backfill materials in the down slope treatment cells were designed to consist of a mixture of 75% Lafarge washed sand and 25% Aquagate and Powdered Activated Carbon (AG+PAC).

As the sand and AG+OC and AG+PAC mixtures were being placed into the excavations (contained in one cubic meter supersacs), representative samples were collected from the top, middle, and bottom of the supersacs.

Prior to sieve analysis, materials were transferred to a bucket to determine the total weight. Once the sieve analysis was completed (fines and coarse materials separated), the percentage of fine materials were calculated. Table J-1 below identifies the acceptable criteria used during the sieve analysis for the two types of premixed sand.

Table J-1 – Acceptable Criteria for Premixed Sand

Type of Premixed Sand	Acceptable Criteria for Sand Weight - (Fines %)
75% Sand and 25% AG/OC	64 - 71 %
75% Sand and 25% AG/PAC	59 - 68.7 %

Overall, the average weight of fine materials (sand) was within the acceptable criteria for both types of premixed sand. The average fines weight (%) for the sand mixed with AG/OC was 68%, whereas the average fines weight (%) for the sand mixed with AG/PAC was 63.9%. If the batches were outside the acceptable criteria, Tervita was then requested to mix in more or less sand to ensure the batches were within the acceptable criteria prior to using onsite. Results of the sieve analysis are summarized in Table J-2 and Table J-3 below.

Table J-2 – Sieve Analysis for Sand and AG/OC

75% Sand and 25% AG/OC					
Date	**Batch Description**	**Total Weight (lbs)**	**Sand - Fine Materials Weight (lbs)**	**AG/OC - Coarse Materials Weight (lbs)**	**Sand – Fine Materials (%)**
18-Jul-17	Bottom bag	14.6	9.8	4.8	67.1%
18-Jul-17	Bottom bag - Batch #8	17.9	12.6	5.3	70.4%
19-Jul-17	Middle bag	17.6	12.6	5.0	71.6%
20-Jul-17	Top bag - Batch #76	18.6	13.2	5.4	71.0%
21-Jul-17	Middle bag - Batch #8	12.8	8.4	4.4	65.6%
21-Jul-17	Top bag - Batch #93	14	9.0	5.0	64.3%
22-Jul-17	Bottom bag - Batch #4	16.6	11.2	5.4	67.5%
24-Jul-17	Middle bag - Batch #5	23.4	16.2	7.2	69.2%

75% Sand and 25% AG/OC					
Date	**Batch Description**	**Total Weight (lbs)**	**Sand - Fine Materials Weight (lbs)**	**AG/OC - Coarse Materials Weight (lbs)**	**Sand – Fine Materials (%)**
25-Jul-17	Middle bag - Batch #65	11.2	8.8	2.4	78.6%
25-Jul-17	Middle bag	14.8	9.6	5.2	64.9%
26-Jul-17	Top bag - Batch #39	25.4	18.2	7.2	71.7%
26-Jul-17	Top bag - Batch #82	21.4	14.0	7.4	65.4%
28-Jul-17	Bottom bag - Batch #55	15.2	12.2	3.0	80.3%
28-Jul-17	Bottom bag - Batch #54	25.8	17.4	8.4	67.4%
29-Jul-17	Top bag - Batch #56	22.4	16.0	6.4	71.4%
2-Aug-17	Middle bag - Batch #25	22.6	16.2	6.4	71.7%
4-Aug-17	Bottom bag - Batch #32	30.2	22.0	8.2	72.8%
8-Aug-17	Top bag - Batch #19	14.8	10.0	4.8	67.6%
14-Aug-17	Batch #5	17.6	10.6	7.0	60.2%
14-Aug-17	Batch #6	14.6	8.6	6.0	58.9%
14-Aug-17	Batch #7	15.2	9.6	5.6	63.2%
14-Aug-17	Batch #8	15.6	10.0	5.6	64.1%
14-Aug-17	Batch #9	15.6	10.4	5.2	66.7%
14-Aug-17	Batch #10	18.2	11.8	6.4	64.8%
17-Aug-17	Mid bag - Batch #6	--- 1	--- 1	--- 1	--- 1
21-Aug-17	Middle bag - Batch #10	22.0	13.8	8.2	62%
1 - QA/QC not completed, materials too wet to use sieve and lack of time to dry materials.				**Average Fines (%)**	**68.0%**

Table J-3 – Sieve Analysis for Sand and AG/PAC

75% Sand and 25% AG/PAC					
Date	**Batch Description**	**Total Weight (lbs)**	**Sand - Fine Materials Weight (lbs)**	**AG/PAC - Coarse Materials Weight (lbs)**	**Sand - Fine Materials (%)**
18-Jul-17	Bottom bag	12.8	8.4	4.4	65.6%
19-Jul-17	Middle bag	19.8	13.4	6.4	67.7%
20-Jul-17	Top bag - Batch #6	20.6	13.2	7.4	64.1%
21-Jul-17	Middle bag - Batch #5	14.8	9.4	5.4	63.5%
21-Jul-17	Top bag - Batch #7	12.2	7.8	4.4	63.9%
22-Jul-17	Bottom bag - Batch #47	12.2	7.6	4.6	62.3%
24-Jul-17	Middle bag - Batch #17	15.0	10.0	5.0	66.7%
25-Jul-17	Middle bag - Batch #93	12.0	7.4	4.6	61.7%
26-Jul-17	Top bag - Batch #35	18.0	12.0	6.0	66.7%
28-Jul-17	Bottom bag - Batch #65	19.8	13.2	6.6	66.7%
28-Jul-17	Bottom bag - Batch #11	17.2	10.8	6.4	62.8%
29-Jul-17	Top Bag - Batch #666	27.0	18.0	9.0	66.7%

75% Sand and 25% AG/PAC					
Date	**Batch Description**	**Total Weight (lbs)**	**Sand - Fine Materials Weight (lbs)**	**AG/PAC - Coarse Materials Weight (lbs)**	**Sand - Fine Materials (%)**
2-Aug-17	Middle bag - Batch #39	26.6	18.0	8.6	67.7%
4-Aug-17	Bottom bag - Batch #36	20.6	14.4	6.2	69.9%
8-Aug-17	Top bag - Batch #14	23.6	15.2	8.4	64.4%
14-Aug-17	Batch #1	15.0	8.6	6.4	57.3%
14-Aug-17	Batch #2	17.4	9.8	7.6	56.3%
14-Aug-17	Batch #3	14.2	8.6	5.6	60.6%
14-Aug-17	Batch #4	22.4	13.6	8.8	60.7%
17-Aug-17	Middle bag - Batch #8	--- 1	--- 1	--- 1	--- 1
21-Aug-17	Middle bag - Batch #4	23.2	14.4	8.8	62.1%
1 - QA/QC not completed, materials too wet to use sieve and lack of time to dry materials.				**Average Fines (%)**	**63.9%**

Appendix K - FPTS Post Construction Monitoring and Maintenance Plan

AECOM
Fourth Floor
3292 Production Way
Burnaby, BC
V5A 4R4
www.aecom.com

604 444 6400 tel
604 294 8597 fax

December 21, 2017
Project No.: 60542455

Parkland Refining (B.C.) Ltd.
355 North Willingdon Avenue
Burnaby, BC V5C 1X4

Attention: Mr. Christopher Boys, P.Geo.
Senior Environmental Specialist

RE: FORESHORE PASSIVE TREATMENT SYSTEM
MONITORING AND MAINTENANCE PLAN
DOWN SLOPE FROM THE EASTERN IMPOUNDING BASIN, AREA 2,
PARKLAND BURNABY REFINERY, BURNABY, B.C.

Dear Mr. Boys:

AECOM has prepared this Foreshore Passive Treatment System (FPTS) Monitoring and Maintenance Plan (MMP) to maintain and assess the performance of the recently installed FPTS along the Foreshore (hereafter referred to as "the Site") area of Burrard Inlet, down slope from the Eastern Impounding Basin (EIB), Area 2 of the Parkland (formerly Chevron) Burnaby Refinery (Figure 1).

The MMP is based on the Ministry of Environment and Climate Change Strategy's (ENV) supported Remedial Action Plan (RAP) prepared in 2016 (AECOM 2016b). This MMP is considered as equivalent to a Performance Verification Plan as defined in ENV's Administration Guidance 14 even though Parkland is currently not seeking a legal instrument or site profile release for the Site.

Contents

SUMMARY OF THE FORESHORE PASSIVE TREATMENT SYSTEM

The FPTS was designed and constructed to be a final remedial action to address free-phase and dissolved phase hydrocarbons and sheens at the Site. The FPTS was installed between July and October 2017 and consisted of the removal of the existing Eastern and Western Interim Remedial Action (IRA) Barriers and the installation of a multicomponent FPTS comprised of permeable subsurface treatment cells for the mitigation of free-phase (aka non-aqueous phase liquids [NAPL]) and dissolved phase hydrocarbons impacted porewater. The FPTS also contains an oleophilic biobarrier (OBB) surface layer for the prevention of sheens. To assess the performance of the FPTS, four distinct types of monitoring wells, Upslope Wells, Performance Wells, Sentry Wells and Compliance Wells were installed and will be monitored under this MMP.

Further information on the FPTS may be found in Appendix A and in the FPTS Construction Report (AECOM 2017).

OBJECTIVES OF THE MONITORING AND MAINTENANCE PLAN

The objectives of the MMP are as follows:

- Collect samples from, and present the data for, the Compliance Wells;
- Assess the presence/absence of NAPL and the concentrations of dissolved phase contaminants of concern (COCs) in the water at the Site;
- Assess the performance of the remedial treatment cells and OBB surface layer installed in 2017; and
- Maintain the integrity of the FPTS by checking and, where needed, replacing the protective rip-rap, cobbles and monitoring wells, and by managing vegetation as required.

SCOPE OF WORK

The scope of work for the MMP is as follows:

- Ensure all required authorizations are obtained and followed;
- Inspect and gauge the 33 monitoring wells on the Foreshore and coordinate repairs or replacements for damaged wells;
- Monitor and sample the 33 monitoring wells as per the schedule provided below;
- Screen water samples for color, clarity, temperature, pH, dissolved oxygen (DO), salinity, electrical conductivity, oxidation reduction potential (ORP), turbidity, and total dissolved solids (TDS);
- Collect water samples from monitoring wells, and surface water samples within the vicinity of the FPTS. Samples will be analyzed for the following COCs: benzene, toluene, ethylbenzene, xylenes (BTEX), volatile petroleum hydrocarbons in water (VPHw), light extractable petroleum hydrocarbons in water (LEPHw), benzo(a)pyrene, naphthalene, dissolved copper and dissolved zinc. In addition, surface water samples will also be analyzed for total copper and zinc;
- Complete trend analysis of the COC concentrations and compare analytical results to their respective Risk-Based Management Target (RBMT, see Appendix B);

- Monitor for the presence of sheens on the surface water in Burrard Inlet at the Site during surface water sampling;
- Maintain the integrity of the treatment cells and the OBB surface layer, which will include inspection and maintenance of the rip-rap, cobbles, vegetation and monitoring wells; and
- Provide analysis and science-based recommendations that address the well monitoring and sampling frequency after three years of monitoring.

MONITORING COMPONENTS OF THE MMP

Monitoring Wells

Thirty-three (33) monitoring wells (PW17-1 through PW17-33) were installed at the Site during construction of the FPTS (refer to Figure 1 and Tables 1 and C-1). Previous monitoring wells in the Eastern and Western IRA Barriers were destroyed during the FPTS construction activities. As indicated in the introduction, the new monitoring wells are divided into the following four types:

1. Upslope Wells: monitoring wells installed upslope of the treatment cells. These wells will be used to monitor porewater concentrations entering the Site.
2. Performance Wells: monitoring wells installed within the treatment cells. These wells will be used to evaluate the ability of the treatment cells to reduce petroleum hydrocarbon concentrations through adsorption and degradation.
3. Sentry Wells: monitoring wells located down slope of the treatment cells, but still within the FPTS. These wells will be used to evaluate the performance of the treatment cells, but also provide an early warning if elevated concentrations of dissolved COCs have migrated past the treatment cells.
4. Compliance Wells: monitoring wells installed twelve meters north of the toe of the slope and beyond the limit of the FPTS.

TABLE 1
FORESHORE MONITORING WELLS

Well Type	Well Name
Upslope Wells (8)	PW17-1, PW17-4, PW17-9, PW17-13, PW17-16, PW17-21, PW17-26, and PW17-31
Performance Wells (8)	PW17-5, PW17-6, PW17-17, PW17-18, PW17-22, PW17-23, PW17-27 and PW17-28
Sentry Wells (8)	PW17-2, PW17-7, PW17-10, PW17-14, PW17-19, PW17-24, PW17-29, and PW17-32
Compliance Wells (9)	PW17-3, PW17-8, PW17-11, PW17-12, PW17-15, PW17-20, PW17-25, PW17-30, and PW17-33

Generally, all wells were screened between 0.45 and 1.2 m bgs with a 0.3 m length screened interval and in some instances a 0.36 m length screen (stainless steel prepacked screens) as presented in the FPTS Construction report (AECOM 2017).

The area between the Eastern and Western IRAs is referred to as the In-Between Area (IBA), as shown in Figure 1. As previously communicated to the ENV (AECOM, 2017b), benzene concentrations in IBA well P4.2-3D increased in early 2016 but became stable since then. In order to continue to monitor this area of the IBA, a porewater monitoring well, PW17-12 was installed to 1.4 metres below ground surface (bgs), and screened between

0.85 and 1.15 m bgs, down slope of the former location of P4.2-3D during FPTS construction.

Surface Water

Surface water samples will be collected from six surface water locations (Figure 1, Table 1). Two samples will be collected from each location; a near bottom surface water and near top surface water sample for a total of twelve surface water samples. It should be noted that there is the potential for surface water samples to be impacted by non-refinery anthropogenic sources within Burrard Inlet.

A boom encompassing the entire FPTS installation area will be in place for one year after construction.

Analytical Program

Water samples collected from the monitoring wells will be submitted to a Canadian Association for Laboratory Accreditation (CALA) certified laboratory on a standard turn-around-time basis, for the following laboratory analyses:

- BTEX and VPHw
- LEPHw
- Benzo(a)pyrene and naphthalene
- Dissolved copper and dissolved zinc

Surface water samples will be submitted for the same analysis as samples collected from the monitoring wells, but will also be analysed for total copper and zinc.

Sampling Schedule

The sampling schedule for the first three years is summarized in Table 2. Following the construction of the FPTS, monitoring described in this MMP was started in November 2017.

During the first six months following installation of the FPTS, additional monitoring and sampling events may be completed. During the first year (Year 1) after installation of the FPTS, monitoring well sampling will be completed on a quarterly basis (March, June, September and December)[1]. In the second and third years (Year 2 and 3), monitoring well sampling will be completed on a semi-annual basis (June and December), after which the program will be reviewed.

Surface water sampling and sheen monitoring will be completed quarterly during the first year, after which the surface water monitoring program will be reviewed.

[1] Monitoring well sampling will be during falling and low tide events whenever possible.

TABLE 2
MONITORING WELL DESIGNATION AND SAMPLING SCHEDULE

Well / Location	Designation	Frequency Year 1[1,2]	Frequency Year 2	Frequency Year 3
Western Seep Area				
PW17-1	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-2	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-3	Compliance Well	Quarterly	Semi-annual	Semi-annual
PW17-4	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-5	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-6	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-7	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-8	Compliance Well	Quarterly	Semi-annual	Semi-annual
PW17-9	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-10	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-11	Compliance Well	Quarterly	Semi-annual	Semi-annual
In-between Area				
PW17-12	Compliance Well	Quarterly	Semi-annual	Semi-annual
Eastern Seep Area				
PW17-13	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-14	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-15	Compliance Well	Quarterly	Semi-annual	Semi-annual
PW17-16	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-17	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-18	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-19	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-20	Compliance Well	Quarterly	Semi-annual	Semi-annual
PW17-21	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-22	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-23	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-24	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-25	Compliance Well	Quarterly	Semi-annual	Semi-annual
PW17-26	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-27	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-28	Performance Well	Quarterly	Semi-annual	Semi-annual
PW17-29	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-30	Compliance Well	Quarterly	Semi-annual	Semi-annual
PW17-31	Upslope Well	Quarterly	Semi-annual	Semi-annual
PW17-32	Sentry Well	Quarterly	Semi-annual	Semi-annual
PW17-33	Compliance Well	Quarterly	Semi-annual	Semi-annual
Surface Water Samples[3]				
Well / Location	**Designation**	**Frequency Year 1**	**Frequency Year 2**	**Frequency Year 3**
P3-3	-	Quarterly	No Sampling	No Sampling
P3-12	-	Quarterly	No Sampling	No Sampling
P6-3	-	Quarterly	No Sampling	No Sampling
P6-12	-	Quarterly	No Sampling	No Sampling
P8-3	-	Quarterly	No Sampling	No Sampling
P8-12	-	Quarterly	No Sampling	No Sampling

Notes:
1. During the first six months following installation of the FPTS, additional monitoring and sampling events may be completed.
2. Quarterly sampling events should occur in March, June, September and December.
3. Two surface water samples will be collected from each location (near top surface and near bottom surface).

Water sampling collection methodologies are presented in Appendix D.

To assure integrity and reliability of the data collected, rigorous quality assurance/quality control (QA/QC) protocols will be observed during sample collection. QA/QC protocols are presented in Appendix F.

PROGRAM REVIEW

Due to disturbance during construction of the FPTS, elevated concentrations in the water samples are anticipated in the first year after installation. This is a lesson learned from previous IRA Barrier construction activities (URS, 2012). Therefore, there will not be any action if elevated concentrations above screening levels in Compliance Wells occur during Year 1.

The Risk-Based Management Targets (RBMTs), which are set out in Appendix B, will be used as screening levels for Compliance Wells after Year 1. Action will be taken if any of the following conditions occur:

- If there is an exceedance above a RBMT in porewater collected from a Compliance Well, the well will be re-sampled twice immediately (e.g., twice within the month following the exceedance).
- If there are two consecutive exceedances (semi-annual in Years 2 and 3) in a Compliance Well above an RBMT, data from adjacent Compliance, Sentry, Performance and Upslope Wells will be assessed to determine if this exceedance is indicative of a wider issue and what further action is required, if any. This will occur in consultation with ENV.

The FPTS includes contingency piping into which bioremediation enhancements (e.g., nutrients, sulphate and nitrate) may be applied as appropriate to further aid the breakdown of petroleum hydrocarbons. If bioremediation enhancements are applied, they will be recorded in the Annual FPTS Monitoring Report.

After three years, the data collected will be reviewed to assess what Site monitoring and sampling frequency will be proposed for subsequent years. The frequency of future Site monitoring and sampling will be assessed based on the absence, decrease, stabilization, or increase of concentrations of contaminants of concern (COCs) in porewater, primarily in the down slope Compliance Wells.

Based on this trend analysis, the following are three potential example scenarios that could arise:

- COCs concentrations are not detected above their respective reported detection limit (RDL) in any of the Compliance Wells – *monitoring and sampling could be discontinued in all wells.*

- COCs concentrations are detected above half of their respective RBMTs in select Compliance Wells – *monitoring and sampling of only these particular wells could continue on a semi-annual basis. The program would then be re-evaluated at the end of each year.*

- COCs concentrations are detected above half of their respective RBMT on an intermittent basis in over half of the Compliance Wells – *monitoring of all wells at the*

FPTS could continue on a semi-annual basis. The program would then be re-evaluated at the end of each year.

REMEDY INTEGRITY INSPECTION AND MAINTENANCE

To maintain integrity of the remedy, regular inspections of the FPTS will be completed during the quarterly and semi-annual monitoring. The inspections and actions will include:

- Visual inspection of the system to check that two layers of rip-rap are above the treatment cells (i.e., maintaining a thickness of approximately 1.4 m) and two layers of cobbles are above the OBB surface layer (i.e., maintaining a thickness of 0.4 m).
    - If necessary, replacing and adding rip-rap and/or cobbles as required to maintain the required thickness.
- Visual inspection of the FPTS to make sure vegetation is not growing above the treatment cells or the OBB surface layer. The roots of the vegetation may puncture the liner, reducing the system effectiveness.
    - If necessary, removing any vegetation that may affect the treatment cells or the OBB surface layer.
- Inspection of the monitoring well network for damage.
    - If necessary, replacing/repairing any wells that are destroyed or damaged.

REPORT

Annual FPTS Monitoring Reports will be prepared and will contain the following key elements:

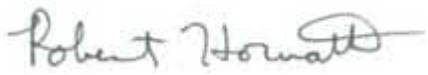
- Summary
- Statement of Objectives
- Description of Sampling
- Presentation of Data
- Presentation of any remedy monitoring and maintenance
- Interpretation and Evaluations
- Recommendations

The Annual FPTS Monitoring Reports will be prepared under the direction of a Contaminated Sites Approved Professional (CSAP).

Yours very truly,

AECOM

per:



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Attachments:

Figure 1 – Site Map and Foreshore Sampling Locations
Table 1 – Foreshore Monitoring Wells
Table 2 – Monitoring Well Designation and Sampling Schedule
Table B-1 – Foreshore Risk Based Management Targets

Appendix A – Background
Appendix B – Regulatory Context
Appendix C – Foreshore Monitoring Wells Construction Details
Appendix D – Sample Collection Methodologies
Appendix E – Port of Vancouver Permit No.16-180
Appendix F – Quality Assurance Quality Control Protocols

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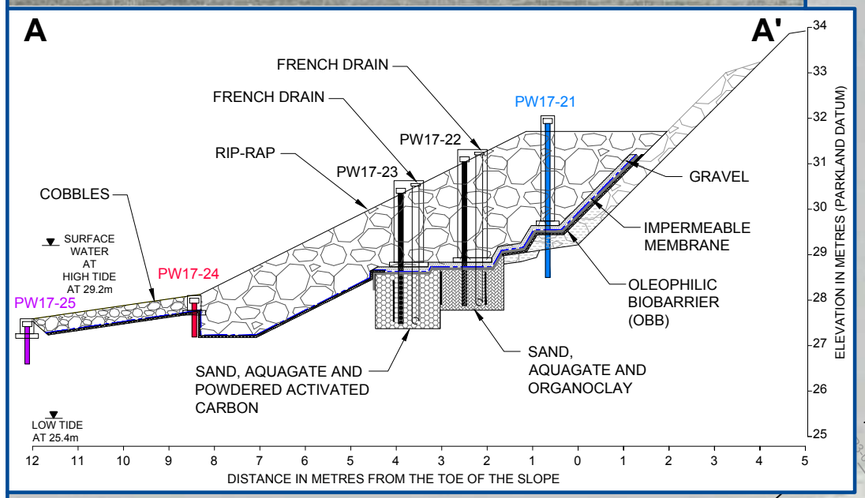
LIMITATIONS

The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of

care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area, and in accordance with AECOM's standard terms and conditions. No other warranty, expressed or implied, is made. This report is for the exclusive use of Parkland Refining (B.C.) Ltd, ENV and VFPA, who may rely upon this report.

AECOM's objective is to perform our work with care, exercising the customary thoroughness and competence of earth science, environmental, and engineering consulting professionals, in accordance with the standard for professional services at the time and location those services are rendered. It is important to recognize that even the most comprehensive scope of services may fail to detect environmental liability on a particular site. Therefore, AECOM cannot act as insurers and cannot "certify" or "underwrite" that a site is free of environmental contamination, and no expressed or implied representation or warranty is included or intended in our reports, except that our work was performed, within the limits prescribed by our client, with the customary thoroughness and competence of our profession.

FIGURE



BURRARD INLET

Eastern Seep Area (ESA)

Inbetween Area (IBA)

Western Seep Area (WSA)

North trench backfilled with mixture of sand, aquagate and activated carbon

South trench backfilled with mixture of sand, aquagate and organoclay

At the end of each trench aquablok

North trench backfilled with mixture of sand, aquagate and activated carbon

South trench backfilled with mixture of sand, aquagate and organoclay

PW17-33
PW17-32
PW17-31
PW17-30
P8-12-O
P8-12-NBO
PW17-29
PW17-25
PW17-24
P6-12-O
P6-12-NBO
PW17-20
PW17-28
PW17-27
P8-3-O
P8-3-NBO
PW17-19
PW17-23
PW17-22
PW17-26
PW17-21
PW17-18
PW17-17
P6-3-O
P6-3-NBO
PW17-16
PW17-15
PW17-14
PW17-12
PW17-13
PW17-11
PW17-10
PW17-9
PW17-8
P3-12-O
P3-12-NBO
PW17-7
PW17-3
PW17-6
PW17-5
PW17-4
PW17-2
P3-3-O
P3-3-NBO
PW17-1

P12-0
P11-0
P10-0
P9-0
P8-0
P7-0
P6-0
P5-0
P4-0
P3-0
P2-0
P1-0

Toe of Slope (High Tide Line)
Top of Slope
Low Tide Line

MW12-3
MW12-5.5
MW12-16
MW12-5
A2MW09-12
CPR-1
MW12-1S
MW12-1I
A2MW09-11
MW10-3I
MW10-3D
UEIB-9
UEIB-8
A2MW09-02
UEIB-7
CPR RAILWAY
CPR Interceptor Trench
CPR-2
MW12-4
MW12-3.5
A2MW09-10
MW10-2I
UEIB-46
UEIB-6
MW10-2D
MW11-10I
UEIB-5
A2MW09-01
UEIB-45
MW11-10S
MW12-2.5
UEIB-4
G2-2A
G2-2B
UEIB-3
MW12-2
U9
A2MW09-05I
UEIB-13
UEIB-11
UEIB-2
U8
PARKLAND REFINERY

SOURCE: GOOGLE EARTH IMAGE (2016)

LEGEND:

- Property Line
- Fence Line
- Foreshore Sampling Transect
- CPR Interceptor Trench
- Refinery Extraction System
- Impermeable Sheet
- Cobble Mat
- Rip Rap Embankment
- French Drain
- Drain Cleanout
- NAPL Seep Observed in 2010
- Surface Water Sample
- POREWATER SAMPLES
- Compliance Well
- Sentry Well
- Performance Well
- Up Gradient Well
- Monitoring Well
- Sentry Monitoring Well
- Extraction Well

ABBREVIATIONS:

O	Ocean - Near Top Surface Water
NBO	Ocean - Near Bottom Surface Water
NAPL	Non-Aqueous Phase Liquid
CPR	Canadian Pacific Railway

GRID NORTH

N W E S

0 10 20 metres

AECOM

SITE MAP AND FORESHORE SAMPLING LOCATIONS

Monitoring & Maintenance Plan
Foreshore Below Area 2 - Parkland Refinery, Burnaby, BC

PARKLAND REFINING (B.C.) LTD.

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
December 2017	60542455	TS	0	FIGURE 1

FILE NAME: H:\URS-CHEVRON\60542455.Final Remedy Installation\5. Deliverables\MM Plan\Figures\Working files\20171218 01 Maintenance Monitoring Plan.dwg

APPENDIX A

BACKGROUND

APPENDIX A – BACKGROUND

Chevron Canada Limited (CCL) first observed NAPL seeps on the north, downward slope of the Parkland (formerly Chevron) Burnaby Refinery towards Burrard Inlet during an inspection on April 21, 2010. The seeps were immediately reported by CCL to the Provincial Emergency Program and addressed using soaker pads and booms. The source of the NAPL is unknown but believed to be associated with historical Refinery operations and the north process sewer (decommissioned in June 2011).

A Preliminary Site Investigation (PSI) was conducted in June 2010, followed by a Detailed Site Investigation (DSI) in April 2011 (URS, 2011a). The Eastern and Western IRA Barriers, comprised of a sand-organoclay mixture and a CETCO Reactive Core Mat (RCM) were constructed in February and March 2011. The Eastern IRA Barrier was refurbished in March and April 2012 by extending the sand-organoclay downgradient into the anchor trench. Porewater, porewater ecologically active zone (EAZ) samples (containing water from wells that are located from ground surface to 1 metre below ground surface), surface water from Burrard Inlet, and ambient air samples, have been collected from the Site on a regular basis in accordance with the Foreshore Monitoring Plan (URS, 2012a).

AECOM completed air, porewater and/or surface water monitoring and sampling in the ESA and WSA from 2011 to 2016. Details of the monitoring and sampling from 2011 to 2016 are included in seven reports completed by AECOM (URS 2011, URS 2012, URS 2013, URS 2014, URS 2015, AECOM 2016a, and AECOM 2016b).

From July to October 2017, the Eastern and Western IRA Barriers were excavated and removed from the Site and taken to an off-site licensed disposal facility. Two Foreshore Passive Treatment Systems (FPTS) were constructed and installed at the Site; one in the Eastern Seep Area and the second in the Western Seep Area. The FPTSs each consist of two subsurface treatment cells; the first up slope treatment cell contains a mixture of sand and AquaGate+Organoclay (AG+OC); the second, down slope treatment cell will contain a mixture of sand and AquaGate+Powdered Activated Carbon (AG+PAC) (AquaBlok, 2010a; AquaBlok 2010b). The subsurface cells are protected by rip-rap which is calculated to withstand the wave forces generated by a 100-year storm event and by local ships. The sheen control layer, which extends down slope of the treatment cells, consists of an OBB layer, which is anchored with 0.2 metre diameter cobbles. Refer to the Remedial Action Plan for further details (AECOM, 2016b). Monitoring wells were installed within and around the remedy and have been discussed within the text of this plan.

APPENDIX B

REGULATORY CONTEXT

APPENDIX B - REGULATORY CONTEXT

The British Columbia Ministry of Environment and Climate Change Strategy (ENV) approved the Stage 10 Amendment (Omnibus) to the Contaminated Sites Regulation (CSR) on October 27, 2016. The Stage 11 (Housekeeping) amendments to the CSR were approved on October 31, 2017. Pursuant to the CSR, standards for aquatic life water use apply to groundwater located within 500 metres of a surface water body containing aquatic life. Standards for aquatic life water use also apply where there is the potential for contaminated groundwater to flow through preferential corridors that discharge directly to a surface water body containing aquatic life.

In 2014, SLR Consulting (Canada) Ltd (SLR) derived Risk Based Management Targets (RBMTs) for the Site and in 2016 completed a Human Health and Ecological Risk Assessment (HHERA) for the contaminants associated with the seeps (SLR 2014 and 2016). The HHERA was submitted to ENV, Port of Vancouver (POV – formerly Port Metro Vancouver) and Fraser Health. The RBMTs are intended to be used as a risk management tool to assess the performance of the FPTS. The RBMTs were developed to be protective of aquatic plants and invertebrates at the community level and fish at the population level. The HHERA did not find any significant risk to human health; therefore, RBMTs were not needed for human receptors.

These RBMTs were established and accepted by the ENV in 2014 (ENV, 2014).

RBMTs for Site porewater were developed for benzene, ethylbenzene, toluene, xylenes, benzo(a)pyrene, naphthalene, VPHw, LEPHw, dissolved copper, and dissolved zinc. The results of SLR's HHERA indicated that all other previously identified COCs were no longer considered to be a concern to humans or marine aquatic life. Concentrations of COCs reported in surface water and porewater samples will be screened against the RBMTs.

The RBMTs for the Site are presented in Table B-1 below.

TABLE B-1 FORESHORE RISK BASED MANAGEMENT TARGETS

Parameter	RBMT micrograms per litre (µg/L)
LEPHw	300
VPHw	1,500
Benzene	2,100
Toluene	770
Ethylbenzene	320
Xylenes	330
Naphthalene	44
Benzo(a)pyrene	0.28
Dissolved copper	6.2
Dissolved zinc	90

APPENDIX C

Foreshore Monitoring Wells Construction Details

APPENDIX C - FORESHORE MONITORING WELLS CONSTRUCTION DETAILS

TABLE C-1
FORESHORE MONITORING WELLS CONSTRUCTION DETAILS

Monitoring Well	Well Type	Total Depth (m bgs)	Top of Well Screen (m bgs)	Bottom of Well Screen (m bgs)	Screen type
PW17-1	Upslope	1.20	0.85	1.15	PVC
PW17-2	Sentry	1.20	0.85	1.15	PVC
PW17-3	Compliance	1.20	0.85	1.15	PVC
PW17-4	Upslope	0.80	0.45	0.75	PVC
PW17-5	Performance	1.10	0.64	1.00	SS
PW17-6	Performance	1.30	0.84	1.20	SS
PW17-7	Sentry	1.05	0.7	1.00	PVC
PW17-8	Compliance	1.30	0.84	1.20	SS
PW17-9	Upslope	1.20	0.85	1.15	PVC
PW17-10	Sentry	1.25	0.85	1.15	PVC
PW17-11	Compliance	1.20	0.74	1.10	SS
PW17-12	Compliance	1.20	0.85	1.15	PVC
PW17-13	Upslope	1.20	0.85	1.15	PVC
PW17-14	Sentry	1.20	0.85	1.15	PVC
PW17-15	Compliance	1.30	0.84	1.20	SS
PW17-16	Upslope	0.80	0.45	0.75	PVC
PW17-17	Performance	1.10	0.64	1.00	SS
PW17-18	Performance	1.30	0.84	1.20	SS
PW17-19	Sentry	1.20	0.87	1.15	PVC
PW17-20	Compliance	1.10	0.64	1.00	SS
PW17-21	Upslope	0.80	0.45	0.75	PVC
PW17-22	Performance	1.10	0.64	1.00	SS
PW17-23	Performance	1.30	0.84	1.20	SS
PW17-24	Sentry	1.20	0.85	1.15	PVC
PW17-25	Compliance	1.25	0.85	1.15	PVC [1]
PW17-26	Upslope	0.80	0.45	0.75	PVC
PW17-27	Performance	1.10	0.64	1.00	SS
PW17-28	Performance	1.30	0.84	1.20	SS
PW17-29	Sentry	1.20	0.85	1.15	PVC
PW17-30	Compliance	1.30	0.84	1.20	SS
PW17-31	Upslope	1.20	0.85	1.15	PVC
PW17-32	Sentry	1.20	0.85	1.15	PVC
PW17-33	Compliance	1.20	0.85	1.15	PVC

Notes:
m bgs - metres below ground surface
SS - Stainless steel wrapped screen prepacked with 20/40 sand
PVC - Schedule 40 - 10 slot screen
1 - Screen consisted of a 3" - 10 slot screen surrounding a 2" - 10 slot screen prepacked with 20/40 filter sand (manufactured by Bluemax Drilling)

APPENDIX D

SAMPLE COLLECTION METHODOLOGIES

APPENDIX D - SAMPLE COLLECTION METHODOLOGIES

MONITORING, WELL PURGING AND WATER SAMPLING METHODOLOGY

There are 33 monitoring wells at the Site (Figure 1 and Table 1).

Porewater monitoring will include recording the time of day, depth to water (DTW), depth to product (DTP) and total depth of the well (TD). The DTW and DTP will be measured using an interface probe which will be decontaminated between monitoring wells to prevent cross contamination.

Porewater samples will be collected from each monitoring well using dedicated high-density polyethylene and silicone tubing attached to a peristaltic pump, to ensure minimal entrainment of silt in the sample as well as minimal losses of volatile constituents. Prior to sample collection, water will be purged from the well for approximately 5 to 10 seconds until clear. During purging, field parameters including pH, temperature, electrical conductivity, salinity, TDS, ORP, DO, and turbidity will be monitored and documented. During purging and sample collection, care will be taken to remove water from near the top of the water column to minimize any disturbance and subsequent entrainment of solids near the base of the well. Samples will be placed into a cooler containing blue or wet ice, and were kept under chain-of-custody procedures until delivery to ALS Laboratories (ALS).

SURFACE WATER SAMPLING METHODOLOGY

A total of 48 surface water samples from 12 locations will be collected the first year after installation of the Final Remedy. Surface water samples will be collected on a quarterly basis. Similar to the historical monitoring programs at the Site, surface water samples were only collected at three transect locations (P3 at the Western Seep Area and P6 and P8 both at the Eastern Seep Area) on the Foreshore, resulting in 12 samples per quarterly event.

Surface water samples will be collected by placing the sample bottles near the surface of the water. Near bottom samples will be collected by placing and opening sample bottles at the sediment-water interface approximately five centimetres above the sediment surface during a falling tide to collect water being emitted from the subsurface sediments of the Foreshore. Samples will only be collected when any turbulence in the water had dissipated and minimal sediment was present in the water column. Care will be taken to preclude the introduction of particulates into the sample container.

The surface water samples will be field screened for colour, clarity, pH, temperature, electrical conductivity, salinity, TDS, ORP, DO and turbidity. Samples will be placed into a cooler containing blue or wet ice, and were kept under chain-of-custody procedures until delivery to ALS.

Sample IDs for surface water samples will follow a similar convention as past investigations at the Site; the sample ID will contain an “O” for surface ocean and “NBO” for near bottom surface samples.

DECONTAMINATION

All non-disposable water monitoring and sampling equipment (i.e., interface probes and YSI multimeters) will be decontaminated between sample locations as follows:

- Washing external and internal surfaces of the sampling equipment with amended water[2]; scrubbing as necessary to remove dirt, grime, grease, and oil;
- Rinsing with de-ionized water; and
- Double rinsing with de-ionized water.

[2] Amended water is a 0.5% solution of an environmentally friendly cleaner labelled Liquinox and de-ionized water.

APPENDIX E

PORT OF VANCOUVER PERMIT NO.16-180

APPENDIX E - PORT OF VANCOUVER PERMIT NO.16-180

The Port of Vancouver issued Permit No.16-180 for construction of the Final Remedy. The permit is valid from May 24, 2017 to May 31, 2022. All contractors will have a copy of Permit No.16-180 when on Site. Conditions within Permit No.16-180 will be adhered to during monitoring and sampling events and maintenance activities (i.e., replacement of protective rip-rap, cobbles and/or monitoring wells, and managing vegetation).

PORT of vancouver	VANCOUVER FRASER PORT AUTHORITY PROJECT AND ENVIRONMENTAL REVIEW REPORT AND PERMIT
PER No.:	**16-180**
Tenant:	**Chevron Canada Limited**
Project:	**Chevron Refinery Foreshore Final Remedy**
Project Location:	**5201 Penzance Drive, Burnaby**
VFPA SID No.:	**BBY089**
Land Use Designation:	**Port Water**
Applicant(s):	**AECOM, on behalf of Chevron Canada Limited**
Applicant Address:	**3292 Production Way, Burnaby, BC, V5A 4R4**
Category of Review:	**B**
Date of Approval:	**May 24, 2017**
Date of Expiry:	**May 31, 2022**

1 INTRODUCTION

The Vancouver Fraser Port Authority (VFPA), a federal port authority, manages lands under the purview of the *Canada Marine Act*, which imparts responsibilities for environmental protection. VFPA accordingly conducts project and environmental reviews of works and activities undertaken on these lands to ensure that the works and activities will not likely cause significant adverse environmental effects. This project and environmental review report and project permit (the Permit) documents VFPA's project and environmental review of PER No. 16-180: Chevron Refinery Foreshore Final Remediation (the Project) proposed by AECOM working on behalf of Chevron Canada Limited (the Applicant).

This project and environmental review was carried out to address VFPA's responsibilities under the *Canada Marine Act*, and to meet the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), as applicable. The proposed Project is not a CEAA 2012 "designated project" and an environmental assessment as described in CEAA 2012 is not required. However, VFPA authorization is required for the proposed Project to proceed and in such circumstances, where applicable, Section 67 of CEAA 2012 requires federal authorities to assure themselves that projects will not likely cause significant adverse environmental effects. This review provides that assurance. In addition, VFPA considers other interests, impacts and mitigations through the project and environmental review.

The project and environmental review considered the application along with supporting studies, assessments and consultations carried out or commissioned by the Applicant, as well as other information provided by the Applicant. In addition, this project and environmental review considered other information available to VFPA and other consultations carried out by VFPA. A full list of information sources germane to the review is provided in the following pages of this report.

This Permit is the authorizing document allowing the Applicant to proceed with the Project subject to the listed project and environmental conditions.

2 PROJECT DESCRIPTION

The Project is the final step in Chevron's Foreshore Remedial Action Plan (RAP) to remediate soil and groundwater near Chevron's Burnaby Refinery at 5201 Penzance Drive, Burnaby, BC. The Project is to mitigate environmental risk by managing the non-aqueous phase liquid (NAPL) and associated contaminants of concern in porewater and surface water in the vicinity of the NAPL seeps. The site of the NAPL seepage and of the Project is located in the northern portion of the refinery in and near the foreshore of Burrard Inlet. The proposed work will be conducted within 250m of archaeological site DhRr-0230.

After the initial observation of the seeps in April 2010, contaminants of concern were recorded in sediment, air, and ground and surface water, including petroleum hydrocarbons and select metals. The seeps were identified as two areas: Western Seep Area (WSA) and Eastern Seep Area (ESA), which are approximately 30m apart. Interim interceptor trenches were first installed in 2011, at both the WSA and ESA, as an interim measure to manage the seeps while more permanent solutions were studied. VFPA issued Permit 10-161 for the interim remediation project.

The works for the remediation activities are planned early July 2017 to late September 2017 at low tide during the day at normal operation hours. The footprint of the work site (including the ESA, WSA, rip-rap, and monitoring wells) is approximately 140m x 30m, or 4200m^2. The excavation footprint will range from 950m^2 to 1500m^2, depending on the extent of contaminated soils in the WSA. The site is not accessible by road; therefore, all equipment will be loaded on a barge and mobilized via Burrard Inlet to the site.

The Project consists of removing the interim remediation barriers installed in 2011 in the foreshore, and installing new permanent remediation measures. The ESA will have subsurface treatment cells installed; the WSA is not expected to require subsurface treatment cells and will be backfilled with appropriate matching subgrade material, provided no contaminated soils are found. If contaminated soils are discovered in the WSA, the size of the WSA excavation will be expanded and subsurface treatment cells will be installed in the same manner as the ESA. Rip-rap will be installed on the foreshore to protect the remediation structures and also to prevent scouring of the slope near the CP Rail right-of-way. Approximately 23 monitoring wells are proposed to be installed. A qualified remediation contractor will conduct these works.

The Applicant completed a *Fisheries Act* self-assessment and submitted a Request for Project Review to Fisheries and Oceans Canada (DFO). DFO responded that a *Fisheries Act* authorization is not required for the project given that serious harm to fish can be avoided by following standard measures. The Applicant will only work in the foreshore during low tide to keep works dry. No equipment or open excavations will be left in intertidal areas overnight or during high tides.

The Applicant has prepared a Construction Environmental Management Plan (CEMP) that includes measures to mitigate potential environmental impacts including: sediment transport and turbidity, contaminated soil and groundwater, riparian vegetation, and spills and leaks. An Environmental Monitor will ensure compliance with the CEMP, this Permit, and applicable environmental regulations. The Environmental Monitor will prepare weekly reports. A qualified archaeological monitor will be on site during ground disturbance to native soils. Aboriginal groups will be given the opportunity to participate in archaeological and environmental monitoring during the Project.

Confirmatory excavation sampling will follow the BC Ministry of Environment's *Technical Guidance 1 Site Characterization and Confirmation Testing (2009)* with samples collected every metre vertically and every 5 metres horizontally from the base and side walls of excavations. Soils and groundwater that are confirmed to be contaminated will be removed and transported to an

approved disposal site. Confirmed contaminated soil will be removed to the extent allowed without affecting geotechnical stability of the CP Rail slope and right-of-way.

The Applicant plans to monitor contamination for a minimum of three (3) years post-construction. The Applicant will conduct ongoing vegetation maintenance and management near the Project site over the life of the remediation structures (~30 years). Rip-rap replacement may be required in the future, subject to a separate subsequent approval by VFPA.

The BC Ministry of Environment (BC MOE) has reviewed the Project and supports the planned works, as outlined in their letter to Chevron dated September 9, 2016.

In this project permit, the Project means the physical activities authorized by VFPA to be carried out pursuant to **PER No. 16-180**, as described below.

2.1 Proposed Works

1. Access to foreshore by loading equipment on a barge and mobilizing via Burrard Inlet to the site, and returning equipment to the barge prior to high-tide.
2. Removal of an estimated 150m^2 of riparian vegetation, including trees, shrubs, and ferns. Vegetation maintenance will be performed over the lifetime of the remedy to prevent damage to the remedy structures.
3. Removal of the boom near the ESA.
4. Excavation and removal of the existing interim remediation barriers (approximately 44m) from the WSA and ESA. The excavations will be staged in 5 to 10 metre segments along the length of the foreshore. Each segment will be excavated, backfilled and covered by the end of each work day before the tide covers the site; there will be minimal in-water works.
5. Contaminated soil and groundwater will be removed and transported on a barge in polypropylene super sack bags. All disposals will be at approved disposal sites.
6. Installation of the new permanent remediation barrier at the ESA within trench segments (5 to 10 metres) in the foreshore. This includes imported fill (e.g., gravel, sand, clay), geogrid filter fabric, and poly sheeting. The ESA subsurface treatment cells will be covered by an oleophilic biobarrier geocomposite to capture potential NAPL sheens. A layer of cobbles 20 centimetres (cm) thick will anchor the oleophilic biobarrier composite.
7. Installation of natural, non-leaching rip-rap of a median 0.7 metres in diameter and total rip rap thickness of 1.4 metres to protect the ESA remediation structures and for scour protection of the CP Rail right-of-way slope from wave forces generated by 100-year storm events and ship wakes.
8. The WSA trench segments will be backfilled with appropriate matching subgrade materials unless additional contamination is discovered, upon which the WSA excavation area will be extended and will receive similar remedy structures as the ESA.
9. Installation of 23 monitoring wells with concrete risers to protect them from shifting rip-rap. Porewater wells will be placed up slope, within and down slope of the ESA and WSA to monitor performance and establish compliance with applicable standards.

3 VANCOUVER FRASER PORT AUTHORITY INTERNAL REVIEWS

The following VFPA departments have reviewed the application and support approval of the Project subject to the listed project and environmental conditions.

☒ Planning	☒ Environmental Programs	☒ Engineering
☒ Marine Operations	☒ Project Communications	☒ Aboriginal Affairs

4 ABORIGINAL CONSULTATION

VFPA Aboriginal Affairs reviewed the proposed works and determined that the project may have the potential to adversely impact Aboriginal rights.

Scope of Consultation

- Tsleil-Waututh Nation
- Squamish Nation
- Musqueam Indian Band
- Sto:lo Nation
- Hul'qumi'num Treaty Group
    - Halalt First Nation
    - Lake Cowichan First Nation
    - Lyackson First Nation
    - Penelakut Tribe
    - Cowichan Tribes
    - Stz'uminus First Nation

All Aboriginal groups listed above were consulted on the proposed project.

Overview of Consultation Activities

On December 14, 2016, a referral package was sent to each of the Aboriginal groups listed above. The referral package included:

- Referral Letter
- Permit Application
- Project Overview Map
- Project Remedial Action Plan

Comments were requested from Aboriginal groups within 40 business days, by February 10, 2017. VFPA elected to extend the review period from the usual 30 business days to account for office closures over the December holiday in some Aboriginal communities.

On January 12, 2017, VFPA sent an update email, reminding Aboriginal groups about the project review and requesting comments by the February 10, 2017 deadline.

VFPA received comments from Aboriginal groups via letters and email. VFPA responded to all comments from Aboriginal groups.

Summary of Issues

Below is a table summarizing comments received by VFPA and how they were considered as part of the project and environmental review.

Issue	VFPA Considerations	Action Required
Current use of lands and resources for traditional purposes		
Contamination of Burrard Inlet	The project involves installing barriers to impede remaining contamination from entering the inlet, and installing long-term monitoring wells to monitor contamination and to assess whether or not further action needs to be taken. This project will reduce contamination and provide an overall environmental benefit to Burrard Inlet. In acknowledgement of the concerns of Aboriginal groups about the contamination, the Applicant committed to making communications relating to monitoring available.	VFPA included the following permit condition (no. 43): The Applicant shall make monitoring reports available to Aboriginal groups.
Presence of Aboriginal group environmental monitors on-site during installation	VFPA acknowledges that the environmental health of Burrard Inlet is of high importance to Aboriginal groups. VFPA is interested in working with Aboriginal groups to allow environmental monitors to be on-site during project works.	VFPA included the following permit condition (no. 25): The Applicant shall make opportunities available for Aboriginal groups to participate in environmental monitoring during project works.
Monitoring and Sampling of Project Area	The Applicant will undertake a monitoring and sampling program for three years, after which the program will be reviewed. Monitoring will likely occur for five years or more, but likely at a reduced frequency, subject to the analytical results from the first three years. The Applicant committed to copying Aboriginal groups on communications related to this issue.	VFPA included the following permit condition (no. 43): The Applicant shall make monitoring reports available to Aboriginal groups.
Preservation of sandy beach	The Applicant has completed the remedial design to limit the amount of sandy beach that will be altered while still installing a robust system that is protective of the environment.	None

Issue	VFPA Considerations	Action Required
Principle of net environmental gain, rather than no net environmental loss	VFPA continues to seek opportunities to work with Aboriginal groups and others to improve environmental management practices and to provide net environmental benefits through various initiatives. VFPA is also keen to continue identifying shared interests and to focus on collaborative projects with Aboriginal groups that will result in net environmental gains within Burrard Inlet. The Applicant provided a response recognizing that Aboriginal groups are leaders in environmental stewardship in Burrard Inlet. Chevron is working with Aboriginal groups and others on environmental initiatives that benefit Burrard Inlet.	None
Monitoring of future cumulative effects of ground and surface water contamination	The Applicant will undertake a monitoring and sampling program for three years, after which the program will be reviewed. Monitoring will likely occur for five years or more, but likely at a reduced frequency, subject to the analytical results from the first three years. The Applicant committed to copying Aboriginal groups on communications related to this issue. The Applicant developed risk-based management targets (RBMTs) which were finalised in 2014 and approved by the BC MOE. The RBMTs are site-specific concentration limits for the parameters of concern in the site porewater, and are designed to be protective of aquatic life that may experience potentially long-term exposures. As long as the concentrations of the parameters are below the RBMTs (which the remedy is designed to ensure), the ecological function and viability of aquatic life in the foreshore will be maintained. The RBMTs form an integral part of the performance monitoring program described in the RAP.	VFPA included the following permit condition (no. 43): The Applicant shall make monitoring reports available to Aboriginal groups.
Impacts to fish and fish habitat as a result of ground and surface water contamination	Impacts to fish and fish habitat are not expected as a result of the project. An analysis of the potential effect on the physical fish habitat was completed and submitted to Fisheries and Oceans Canada as part of the Request for Review process. That analysis showed that the physical changes to the Foreshore area would not result in significant harm to fish.	None

Issue	VFPA Considerations	Action Required
Loss of riparian vegetation resulting from lowering of groundwater levels	The drawdown from the Perimeter Extraction System is limited to 10 to 30 meters from the well. The wells are located far enough from Burrard Inlet to affect the water table near the inlet. Therefore, the project is not expected to have an effect on riparian vegetation as a result of lowering groundwater levels.	None
Loss of wildlife habitat resulting from lowering groundwater levels	The drawdown from the Perimeter Extraction System is limited to 10 to 30 meters from the well. The wells are located far enough from Burrard Inlet to affect the water table near the inlet. Therefore, the project is not expected to have an effect on wildlife habitat as a result of lowering groundwater levels.	None
Cultural Heritage		
Project area holds high cultural value for TWN	VFPA acknowledges the importance of the area to Aboriginal groups. The Applicant recognizes the cultural sensitivity of the site and has been working with an Aboriginal-owned business to ensure all activities are carried out in regards to this sensitivity.	None
Impacts to archaeological resources	VFPA understands that the Applicant is working with Aboriginal groups to address potential impacts to archaeology. This includes the use of Aboriginal cultural monitors during project works.	VFPA included the following permit condition (no. 24): The Applicant shall make opportunities available for Aboriginal groups to provide archaeological monitors during project works.
Additional Issues		
Outstanding project design considerations	VFPA will endeavor to share details around materials used with Aboriginal groups when they become available from the Applicant. This may occur through a post-construction report, which will be shared with Aboriginal groups.	None

Based on the record of consultation, VFPA is of the view that the duty to consult has been met.

5 NOTIFICATIONS

5.1 Community Notification

The proposed Project was assessed by VFPA to have minimal or no potential impacts to community interests in the surrounding area either during construction or once the project is completed. Therefore no community consultation or construction notification was required.

6 INFORMATION SOURCES

VFPA has relied upon the following sources of information in its review of the Project.

- Application form and materials submitted by the Applicant on behalf of the tenant on November 23-December 16, 2016.
- Foreshore Remedial Action Plan Below Area 2 Eastern Impounding Basin – Chevron Burnaby Refinery, Burnaby, BC" October 27, 2016, AECOM
- Letter titled "Final Remediation Action Plan Below Area 2 Eastern Impounding Basin – Chevron Refinery", September 9, 2016, Lavinia Zanini of the BC Ministry of Environment
- Email dated 2016-10-04, from Michael Engelsjord of DFO to Chris Boys of Chevron, "Serious harm to fish can be avoided or mitigated."
- Draft Construction Environmental Management Plan (CEMP) for the Foreshore Final Remedy submitted by Aecom February 3, 2017.
- Email correspondence from Michael Gill May 15, 2017 re: Cost Proposal for tree planting at EIB in Area 2.
- All plans and drawings labelled PER No. 16-180-A to D.

7 PROJECT AND ENVIRONMENTAL CONDITIONS

VFPA has undertaken and completed a review of the Project in accordance with the *Canada Marine Act* and Section 5 of the Port Authorities Operations Regulations and, as applicable, Section 67 of the *Canadian Environmental Assessment Act, 2012*.

If at any time the Applicant fails to comply with any of the project and environmental conditions set out in the project permit (the Permit) below, or if VFPA determines that the Applicant has provided any incomplete, incorrect or misleading information in relation to the Project, VFPA may, in its sole and absolute discretion, cancel its authorization for the Project or change the project and environmental conditions to which such authorization is subject.

Pursuant to Section 29 of the Port Authorities Operations Regulations, VFPA may also cancel its authorization for the Project, or change the project and environmental conditions to which such authorization is subject, if new information is made available to VFPA at any time in relation to the potential adverse environmental and other effects of the Project.

The following are the minimum conditions that must be followed by the Applicant to mitigate potential or foreseeable adverse environmental and other effects.

No.	GENERAL CONDITIONS
1.	This Permit is conditional on a valid tenure agreement with respect to the subject premises being in place. **No construction or any other physical activities may commence in the absence of a valid tenure agreement.**
2.	This Permit is granted subject to the fulfillment of all other requirements of VFPA, relating to the Project. Furthermore, prior to commencing construction or any other physical activities the Applicant shall ensure that it has complied with all other necessary legal requirements and that all necessary regulatory approvals have been obtained.
3.	This Permit in no way endorses or warrants the design, engineering, or construction of the Project and no person may rely upon this Permit for any purpose other than the fact that VFPA has permitted the construction of the Project, in accordance with the terms and conditions of this Permit.

4.	In consideration of the granting of this Permit by VFPA the Applicant agrees to indemnify and save harmless VFPA against any and all actions, claims, loss, damages or other expenses in any way arising or following from or caused by the granting of this Permit or the construction or operation of the Project as contemplated by this Permit.
5.	The Applicant is responsible for locating all existing site services and utilities including any located underground and to employ best practices and meet applicable code requirements with respect to protection of existing site services and clearance between existing and proposed site services. The Applicant is responsible for repair or replacement of any damage to existing site services and utilities, to the satisfaction of VFPA, that result from construction and operation of the Project.
6.	The Applicant shall undertake and deliver the Project to total completion in a professional, timely and diligent manner in accordance with the Application submitted by the Applicant and the applicable standards and specifications set out in the sections above entitled Project Description and Information Sources. The Applicant shall not carry out any other physical activities unless expressly authorized by VFPA.
7.	The Applicant shall establish a spill prevention, containment and clean-up plan for hydrocarbon products (including fuel, oil and hydraulic fluid) and any other deleterious substances using standards, practices, methods and procedures to a good commercial standard, conforming to applicable law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances. The Applicant shall ensure that appropriate spill containment and clean-up supplies are available on site at all times and that all personnel working on the project are familiar with the spill prevention, containment and clean-up plan.
8.	The Applicant shall have due regard to the potential application of the *Migratory Birds Convention Act* (Canada) and/or the *Wildlife Act* (British Columbia). To reduce the risk of Project-related harm to birds and/or their active nests and eggs, the Applicant may wish to avoid certain physical activities during the general bird breeding season, which falls between **April 1 and July 31**, or outside of this time span if occupied nests are present. The Applicant shall exercise all due diligence to avoid causing harm to birds and/or their active nests and eggs. The Applicant shall also have due regard to nests of those species of birds protected by Applicable Law at all times of the year, regardless of the time of year or whether or not the nests are occupied. The Applicant should, where circumstances warrant, retain the services of qualified environmental professionals to assist in developing and undertaking appropriate bird nest surveys immediately before, during and after the general bird breeding season.
9.	The Applicant shall cooperate fully with VFPA in respect of any review by VFPA of the Applicant's compliance with these conditions including, without limitation, providing any information or documentation required by VFPA.
10.	The Applicant shall make a copy of this Permit available to all employees, agents, contractors, licensees and invitees prior to commencing any physical activities. The Applicant shall be solely responsible for ensuring that all such employees, agents, contractors, licensees and invitees comply with these conditions.

11.	The Applicant shall make available upon request by any regulatory authority (such as a Fishery Officer) a copy of this Permit.	
12.	Unless otherwise noted, the Applicant shall submit all documents required for VFPA approval to **email: per@portvancouver.com; fax: 1-866-284-4271 and referencing PER No.16-180.**	
	CONDITIONS – PRIOR TO COMMENCING CONSTRUCTION OR ANY PHYSICAL ACTIVITIES	**SUBMISSION TIMING (business days)**
13.	The Applicant shall notify the Fisheries and Oceans Canada (DFO), Conservation and Protection Field Supervisor for Fraser Valley West in Langley, British Columbia (tel: 604-607-4150; fax: 604-607-4199). The Applicant shall copy VFPA Environmental Programs and the Harbour Master on this notification EnvironmentalPrograms@portvancouver.com and Harbour_Master@portvancouver.com; or fax 1-866-284-4271.	2 days before commencing construction or any physical activities
14.	The Applicant shall submit signed and sealed drawings for proposed works approved for construction by a professional engineer licensed to practice in the Province of British Columbia.	5 days before commencing construction or any physical activities
15.	The Applicant shall distribute a construction notice to the City of Burnaby describing the works and activities, hours of construction, and contact information. The Applicant shall copy VFPA when the construction notice is distributed.	10 days before commencing construction or any physical activities
16.	Prior to the commencement of any vessel-related activities, the Applicant shall contact the appropriate Canadian Coast Guard ("CCG") Marine Communications and Traffic Services ("MCTS") centre regarding the issuance of a Notice to Shipping ("NOTSHIP") to advise the marine community of potential hazards associated with the Project. The Applicant must advise CCG that works are planned to occur near a CCG-owned radar tower.	As per Coast Guard requirements
17.	The Applicant shall submit a Vegetation Compensation Plan to the satisfaction of VFPA. The Vegetation Compensation Plan must include a description of the type and area of vegetation to be removed and describe how impacts will be compensated.	10 days before commencing construction or any physical activities
18.	The Applicant shall submit a finalized Construction Environmental Management Plan (CEMP) to the satisfaction of VFPA.	10 days before commencing construction or any physical activities
	CONDITIONS – DURING CONSTRUCTION OR ANY PHYSICAL ACTIVITIES	
19.	The Applicant shall notify VFPA upon commencement of construction or any physical activities of the Project.	

20.	The Project shall be monitored by an appropriately qualified Environmental Monitor. The Environmental Monitor shall be empowered in writing to direct works to ensure compliance with this Permit and the Construction Environmental Management Plan. Monitoring events shall occur when the Environmental Monitor deems it appropriate but in no case less than weekly, and shall be full time during works with potential to cause adverse effects on fish or fish habitat.
21.	The Environmental Monitor shall provide monitoring reports to VFPA on a weekly basis or more frequently if circumstances warrant. The VFPA reserves the right to rule on the adequacy of the monitoring and the content of the reports.
22.	All general construction and physical activities related to the Project shall be conducted from **Monday to Saturday** between the hours of **7:00am and 8:00pm.** No construction and physical activities shall occur during Sundays or holidays. These hours shall not be modified without prior approval from VFPA.
23.	The Applicant shall ensure that an appropriately qualified archaeological monitor be on site at all times during ground disturbing activities that may intrude into native soils.
24.	The Applicant shall make opportunities available for Aboriginal groups to provide archaeological monitors during project works.
25.	The Applicant shall make opportunities available for Aboriginal groups to participate in environmental monitoring during project works.
26.	In the event that evidence of what is suspected to be an archaeological resource is encountered, the Applicant shall: a) Immediately stop any activities that might disturb the archaeological resource or the site in which it is contained ("Site"). b) Not move or otherwise disturb the artifacts or other remains present at the Site. c) Stake or flag off the Site to prevent additional disturbances. d) Immediately notify VFPA.
27.	The Applicant shall not, directly or indirectly: (a) deposit or permit the deposit of a deleterious substance of any type in water frequented by fish in a manner contrary to Section 36(3) of the *Fisheries Act*; or (b) adversely affect fish or fish habitat in a manner contrary to Section 35(1) of the *Fisheries Act*.
28.	The Applicant shall ensure that debris and waste material resulting from the Project are contained, collected, and disposed of at suitable upland locations using standards, practices, methods and procedures to a good commercial standard, conforming to applicable law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances.
29.	The Applicant shall ensure that all equipment is in good mechanical condition and maintained free of fluid leaks, invasive species, and noxious weeds.

30.	The Applicant shall not permit barges or other vessels used during the Project to ground on the foreshore or seabed or otherwise disturb the foreshore or seabed (including disturbance as a result of vessel propeller wash), excepting only such disturbance as is reasonably required to complete the Project.
31.	Works in shoreline shall be limited to the project area as defined in the Construction Environmental Plan and PER No. 16-180-A to D. The Applicant shall be responsible for the repair of any damage, contamination, or erosion resulting from disturbance to the intertidal foreshore during the Project.
32.	Existing native riparian vegetation shall be retained where possible, and disturbance or clearing of vegetation shall be staged and strictly limited to that required for Project implementation.
33.	Works in the intertidal area shall be undertaken in the dry (i.e., above the water surface).
34.	The Applicant shall use a clean excavator bucket. The bucket and any portion of the excavator arm that will be in contact with or near Burrard Inlet shall be clean prior to the start of works.
35.	The direct or indirect release or deposit of sediment or sediment laden water into the aquatic environment shall be minimized during the works. In this regard, reference should be made to the water quality criteria described in the British Columbia Water Quality Guidelines (Criteria): May 2015 Edition produced by the BC Ministry of Environment.
36.	Should contaminated materials be encountered, the Applicant shall ensure that all contaminated materials, including contaminated drill cuttings and equipment wash water, are removed, contained, and disposed of at appropriate off-site facilities using standards, practices, methods and procedures to a good commercial standard, conforming to Applicable Law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances. Suspect materials should be treated as contaminated or stockpiled until their environmental quality has been determined.
37.	Materials brought onto the property to be used for backfilling, site preparation, or other uses shall be from sources demonstrated to be clean and free of environmental contamination.

38.	During any vessel-related activities, the Applicant shall: a) Position vessels and equipment associated with the Project in such a manner so as not to obstruct line of sight to navigational aids or markers. b) As per the International Regulations for Preventing Collisions at Sea, exhibit the appropriate lights and day shapes at all times. c) Monitor the VHF channel used for MCTS communications in the respective area at all times and participate as necessary. d) Be familiar with vessel movements in areas affected by the Project. The Applicant shall plan and execute the Project in a manner that will not impede navigation or interfere with vessel operations. e) During night hours, unless working 24 hrs per day, the rig and associated equipment shall be moored outside the navigation channel and lit in accordance with all applicable regulations.	
	CONDITIONS – UPON COMPLETION	**SUBMISSION TIMING (Business Days)**
39.	The Applicant shall notify VFPA upon completion of the Project.	Within 10 days of completion
40.	The Applicant shall provide record drawings, in both AutoCAD and Adobe (PDF) format to VFPA.	Within 40 days of completion
41.	The Applicant shall confirm the Project was constructed within the tenured area by providing to VFPA: a) Digital photographs of the tenured area, both before and after construction of the Project, from the land and water side of the tenured area. b) A survey plan. c) A letter from an engineer confirming the Project was constructed within the tenured area.	Within 40 days of completion
42.	The Applicant shall submit a comprehensive post-construction report, to VFPA's satisfaction, which shall include: • A description of any known or suspected contamination that remains at the site, and any new contamination characteristics that can be attributed to the site; • A summary of all environmental monitoring and environmental incidents for the Project; • Copies of all manifest for contaminated soils and groundwater removed from the Project location; and • Plans and schedules for post-construction monitoring as detailed in "Section 8: Performance Verification Plan" of the Applicant's Foreshore Remedial Action Plan dated October 27, 2016.	Within 40 days of completion

43.	The Applicant shall provide VFPA all future environmental monitoring data and reports that are related to the Project until such time that environmental monitoring at the Project site is completed. Monitoring data and reports shall include, at minimum, monitoring as detailed in "Section 8: Performance Verification Plan" of the Applicant's Foreshore Remedial Action Plan dated October 27, 2016. The Applicant shall also make monitoring reports available to Aboriginal groups and the BC MOE.	Within 30 days of each monitoring period

VFPA reserves the right to rescind or revise these conditions at any time that new information warranting this action is made available to VFPA.

LENGTH OF PERMIT VALIDITY

The Project must be completed no later than May 31, 2022 (the Expiry Date).

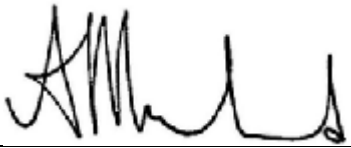
AMENDMENTS

- Details of any material proposed changes to the Project, including days and hours when construction and any physical activities will be conducted, must be submitted to VFPA for consideration of an amendment to this Permit.
- For an extension to the Expiry Date, the Applicant must apply in writing to VFPA no later than 30 days prior to that date.

Failure to apply for an extension as required may, at the sole discretion of VFPA, result in termination of this Permit.

8 ENVIRONMENTAL REVIEW DECISION

In completing the environmental review, VFPA has reviewed and taken into account relevant information available on the proposed project, has considered the information and proposed mitigations provided by the Applicant and other information as listed elsewhere in this document, and concludes that with the implementation of proposed mitigation measures and conditions described in the project and environmental conditions section above, the Project is not likely to cause significant adverse environmental effects.



ANDREA MACLEOD
MANAGER, ENVIRONMENTAL PROGRAMS

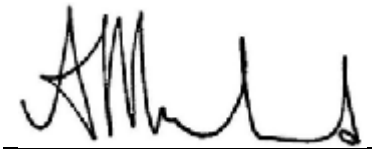
May 24, 2017
DATE OF DECISION

9 CONCLUSION

In completing the project and environmental review, VFPA concludes that with the implementation of proposed mitigation measures and conditions described in the project and environmental conditions section above, the Project has appropriately addressed all identified concerns.

PROJECT AND ENVIRONMENTAL REVIEW DECISION

Project Permit PER No. 16-180 is approved by:



ANDREA MACLEOD
MANAGER, ENVIRONMENTAL PROGRAMS

May 24, 2017
DATE OF APPROVAL

CONTACT INFORMATION

Vancouver Fraser Port Authority (VFPA)
100 The Pointe, 999 Canada Place
Vancouver BC V6C 3T4 Canada

Project & Environmental Review
Tel.: 604-665-9047
Fax: 1-866-284-4271
Email: PER@portvancouver.com
Website: www.portvancouver.com

Canada

PER No. 16-180-A

Chevron Refinery Foreshore Final Remedy

PER #16-180

Proposed Project Area

VFPA Boundary

N

20 10 0 20 m

PORT of vancouver

VFPA Spatial Data Group
May 2017
PLAN # G2016-133

Any areas marked "proposed" represent approximate locations.

PER No. 16-180-B

VANCOUVER FRASER PORT AUTHORITY

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B NORTH

B' SOUTH

RECEPTORS

HUMAN HEALTH
Recreational Users

ECOLOGICAL
Aquatic

ELEVATION (metres)
(Chevron's Mill Datum)

40 (10)
35 (5)
30 (0)
25 (-5)
(masl)

Approximate Low Tide Line

Approximate Mid Tide Line

Toe of Slope and Approximate High Tide Line

BURRARD INLET

Boom Location

P6-12D

P6-8D

P5.25-5

P5.5-3R

Infrequent sheens & odours

Porewater Elevation (High Tide)

Porewater Elevation (Low Tide)

NAPL Detection Core Samples April, 2012

CPR Interceptor Trench

CPR ROW

MW12-1S*

Culverts

Perforated Pipe

MW12-1S
July, 2012
NAPL last observed

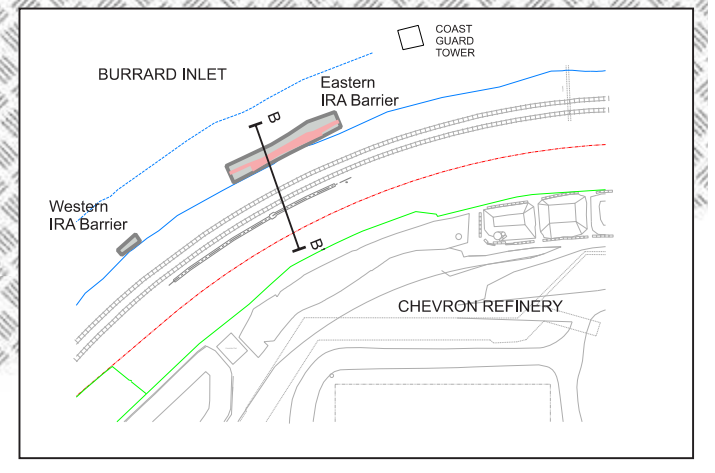
January 2011
CP Rail Ditch
NAPL last observed

Foreshore
April, 2010
NAPL last observed

September, 2011
NAPL last observed

Original Foreshore IRA March, 2011

Foreshore IRA Refurbishment March, 2012



LEGEND:

Borehole/ Monitoring Well

Screened Interval

Groundwater Elevations

Beach Sand

Fill/Alluvium/Colluvium: sand, some gravel, silt and clay imported fill in areas

Till: sandy silt, trace gravel, dense, grey

Organoclay and beach sand mixture

Organoclay and imported sand mixture

Excavation Limit

Geogrid/Filter Fabric

Solid Poly Sheeting

Geogrid and Oleophilic Biobarrier (OBB)

Rip-Rap boulders

Groundwater Table & Flow Direction

NAPL Last Observed Historically

Pump

NOTE: Chevron Mill Datum = Geodetic Datum + 27.85 metres (91.37 feet)

* NAPL detected in CPR ROW Investigation MW12-1S was detected in soil sampes with ultraviolet light.

ABBREVIATIONS:

IRA	Interim Remedial Action
CPR	Canadian Pacific Railway
ROW	Right-of-Way
NAPL	Non-Aqueous Phase Liquid
masl	metres above sea level

0 5 10m
HORIZONTAL

AECOM

FORESHORE CONCEPTUAL SITE MODEL

Remedial Action Plan
Foreshore Below Area 2 - Chevron Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
July 2016	60347433	TS	0	FIGURE 3

H:\URS-CHEVRON\39549154.CCL Foreshore Final Remedy\5. Deliverables\April 2013 Presentation\Figures.J-03 CSM.cdr

PER No. 16-180-C

EXISTING COAST GUARD TOWER

BURRARD INLET

LIMIT OF CONSTRUCTION

UTM: E= 500940.23m
N= 5460273.11m
CHEVRON MILL DATUM
REFERENCE SYSTEM:
X= 138.08m
Y = 268.41m

VANCOUVER FRASER PORT AUTHORITY

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EASTERN SEEP AREA

TOTAL CONSTRUCTION AREA
3111m²

ESA CONSTRUCTION AREA
922m²

LOW TIDE LINE

CPR RAIL CORRIDOR

WESTERN SEEP AREA

CONTINGENCY AREA
524m²

LIMIT OF CONSTRUCTION

WSA CONSTRUCTION AREA
9.4m²

LEGEND

TOP OF SLOPE

BOTTOM OF SLOPE

NOTE:

Locations and calculated areas are approximate

PLAN

0 6.25 12.5 m

1:250

NOT FOR CONSTRUCTION

PROJECT

FORESHORE REMEDIAL ACTION PLAN
BELOW AREA 2 EASTERN IMPOUNDING BASIN
CHEVRON BURNABY REFINERY

CLIENT

Chevron Canada Limited
Burnaby Refinery
355 North Willingdon Avenue
Burnaby BC V5C 1X4

CONSULTANT

AECOM
3292 Production Way
Burnaby, BC
1.604.444.6400 tel 1.604294.8597 fax
www.aecom.com

PROJECT NUMBER

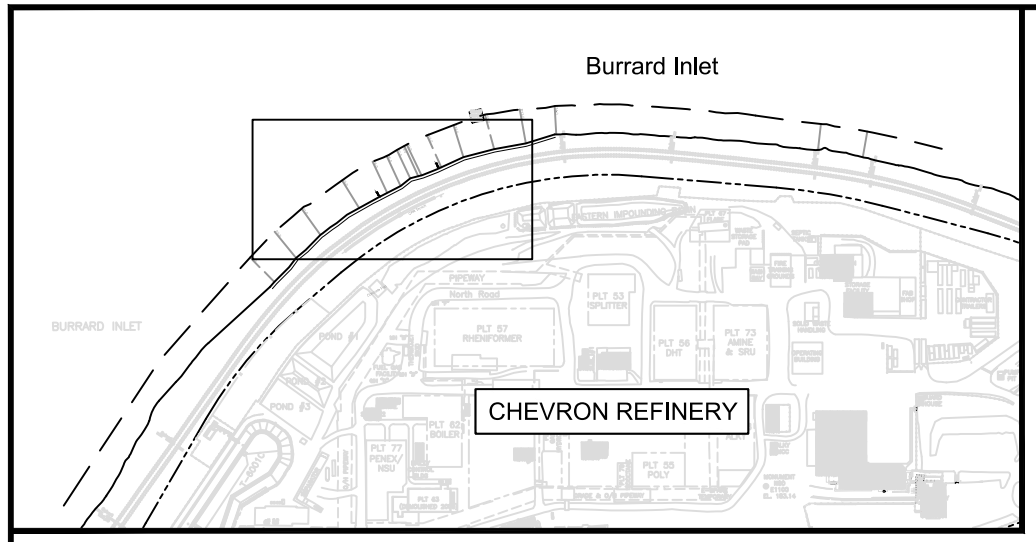
60347433

TITLE

FOR PORT OF VANCOUVER
PERMIT REFERENCE

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm
Last saved by: TIM.SMYTH(2016-12-14) Last Plotted: 2016-12-14
Filename: H:\URS-CHEVRON\60347433.3954\9154.CO_FORESHORE FINAL REMEDY\3. WORKING FILES\2016 CONTRACT DESIGN\900-CAD, GIS\910-CAD\05-MODELS\PORT OF VANCOUVER PERMIT APPLICATION\60347433-CONSTRUCTION AREAS.DWG
Printed on ___% Post-Consumer Recycled Content Paper

PER No. 16-180-D



Meters
10 0 10 20

PROPOSED MONITORING WELLS
PROPOSED AQUABLOK
EXISTING INTERIM REMEDIAL ACTION
PROPOSED POINT OF COMPLIANCE FORESHORE MONITORING WELL LOCATIONS
PROPOSED MONITORING WELLS
PROPOSED UPGRADIENT MONITORING WELLS
PROPOSED IMPERMEABLE POLYETHYLENE SHEET
PROPOSED SUBSURFACE COMPONENT
PROPOSED OLEOPHILLIC BIOBARRIER (OBB) EXTENTS
PROPOSED EMBANKMENT
PROPOSED AQUABLOK
PROPOSED RIP-RAP
PROPOSED COBBLES
PROPOSED MONITORING WELLS
REMOVE EXISTING INTERIM REMEDIAL ACTION AND BACKFILL WITH NATIVE SEDIMENT AND BEACH SAND TO MATCH EXISTING STRATIGRAPHY AND RESTORE SURFACE AND RIP RAP

EASTERN SEEP AREA
INBETWEEN AREA
WESTERN SEEP AREA
SEEPS
Toe of Slope (High Tide Line)
Top of Slope
Low Tide Line
COAST GUARD SITE
CPR ROW
CPR Trench
UNLINED PORTION OF EIB
PIPEWAY

MW12-14
MW12-3
A2MW09-13
MW12-5.5
MW03-02
A2MW09-12
UEIB-16
UEIB-17
UEIB-15
A2MW
MW03-01
UEIB-10
CPR-1
MW12-1S
MW12-1I
A2MW09-11
UEIB-9
MW10-3I
MW10-3D
UEIB-8
A2MW09-02
UEIB-7
CPR-2
MW10-2I
UEIB-46
UEIB-6
MW10-2D
MW11-10I
UEIB-5
A2MW09-01
MW11-10S
UEIB-45
A2MW09-10
UEIB-4
MW12-2.5
G2-2A
G2-2B
MW12-2
U9
UEIB-3
A2MW09-05I
UEIB-13
U8
UEIB-11
UEIB-2
G2-2WT
MW10-1I
SPT-3
MW10-1D
UEIB-14
UEIB-1
A2

VANCOUVER FRASER PORT AUTHORITY
This drawing has been reviewed by the Vancouver Fraser Port Authority solely for the purpose of VFPA's issuance of a Project Permit. This permit in no way denotes design, engineering or structural approval or endorsement.

REFERENCES		REVISIONS							REVISIONS								
DRAWING NO.	TITLE	NO.	DESCRIPTION	BY	CHK.	APR.	DATE	CLIENT	NO.	DESCRIPTION	BY	CHK.	APR.	DATE	CLIENT		
																SCALE:	AS SHOWN
																DESIGNED BY:	RH
																DRAWN BY:	TS
																CHECKED BY:	RK
																PROJECT MNGR:	MG
																CLIENT:	

AECOM
3292 Production Way
Burnaby, BC
T 1.604.444.6400 F 1.604.294.8597

Chevron Canada Limited
Burnaby Refinery

Foreshore Final Remedy

FINAL REMEDY MAP VIEW

PROJECT NO.
FIGURE NO. 16
REV NO. 1
DATE July 2016

PORT of vancouver

Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4
portvancouver.com

September 28, 2017

Mr. Michael Gill
Senior Environmental Engineer
AECOM
3293 Production Way
Burnaby, BC V5A 4R4

Dear Mr. Gill:

Re: **VFPA Project Permit No. 16-180**
Chevron Refinery Foreshore Final Remedy
Request for Extended Hours of Work

The Vancouver Fraser Port Authority (VFPA) has received AECOM's September 19, 2017 request to undertake Project Permit No. 16-180 shoreline remediation activities within VFPA jurisdiction during extended hours of work at night Monday to Saturday 12am to 7am in Burnaby, BC. This constitutes an exemption to Condition 22 of the Permit.

Extended hours of work are understood to be limited to the following dates: from September 28 to November 15, 2017. The shoreline remediation activities proposed during these hours include:

- Minor rip rap placement;
- Excavation and backfill to 0.4 m depth from 8 m to 12 m from the original toe of the slope;
- Placement of a geotextile;
- Placement of 200 mm cobbles on top of geotextile to grade; and
- Installation of monitoring wells using an excavator mounted auger.

Due to AECOM's need to work within the low tide window to mitigate the in-water dispersal of suspended contaminated sediments in conjunction with their Project Permit, **VFPA will allow extended hours of work during the above noted windows provided the following conditions are met:**

1. AECOM shall ensure the scope of works undertaken during extended hours is limited to the activities outlined in their September 20 and 21, 2017 emails detailing the request.

... /2

2. AECOM must implement all proposed mitigation measures and activities outlined in their September 20 and 21, 2017 emails including a construction notification email to the City of Burnaby and the Tsleil Waututh First Nation prior to extended work hours. VFPA must approve the content of the email prior to distribution. It is understood that the proposed works were communicated to the Chevron Burnaby Community Advisory Panel during their September 20, 2017 meeting and that no concerns were raised.

3. All Project Permit No. 16-180 conditions shall be strictly adhered to during extended work windows.

VFPA reserves the right to cancel or revoke authorization for remediation work within the port authority's jurisdiction during extended periods should noise levels or disturbances to surrounding residents exceed reasonable levels.

Should you have any questions please contact Spencer Chaisson, Environmental Coordinator at 604-665-9389 or spencer.chaisson@portvancouver.com.

Yours truly,

VANCOUVER FRASER PORT AUTHORITY

Greg Yeomans
Director, Planning & Development

cc Tegan Smith, Manager, Planning, VFPA
Andrea Macleod, Manager, Environmental Programs
Spencer Chaisson, Environmental Programs, VFPA
Barbara Yandel, Real Estate, VFPA
Jessica Davies, Aboriginal Affairs, VFPA
Cherryl Lam, Project Communications, VFPA

Gauthier, Ken

From: Chaisson, Spencer <Spencer.Chaisson@portvancouver.com>
Sent: Tuesday, November 07, 2017 3:43 PM
To: Southern, Leslie
Cc: Gauthier, Ken; Kannappan, Ram; Horwath, Robert; Gill, Michael (Vancouver); christopher.boys@parkland.ca
Subject: RE: VFPA Permit 16-180 - future sampling events

Hi Leslie,

VFPA has decided that additional approval for ongoing monitoring, during night or day, is not required so long as there are no new intrusive works. This does not limit any of the conditions or requirements of VFPA Permit 16-180.

Several restrictions will apply:

1. Crossing other lease boundaries for access will continue to require prior approval – specifically if you plan night time access across the Penzance rail tracks, which is not a public crossing. You have stated that access will be by boat but we must be alerted if that changes.
2. Share the well sampling/monitoring schedule with the Chevron/Parkland Community Advisory Panel so that they are aware of planned night time works.
3. For all night time works that require access by boat – myself and Marine Operations (Harbour_Master@portvancouver.com) must be notified 2 days in advance via email.

These requirements will be reiterated after VFPA receives the plans and schedules for post-construction monitoring as detailed in condition 42 of VFPA Permit 16-180.

Thank you,

Spencer Chaisson
Environmental Coordinator
Environmental Programs
P 604.665.9389
E spencer.chaisson@portvancouver.com

PORT of vancouver

Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4
portvancouver.com

From: Chaisson, Spencer
Sent: Friday, November 03, 2017 12:10 PM
To: 'Southern, Leslie' <leslie.southern@aecom.com>
Cc: Gauthier, Ken <ken.gauthier@aecom.com>; Kannappan, Ram <ram.kannappan@aecom.com>; Horwath, Robert <robert.horwath@aecom.com>; Gill, Michael (Vancouver) <michael.gill@aecom.com>; christopher.boys@parkland.ca
Subject: RE: VFPA Permit 16-180 - November sampling event

Hello Leslie.

Thank you for providing this information. By way of this email, provided the ongoing activities consist of monitoring and sampling the wells at the site (i.e., no new intrusive works), the period of validity for VFPA Permit 16-180 extended work hours as stated in the attached 2017-09-28 letter is hereby extended to November 16, 2017.

As project construction nears completion and you move on to monitoring, please be sure to fulfill conditions 39 to 43 of VFPA Permit 16-180.

Thank you,

Spencer Chaisson
Environmental Coordinator
Environmental Programs
P 604.665.9389
E spencer.chaisson@portvancouver.com

PORT of vancouver

Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4
portvancouver.com

From: Southern, Leslie [mailto:leslie.southern@aecom.com]
Sent: Friday, November 03, 2017 11:43 AM
To: Chaisson, Spencer <Spencer.Chaisson@portvancouver.com>
Cc: Gauthier, Ken <ken.gauthier@aecom.com>; Kannappan, Ram <ram.kannappan@aecom.com>; Horwath, Robert <robert.horwath@aecom.com>; Gill, Michael (Vancouver) <michael.gill@aecom.com>; christopher.boys@parkland.ca
Subject: VFPA Permit 16-180 - November sampling event

Spencer,

As discussed, we plan on collecting porewater samples from the wells on the Foreshore in November 14-16, approximately 6:30pm to 11:00pm). The sampling must be completed at night, when the tide allows access. A subcontractor will provide access to the site via boat. They will bring a generator and light stands to illuminate the work area - which is comprised of the two barriers. A barge and heavy equipment will not be at the site.

The exemption to condition 22 of the permit provided on September 28, to allow for extended work hours expires on November 15, 2017. Can this be extended to November 16?

Thank you,

Leslie

Leslie Southern M.Sc., P.Ag.
Environmental Scientist
leslie.southern@aecom.com

AECOM
3292 Production Way, Suite 330
Burnaby, BC V5A 4R4
T 604-444-6608 F 604-294-8597
www.aecom.com

APPENDIX F

QUALITY ASSURANCE AND QUALITY CONTROL PROGRAM

APPENDIX F - QUALITY ASSURANCE AND QUALITY CONTROL PROTOCOLS

1. DATA QA/QC

In order to assure the integrity and defensibility of the data collected, rigorous QA/QC protocols will be observed. These protocols ensure that all samples are properly collected, identified, stored, shipped, and documented. Standard operating procedures (SOPs) for sample collection and storage, equipment decontamination, and sample chain of custody protocols will be followed. Porewater and surface water samples will be collected using sampling techniques presented in Section 6. The use of these methods will ensure the quality, soundness, and defensibility of the data obtained. The laboratory analytical data, once generated, will be proofed for inconsistencies and anomalies. Field duplicates, trip blanks, and rinsate blanks will be collected for QA/QC purposes.

1.1. Field Duplicate Samples

Field duplicate samples are two identical samples that are submitted to the laboratory with no indication that they are the same. The analysis of field duplicate samples provides an indication of the total precision of the sampling and analysis process. Field duplicate samples will be collected and analyzed at a rate of approximately 10% of samples for a given analytical suite.

1.2. Trip Blanks

Trip blanks are samples of clean deionized, distilled (Reagent Grade Type II) water that are prepared in the laboratory, taken to the field, retained on site throughout sample collection, returned to the laboratory, and analyzed with the environmental samples. The QA/QC review identifies trip blanks with detections of target analytes and evaluates the effect of the detections on associated sample results for possible cross-contamination during transport. One trip blank will be included for analysis in every cooler submitted to the laboratory.

1.3. Rinsate Blanks

Rinsate blanks are samples of deionized and distilled analyte free (Reagent Grade Type II) water that are prepared in the field by pouring water over or through decontaminated field sampling equipment, prior to the collection of the environmental samples. The QA/QC review identifies rinsate blank detections of target analytes and evaluates the effect of the detections on associated sample results for possible cross-contamination during sample collection. Rinsate blank samples will be collected and analyzed at a rate of approximately 5% of samples for petroleum hydrocarbon parameters (BTEX, VPHw, and LEPHw).

QUALITY ASSURANCE/QUALITY CONTROL

2. Precision

Precision measures the reproducibility of repetitive measurements and is usually expressed in terms of imprecision. It is strictly defined as the degree of mutual agreement among multiple independent measurements as the result of repeated application of the same process under similar conditions.

Analytical precision is a measurement of the variability associated with the duplicate (*i.e.,* two) or replicate (*i.e.,* more than two) analyses of the same sample in the laboratory, and is determined by the analysis of matrix spike duplicate or laboratory duplicate samples.

Total precision is a measurement of the variability associated with the entire sampling and analysis process. It is determined by the analysis of duplicate or replicate field samples and incorporates any variability introduced by the analytical procedure, sample collection and handling procedures, and matrix factors. Precision data must be interpreted by taking into consideration these possible sources of variability.

Duplicate field samples will be collected, and duplicate spiked or unspiked samples will be analyzed to assess analytical precision. The results will be assessed using the relative percent difference (RPD) between duplicate measurements. The equation used to calculate RPD for duplicate samples is:

$$RPD = \frac{(A - B)}{((A + B)/2)} \times 100$$

where:

A = analytical result
B = duplicate result.

Note that for RPDs the result can be a positive or a negative value. RPDs are often presented as *absolute* RPDs, in which case the absolute value of the RPD is reported, always resulting in a positive number. Reporting the absolute RPD results in a reduction in information, since, for instance, if a duplicate sample consistently returns higher results than the original sample, all RPD values would be negative and it may be an indication of a precision problem. In this case, if absolute RPD was reported, no indication would be forthcoming.

Total precision will be determined by collecting field duplicate samples. These samples will be collected and analyzed at a rate of approximately 10% of total samples for each analytical suite.

Analytical precision will be determined in the laboratory by running matrix spike/matrix spike duplicate (MS/MSD) pairs, or by running laboratory duplicate analyses. These samples will be

analyzed at a rate of approximately 5% for each analytical suite.

3. Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (*e.g.,* variability due to imprecision) and systematic error (*e.g.,* bias). Therefore, accuracy reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ beyond acceptable limits from the true value or known concentration of the spike or standard. Acceptance criteria are indicated in the individual standardized analytical methods.

Analytical accuracy is typically measured by determining the percent recovery of known target analytes that are spiked into a field sample (*i.e.,* a surrogate or matrix spike), or reagent water (*i.e.,* laboratory control sample [LCS] or blank spike) before extraction at known concentrations. Percent recovery is calculated as:

$$\%REC = \frac{A}{B} \times 100$$

where:

A = obtained value
B = true value.

Analytical accuracy will be determined in the laboratory by the running of MS samples or laboratory control samples. These samples will be analyzed at a minimum rate of 5% for each analytical suite.

4. Completeness

Completeness for the investigation will be defined as the percentage of valid analytical results. Results made uncertain due to missed hold times, improper calibration, blank contamination, or poor calibration verification results would be deemed invalid. Results that may be flagged due to matrix effects are not considered invalid. Completeness for projects should exceed 90%. Completeness is calculated by:

$$completeness = \frac{A}{B} \times 100$$

where:

A = number of valid analytical results
B = total number of analytical results.

Appendix L – Project Data

Table L-1 Project Data

Project Team Members	
The project team consisted of Parkland, AECOM, Tervita, Inlailawatash, Tsleil-Waututh First Nation, Mercury Launch & Tug Ltd., and PS Surveys	
Date	**Project Milestones**
July 10, 2017	Construction Begins
July 13-15 and August 16-17, 2017	Western IRA Barrier Excavated
July 14-August 8, 2017	Eastern IRA Barrier Excavated
July 12 - October 21, 2017	Western FPTS Installed [2]
July 12-October 21, 2017	Eastern FPTS Installed [2]
October 30, 2017	Construction Completed
October 9, 10, 11, 12, 13, 14, 20 and 21, 2017	Night shifts
Total hours worked	5642
Number of First Aids and Recordable Injuries	0

Equipment Used on Site During Construction[1]
Tug boat
Barge and Ramp
Barge crane
Rescue Boat (12 Ft Aluminum Boat)
Water Taxi
Marooka Dump Truck
Bobcat T650 - 3000 lb Skid Steer (with Bobcat 30C Auger attachment)
Small Equipment and Hand Tools
20 Tonne Excavator
Forklift
Loader
PID
GPS survey unit
Generator
Light towers
Submersible Sump Pump
Heron Oil/Water Interface meter
RKI Eagle
YSI 556 Water Quality Meter
Hach 2100Q Turbidity Meter

Sediment, Sand-organoclay and Backfill Samples		
Sample	**Quantity**	
Limit Samples from Eastern IRA Barrier	36	
Sand-organoclay samples from within the Eastern IRA Barrier	31	
Limit Samples from Western IRA Barrier	17	
Sand-organoclay samples from within the Western IRA Barrier	3	
Samples of backfill material	14	
Samples collected from up gradient of Eastern IRA Barrier	5	

Number of samples with exceedances above CSR Stage 11 Standards	
Total Limit Samples	7
Eastern IRA Barrier	5
Western IRA Barrier	2

Parameters which exceeded CSR Stage 11 Standards in Excavation Limit Samples			
Location	**Parameter**	**Maximum Concentration (µg/g)**	**Minimum Concentration (µg/g)**
Eastern IRA Barrier	2-Methylnapthalene	0.717	< 0.050
	Naphthalene	0.377	< 0.050
Western IRA Barrier	EPH (C10-C19)	2,250	< 200
	EPH (C10-C19) Silica Gel	2,770	1,610
	LEPH	2,250	< 200

Dimensions (metres)			
Area	**Length [3]**	**Width [3]**	**Depth [3]**
Western Trench Excavation	10 m	3 m	1.2 m
Eastern Trench Excavation	44 m	Generally 2.8 m, and 4 m at its widest point	1.2 m
Western FPTS	20 m	13 m	1.2 m
Eastern FPTS	60 m	17.5 m	1.2 m

Materials Installed at the Site	
Material	**Quantity**
Aquagate	36.1 tonnes
Aquagate and Powder Activated Carbon	36 tonnes
Aquablock	4 tonnes
Lafarge washed sand	627.7 tonnes
Cobbles	320.2 tonnes
Rip Rap	2,817.3 tonnes
Filter Fabric (Nilex Non-Woven 4510)	1254 m^2
HDPE Geomembrane (GSE HD)	1672 m^2
Geogrid (Nilex Bx1100 Biaxial)	1200 m^2
OBB (GSE Tendrain 7.6mm Geocomposite)	720 m^2
OBB (Skap Transnet HDPE Geocomposite with TN 330 Geonet)	242 m^2
Black Polyethylene (4 mm)	3 rolls
Well Materials	Quantity unconfirmed
Concrete	Quantity unconfirmed

Materials Removed from Site		
Type	**Classification**	**Volume**
Soil	Classified as above CSR Commercial Land Use Standard	103 tonnes
Soil	Classified as above CSR Residential Land Use Standard	367 tonnes
Demolition Refuse	Not classified	16 tonnes
Groundwater	Groundwater with trace BTEX	170,000 litres

Environmental Monitoring During Construction	
Number of surface water samples collected associated with Environmental Monitoring	320
Number of exceedances above WQG in surface water samples collected during Environmental Monitoring	128
Number of Environmental Incidents	0

Monitoring Wells Installed at the Site	
Total number of monitoring wells installed at the Site	33
Compliance wells	9
Sentry wells	8
Performance wells	8
Up Gradient wells	8

Tide	
High Tide	29.2 m (Refinery Datum)[4]
Low Tide	25.4 m (Refinery Datum)[4]
Area of Western FPTS exposed at high tide	215 m^2
Area of Eastern FPTS exposed at high tide	792 m^2

Notes and Acronyms

[1] The list of equipment is not exhaustive

[2] Timeline references the first day rip rap was removed off ground surface to completion of down slope cobble matting

[3] Unless otherwise specified, trench dimensions were approximated based on the maximum transect across or within the barrier

[4] Refinery datum is 27.9 metres above sea level

BTEX = benzene, toluene, ethylbenzene, xylenes
CSR = Contaminated Sites Regulation
EPH = extractable petroleum hydrocarbons
FPTS = Foreshore Passive Treatment System
IRA = Interim Remedial Action
HDPE = high density polyethylene
LEPH = light extractable petroleum hydrocarbons
m = metres
mm = millimetre
OBB = oleophilic bio barrier
RDL = Reportable Detection Limit
µg/g = micrograms per gram
WQG = Water Quality Guidelines