20 February 2018

Mary River Project

2017 Marine Environmental Effects Monitoring Program (MEEMP) and Aquatic Invasive Species (AIS) Monitoring Program

Submitted to:
Baffinland Iron Mines Corporation
2275 Upper Middle Road East,
Suite 300
Oakville, ON
L6H 0C3

REPORT

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Executive Summary

In 2017, Baffinland undertook a third consecutive year of environmental effects monitoring (EEM) at Milne Port as part of the Marine Ecological Effects Monitoring Program (MEEMP) and Aquatic Invasive Species (AIS) monitoring program for the Mary River Project. The MEEMP was developed in 2015 following completion of marine baseline studies in Milne Port during 2013 and 2014. Study components for the 2017 MEEMP included marine water and sediment quality, marine epifauna[1], marine vegetation (i.e., macroflora), and fish and fish habitat. The MEEMP sampling design is based on the Metal Mining Technical Guidance for Environmental Effects Monitoring (EEM) (Environment Canada 2012), and includes statistical approaches to detecting potential project-induced impacts on the marine environment. The MEEMP study design and data collection methodology followed the same approach utilized in 2016 to provide technical continuity and repeatability of the program and to allow for inter-annual comparisons of the multi-year dataset. The AIS monitoring program was also developed in 2015 as part of the MEEMP to enhance baseline data and provide early warning of potential AIS introductions in Milne Port. Monitoring parameters for the 2017 AIS monitoring program targeted lower trophic levels, including zooplankton, benthic invertebrates (i.e., epifauna and infauna[2]), macroflora and fish.

Sampling methodology for the 2017 MEEMP and AIS monitoring programs generally followed the approach of previous years (2014-2016). Vertical water quality profiling was conducted at 19 sampling stations in Milne Inlet to collect surface-to-bottom measurements of conductivity, temperature, depth, dissolved oxygen, pH, turbidity and chlorophyll *a*. Discrete water quality samples were collected at four sampling stations near the effluent discharge point in Milne Port (distributed in a radial design) to monitor for potential changes in water quality due to site drainage and operational discharges (including iron ore stockpile run-off). Sediment samples and underwater video were collected along four transects surveyed in previous years (2014-2016) as part of a radial gradient design that allowed for monitoring effects as a function of distance from the ore dock point source, in consideration of potential contaminant issues (e.g., ore dust, hydrocarbon deposition) and/or physical impacts (sediment re-suspension and transportation) in the marine environment. Fish sampling was conducted throughout Milne Port using a combination of fish collection techniques (e.g. gill net, Fukui trap, trolling, and jigging). Incidental fish mortalities were retained for aging, body burden, stomach content, and toxicology analyses. Zooplankton, benthic infaunal and fish samples were collected in Milne Port, along with additional underwater video surveys, as part of the AIS monitoring program. Settlement baskets deployed in 2016 were recovered from the southwest corner of the ore dock for analysis of encrusting epifauna and additional baskets were deployed on the eastern side of the ore dock. Additional sampling for sediment, benthic infauna and zooplankton (including deployment of settlement baskets) was conducted in 2017 at Ragged Island to screen for the presence of AIS near existing ship anchorage sites.

Oceanographic conditions in Milne Inlet were primarily tidal driven with influences from freshwater input, winds, atmospheric conditions and heat fluxes. Short term variations in physical properties mostly occurred in the upper layers of the water column. Salinity and temperature depth profiles showed a vertical density gradient with relatively "lighter" warmer and less saline water floating on top of heavier colder and more saline water. Water in Milne Inlet

[1] Epifauna – organisms living on the seafloor (e.g. sea stars, crab).

[2] Infauna – organisms living in the substrate of the seafloor (e.g. polychaete worms, clams).

and at Ragged Island was clear throughout the water column with slightly higher turbidity at the surface. Turbidity adjacent to the vessel anchorage location at Ragged Island ranged between 1 and 1.5 NTU.

All water quality samples collected in 2017 were below the applicable water quality guidelines[3] for all tested parameters. Concentrations of iron and aluminum were above detection limits; however, these parameters do not have established limits in the CCME guidelines. Temporal and spatial variability were generally low among water samples collected throughout the water quality program. A single sample collected near the effluent discharge location contained moderately elevated levels of TSS, turbidity, aluminum and iron (relative to the other three sampling stations located offshore); however, the sample was collected during a storm event when heavy wave action was observed to be re-suspending sediment from the seafloor at the sampling site. The higher concentrations of TSS, turbidity, and metals observed in this one sample were assumed to be representative of sediment re-suspension in the water column during sample collection, and not related to effluent discharge.

Sediment samples were analyzed for particle size composition, organic content and concentrations of metals and hydrocarbons. Particle size composition was generally consistent with results from previous years (2014 through 2016). Metal concentrations were generally correlated with sediment physical composition. In general, metal concentrations, when detected, were higher in areas with a higher proportion of fines. Arsenic concentrations exceeded CCME Interim Sediment Quality Guidelines (ISQGs) at three stations, but did not exceed the CCME Probable Effect Level (PEL). Exceedances of CCME ISQG for arsenic were also reported in previous years (2014 through 2016). High concentrations of arsenic in local sediments are likely naturally-occurring, as arsenic is not a component of ore processing or other Project-related activities. All other metals, volatile organic compounds, and hydrocarbons, were below CCME ISQG levels in 2017.

Significant changes in sediment composition (i.e., per cent fines, iron concentrations) over time were observed in Milne Port, particularly on the West and East Transects; however, it is unclear as to whether these changes are indicative of Project-related effects or associated with natural processes. On the East Transect, percent fines and iron concentrations were shown to increase significantly in the proximity of the dock and at the 500 m sampling station. These changes in sediment composition in proximity to the ore dock may represent ore dust deposition or may reflect substrate shifts due changes in local hydrodynamic conditions caused by the presence of the dock. On the West Transect, no differences were observed in percent fines or iron concentrations near the dock, but significant increases were observed at the far-field sampling locations (500 m, 1,000 m, and 1,500 m sampling stations). Percent fines at these stations increased significantly from 2014 to 2017, although measurements in 2015 and 2016 were not significantly different from either 2014 or 2017. Iron concentrations at these stations also increased significantly from 2015 to 2017, although measurements in 2017 were not significantly different from 2014 baseline conditions. Changes in sediment composition on the West Transect may be related to propeller scour effects (and re-deposition of sediment) or due to alluvial depositions from Philips Creek. To date, no clear long-term trends are evident in sediment accumulation or iron concentrations.

Benthic epifaunal abundance and macroflora cover were generally highly variable along the radial transects within each monitoring year, and between monitoring years, with few identifiable trends. On the West Transect, a significant decrease in epifauna abundance was observed at the closest sampling station to the ore dock in 2017. On the same transect in the same year (2017), a significant increase in epifauna abundance was observed at the

[3] Canadian Council of Ministers of the Environment (CCME) – Canadian Water Quality Guidelines {WQG} for The Protection of Aquatic Life (CCME 2002)

far-field station (1,500 m) closest to the Phillips Creek. The epifaunal community in this area was dominated by brittle stars and sea urchins, both mobile taxa. As a result, it is possible that epifauna have simply re-distributed further along the West Transect in 2017 in response to changes in sediment composition. In general, the total abundance and relative abundance of epifauna was similar in all areas between 2016 and 2017, suggesting that while changes in distribution may have occurred along the West Transect, the overall community composition has remained unchanged from previous years.

Total fish catch was generally lower compared to the 2016 survey, but comparable with catch levels in 2015 and 2016. The observed decrease in total fish catch in 2017 compared to 2016 may be attributable to timing of sampling, as 2017 sampling began two weeks later than in 2016. Arctic char, an anadramous species with a narrow migratory window in the marine environment, were the dominant species captured in captured in 2016 representing 80% of the total catch. Arctic char were less common in 2017, representing only 19% of the total catch. Stomach content analysis of Arctic char contained larval fish, planktonic amphipods, and epibenthic mysid shrimp; all taxa which were identified in the zooplankton samples collected during the AIS monitoring program. One new genus of fish was identified during the survey, sand lance (*Ammodytes* sp.), which is a schooling bottom-dwelling fish that occurs in coastal inshore waters and is an important forage fish for marine birds, mammals and fish. In addition to the adult specimen captured, larval sand lance were also collected in the zooplankton samples in Milne Port, indicating successful spawning is likely occurring in Milne Inlet.

Metals in Arctic char tissue samples were primarily below detectable limits, except for arsenic, cadmium, chromium, copper, iron, mercury, and zinc, whose concentrations exceeded detection limits during at least one sampling event. Concentrations of these metals in fish tissue were generally consistent throughout 2010 to 2017. None of the samples exceeded Health Canada's guideline for mercury in fish tissue for human consumption of 0.5 mg/kg.

No species recorded during AIS sampling were identified as invasive to the Arctic region. One species of benthic invertebrate collected in infauna samples in Milne Port in both 2017 and 2013, a tube-dwelling amphipod, *Monocorophium insidosium*, is listed as "invasive" in the global database of invasive species. The best available literature is currently inconclusive as to whether this species is invasive to the northeastern Atlantic or if its occurrence in Milne Inlet falls within the northern range of its natural geographic distribution. Further, this species was identified during surveys in 2013, prior to the initiation of operational iron ore shipping, which suggests that Project shipping activities were not the initial vector of its arrival in Milne Port. Upon recovery of the settlement baskets, it was determined that the amount of colonization on the settlement baskets was insufficient for analysis, so no processing of the samples occurred. The settlement baskets were cleaned and re-deployed in the same location on the southwest corner of the existing ore dock for retrieval in 2018. Additional settlement baskets were deployed on the northeast side of the ore dock in Milne Port and at Ragged Island for retrieval in 2019 assuming a two-year cycle of epifaunal growth is required for sampling and analysis.

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ACRONYMS AND ABBREVIATIONS

Abbreviation and Acronyms	Definition
°C	Degree Celsius
AICc	Akaike's information criterion, corrected for small sample size
AIS	Aquatic Invasive Species
ANOVA	Analysis of Variance
ANCOVA	Analysis of Covariance
Baffinland	Baffinland Iron Mines Corporation
BACI	Before/After Control/Impact
Biologica	Biologica Environmental Services
CCME	Canadian Council of Ministers of Environment
CPUE	Catch Per Unit Effort
CRM	Certified Reference Materials
CTD	Conductivity, Temperature, Depth
DFO	Fisheries and Oceans Canada
DL	Detection Limit
EEM	Environmental effect monitoring
ERP	Early Revenue Phase
ESQG	Interim Sediment Quality Guidelines
FEIS	Final Environmental Impact Statement
GAM	Generalized Additive Model
GRTS	Generalized Random Tessellation Stratification
GPS	Global Positioning System
HDPE	High Density Polyethlene
IM	Incidental Mortality
Indet.	Indeterminate
ISQG	Interim Sediment Quality Guideline
LSA	Local Study Area
Maxxam	Maxxam Analytics
MEEMP	Marine Environmental Effect Monitoring Program
MEWG	Marine Environmental Working Group
m	Metre(s)
MDL	Method Detection Limit
mg/kg	Milligrams per Kilogram
Mg/L	Milligrams per Litre
mg	Milligram
mm	Millimetre
Mtpa	Million tonnes per annum
µm	Micrometre

Abbreviation and Acronyms	Definition
NRI	Nunavut Research Institute
NTU	Nephelometric Turbidity Unit
NIRB	Nunavut Impact Review Board
No.	Number
PAH	Polycyclic Aromatic Hydrocarbons
PC	Project Certificate
PCA	Principal Component Analysis
PEL	Probable Effect Level
PSU	Practical Salinity Unit
QA/QC	Quality Assurance/Quality Control
RM	Repeated Measures
RPD	Relative Percent Differences
SD	Standard Deviation
SE	Standard Error
SEM	Sikumiut Environmental Management Ltd.
sp.	Species
SWI	Standard Working Instructions
The Project	Mary River Project
TIC	Total Inorganic Carbon
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UTM	Universal Transverse Mercator
WQG	Water Quality Guidelines
WW	Wet weight

1.0 INTRODUCTION

In 2017, Baffinland Iron Mines Corporation (Baffinland) undertook the third consecutive year of environmental effects monitoring (EEM) at Milne Port as part of the 2017 Marine Ecological Effects Monitoring Program (MEEMP) and Aquatic Invasive Species (AIS) monitoring program for the Mary River Project. Both programs were originally developed in 2015 following completion of marine baseline studies in Milne Port during 2013 and 2014. The MEEMP and AIS monitoring programs are intended to provide a primary means to identify and quantify project-induced change in the marine environment. Where such change occurs, the programs assist in identifying appropriate modifications to, or mitigation of, project operational activities to avoid and/or minimize adverse effects on the marine environment. Results from the MEEMP and AIS monitoring programs also provide information to the Nunavut Impact Review Board (NIRB) to support its yearly review of the Mary River Project. This report presents the results for the MEEMP and AIS monitoring programs conducted in Milne Inlet during the 2017 open-water season. Some results include analyses of survey data collected in previous survey years (2010-2016) for comparative purposes.

1.1 Background

The Mary River Project (hereafter, “the Project”) is an operating iron ore mine located in the Qikiqtaaluk Region of North Baffin Island, Nunavut (Figure 1). Baffinland is the owner and operator of the Project. The operating Mine Site is connected to a port at Milne Inlet (Milne Port) via the 100-km long Milne Inlet Tote Road. Undeveloped components of the Project include a South Railway connecting the Mine Station to a future port at Steensby Inlet (Steensby Port).

A Project Certificate No. 005, amended by the Nunavut Impact Review Board (NIRB) on 27 May 2014, authorizes Baffinland to mine up to 22.2 million tonnes per annum (Mtpa) of iron ore from Deposit No. 1. Of this 22.2 Mtpa, Baffinland is authorized to transport 18 Mtpa of ore by rail to Steensby Port for year-round shipping through the Southern Shipping Route (via Foxe Basin and Hudson Strait), and 4.2 Mtpa of ore by truck to Milne Port for open-water shipping through the Northern Shipping Route using chartered ore carrier vessels.

To date, Baffinland has been operating under the Early Revenue Phase (ERP) of the Project, which includes shipping up to 4.2 Mtpa during the open-water season from late July to late October, and the deferral of ore shipments from Steensby Port. Shipping of ore from Milne Inlet during the ERP began in 2015 and is expected to continue for the life of the Project (20+ years). During the first year of ERP Operations in 2015, Baffinland shipped approximately 900,000 tonnes via 13 ore carrier voyages. The amount of ore shipped during the 2017 open-water season has since increased to approximately 4.05 million tonnes via 58 return ore carrier voyages.

As a part of regulatory commitments, Baffinland has developed and implemented a multi-parameter EEM program for the marine environment, collectively referred to as the MEEMP. The MEEMP was designed to evaluate potential Project-related impacts on the marine environment as predicted in the Final Environmental Impact Statement (FEIS; Baffinland 2013) and FEIS Addendum (Baffinland 2013). Potential effects on the marine environment may include:

- Changes in water and sediment quality

- Changes in marine habitat and biota from contaminant sources (e.g., ore dust, hydrocarbon leaks, wastewater, and site runoff)
- Physical perturbations caused by shipping (sediment re-suspension and transportation)

The MEEMP includes monitoring of marine water and sediment quality, marine invertebrates, marine vegetation, and fish and fish habitat. The MEEMP sampling design is based on the Metal Mining Environmental Effects Monitoring (EEM) guidelines (Environment Canada 2012), and includes statistical approaches to detecting potential Project-induced impacts on the marine environment.

AIS monitoring is also an integral component of the MEEMP. AIS monitoring addresses the potential risks of invasive species introduction to the marine environment from ship ballast water and biofouling. The AIS study consists of collection of data on marine biological components, such as benthic invertebrates, zooplankton and fish, to establish a comprehensive inventory of aquatic species against which any changes in species composition caused by invasive species could be easily identifiable. Marine species identified during baseline studies in 2008, 2010 and 2013 also contributed to the AIS inventory.

This report presents the results of MEEMP and AIS monitoring programs conducted in the marine environment at Milne Port and in Milne Inlet during the 2017 open-water season.

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LEGEND

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- NUNAVUT SETTLEMENT AREA

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REFERENCE(S)

LOCAL STUDY AREA BOUNDARY DIGITIZED FROM THE MARY RIVER PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT (FEBRUARY 2012). HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT

BAFFINLAND IRON MINES CORPORATION

PROJECT

MARY RIVER PROJECT – MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE

PROJECT LOCATION

CONSULTANT

Golder Associates

YYYY-MM-DD	2018-02-20
DESIGNED	EG
PREPARED	AA
REVIEWED	JS
APPROVED	PR

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1.2 Objectives

In accordance with existing Terms and Conditions of Project Certificate #005, Baffinland is responsible for the establishment and implementation of the MEEMP which comprises EEM studies that are conducted over a sufficient time period such to allow for the following objectives:

- Assess the accuracy of effects predictions in the FEIS (Baffinland 2012) and Addendum 1 (Baffinland 2013).
- Assess the effectiveness of Project mitigation measures.
- Verify compliance of the Project with regulatory requirements, Project permits, standards and policies.
- Identify unforeseen adverse effects and provide early warnings of undesirable changes in the environment.
- Improve understanding of local environmental processes and potential Project-related cause-and-effect relationships.
- Provide feedback to the applicable regulators (e.g. NIRB) and advisory bodies (e.g. Marine Environmental Working Group or MEWG) with respect to:
    - Potential adjustments to existing monitoring protocols or monitoring framework to allow for the most scientifically defensible synthesis, analysis and interpretation of data.
    - Project management decisions requiring modification of operational practices where and when necessary.

The MEEMP was developed in consideration of Project-specific monitoring requirements outlined in the following Terms and Conditions of Project Certificate #005:

- Condition No. 76 – *'The Proponent shall develop a comprehensive Environmental Effects Monitoring Program to address concerns and identify potential impacts of the Project on the marine environment.'*
- Condition No. 83 (a) – *'To identify potential for and conduct monitoring to identify effects of sediment redistribution associated with construction and operation of the Milne Port.'*
- Condition No. 85 – *'The Proponent shall develop a monitoring plan to verify its impact predictions associated with sediment redistribution resulting from propeller wash in shallow water locations along the shipping route. If monitoring detects negative impacts from sediment redistribution, additional mitigation measures will need to be developed and implemented.'*
- Condition No. 87 – '*The Proponent shall develop a detailed monitoring program at a number of sites over the long term to evaluate changes to marine habitat and organisms and to monitor for non-native introductions resulting from Project-related shipping. This program needs to be able to detect changes that may have biological consequences and should be initiated several years prior to any ballast water discharge into Steensby Inlet and Milne Inlet to collect sufficient baseline data and should continue over the life of the Project.'*

- Condition No. 99 (a) – *'Establish shipping season, inter-annual baseline in Steensby Inlet and Milne Inlet that enables effective monitoring of physical and chemical effects of ballast water releases, sewage outfall, and bottom scour by ship props, particularly downslope and downstream from the docks. This shall include the selection and identification of physical, chemical, and biological community/indicator components. The biological indicators shall include both pelagic and benthic species but with emphasis on relatively sedentary benthic species (e.g., sculpins).'*
- Condition No. 99 (b) (ii) – *'The collection of additional baseline data in Milne Inlet on narwhal, bowhead and anadromous Arctic char abundance, distribution ecology and habitat use.'*
- Condition No. 113 – *'The Proponent shall conduct monitoring of marine fish and fish habitat, which includes but is not limited to, monitoring for Arctic char stock size and health condition in Steensby Inlet and Milne Inlet, as recommended by the Marine Environment Working Group.'*
- Condition No. 114 – *'In the event of the development of a commercial fishery in the Steensby Inlet area or Milne Inlet‐Eclipse Sound areas, the Proponent, in conjunction with the Marine Environment Working Group, shall update its monitoring program for marine fish and fish habitat to ensure that the ability to identify Arctic char stock(s) potentially affected by Project activities and monitor for changes in stock size and structure of affected stocks and fish health (condition, taste) is maintained to address any additional monitoring issues identified by the MEWG relating to the commercial fishery.'*
- Condition No. 126 – *'The Proponent shall design monitoring programs to ensure that local users of the marine area in communities along the shipping route have opportunity to be engaged throughout the life of the Project in assisting with monitoring and evaluating potential project-induced impacts and changes in marine mammal distributions.'*

1.3 Study Area

Field sampling conducted in support of the 2017 MEEMP and AIS monitoring programs was conducted primarily within the Local Study Area (LSA) for the Marine Environment as defined[4] in the FEIS and Addendum 1 (Baffinland 2012; 2013). The LSA includes all of Milne Port (Assomption Harbour) and extends north up to 4 km from the existing terminal (spanning the full width of Milne Inlet at the northern boundary) (Figure 1). The southeast boundary of the LSA ends at the confluence of Milne Inlet with Phillips Creek.

In 2017, water quality and AIS monitoring was extended to Ragged Island (north of the LSA boundary) in response to concerns that ships were potentially discharging ballast water while occupying anchorage sites in this area (based on feedback provided during community workshops and annual MEWG meetings in 2016).

[4] The LSA includes all marine waters where there exists a reasonable potential for direct measurable effects from Project activities on the marine environment.

2.0 MATERIALS AND METHODS

2.1 Study Design

2.1.1 MEEMP

The sampling design for the MEEMP was based on a radial gradient pattern originating at the ore dock (Figure 2). The ore dock represents the potential point source for contaminants (e.g., ore dust, hydrocarbon deposition) and physical perturbations (e.g., sediment re-suspension and transportation). The radial pattern is designed to detect potential Project-related effects based on a gradient of key components with numerical indicators (e.g., metal concentrations in sediment and abundance of benthic biota) with increasing distance from the point source.

The MEEMP included the following study components:

- Marine water quality
- Marine sediment quality
- Substrate, macroflora, and benthic epifauna
- Fish surveys

Water quality was added to the MEEMP in 2015 to monitor for potential changes in water quality associated with site drainage and treated effluent discharges to the marine environment (including iron ore stockpile run-off). Four water quality stations were arranged near the site discharge point for compliance monitoring; one station next to the site discharge point, and three stations located slightly offshore in a radial pattern.

The EEM sampling design for sediment quality, benthic infauna and macroflora was based on a radial gradient transect design extending out from the ore dock. A series of sampling stations were arranged at increasing distances from the point source along each of four transects. Three transects (East, West and Coastal) were arranged along the 15 metre (m) depth contour to minimize the confounding influence of depth on sediment and associated biota. The 15 m depth contour was considered to be unaffected by winter ice scour and was previously associated with relatively higher species counts and increased species diversity for both marine flora and fauna (SEM 2015). The East and West Transects extended approximately 1,700 m and 1,800 m to the east and the west of the ore dock respectively. The Coastal Transect started at the eastern terminus of the East Transect and extended north along the 15 m depth contour for approximately 4,250 m. The fourth transect (North Transect) extended directly offshore of the existing ore dock out to a distance of 2,000 m, corresponding with a water depth of approximately 100 m. This transect included both a distance and depth gradient for consideration in the EEM analyses.

The statistical design was based on repeated measures (RM) distance regression analyses with each station re-sampled annually. The RM distance regression analysis is an alternative to the Before/After Control/Impact (BACI) analysis of variance (ANOVA) design and has higher sensitivity to change and is more robust than simple comparison of parameters between control and impact locations. From the point source, stations are established along the distance gradient which allows for physical, chemical and biological changes to be assessed spatially (SEM 2015). This design was also used to identify adverse (negative) environmental effects for further mitigation and/or alterations to Project activities. Analysis of covariance (ANCOVA) was applied to baseline and monitoring data to compare gradients in the regression line to determine if monitoring results are significantly different than baseline conditions. Should the linear regression not adequately describe the data, a quadratic or logarithmic equation was used to better describe the data[5].

Fish survey data were used for two different analyses – 1) relative abundance, as indicated by catch per unit effort (CPUE) and 2) length frequency analysis. For the first analysis, it was important to sample the area randomly, to accurately represent the underlying relative abundance of fish. For the second analysis, a high number of captured fish was important, to be able to construct a detailed fish length histogram. Due to the different requirements of data, sampling proceeded in two steps. In the first step, fish were sampled at spatially-balanced, randomly-selected areas along the transects. Once the initial sampling effort was complete, the crew returned to stations that had high fish densities and sampled again to increase the number of fish captured for length frequency analysis. Note that this assumed no differences in the spatial distribution of fish of different age classes. Fish data from Generalized Random Tessellation Stratification (GRTS)-based sampling locations were used to calculate species distribution, relative abundance, and CPUE. Fish data from all sampling locations (both random and selective) were used to construct species-specific length and weight distributions.

2.1.2 Aquatic Invasive Species

The AIS monitoring program was designed to detect potential introduction of non-native species from ballast water discharges and/or hull biofouling. AIS monitoring did not follow a radial gradient design, but was instead based on a Before/After experimental design that focused on areas with the highest likelihood of marine invasion. Monitoring for the AIS program was conducted at the surveillance level with a threshold of detection of a single occurrence of an invasive species in order to trigger adaptive management measures (e.g., ballast water treatment) and/or potential corrective actions (measures to eradicate the AIS), if deemed feasible.

Since all ballast water releases are required to occur in Milne Port, AIS sampling conducted to date has largely focused in southern Milne Inlet. Baseline AIS surveys were conducted in 2014 to enhance marine flora and fauna inventories collected during baseline sampling in 2008 and 2013. AIS monitoring undertaken in 2015 and 2016 focused on identification of organisms not previously detected during the baseline program (as primary indicators of invasion). Equivalent AIS monitoring was conducted in the Milne Port area during 2017, although the program was expanded to include AIS sampling at Ragged Island in response to public concern over ships discharging ballast water while occupying anchorage sites in this area.

The AIS monitoring program included the following study components:

- Zooplankton
- Benthic infauna
- Macroflora and benthic epifauna
- Fish and mobile epifauna
- Encrusting epifauna

[5] The equation for a quadratic regression model is: $y = ax^2+bx+y_0$, where a is the curve of the line, b is the slope of the line and y_0 is the y-intercept.

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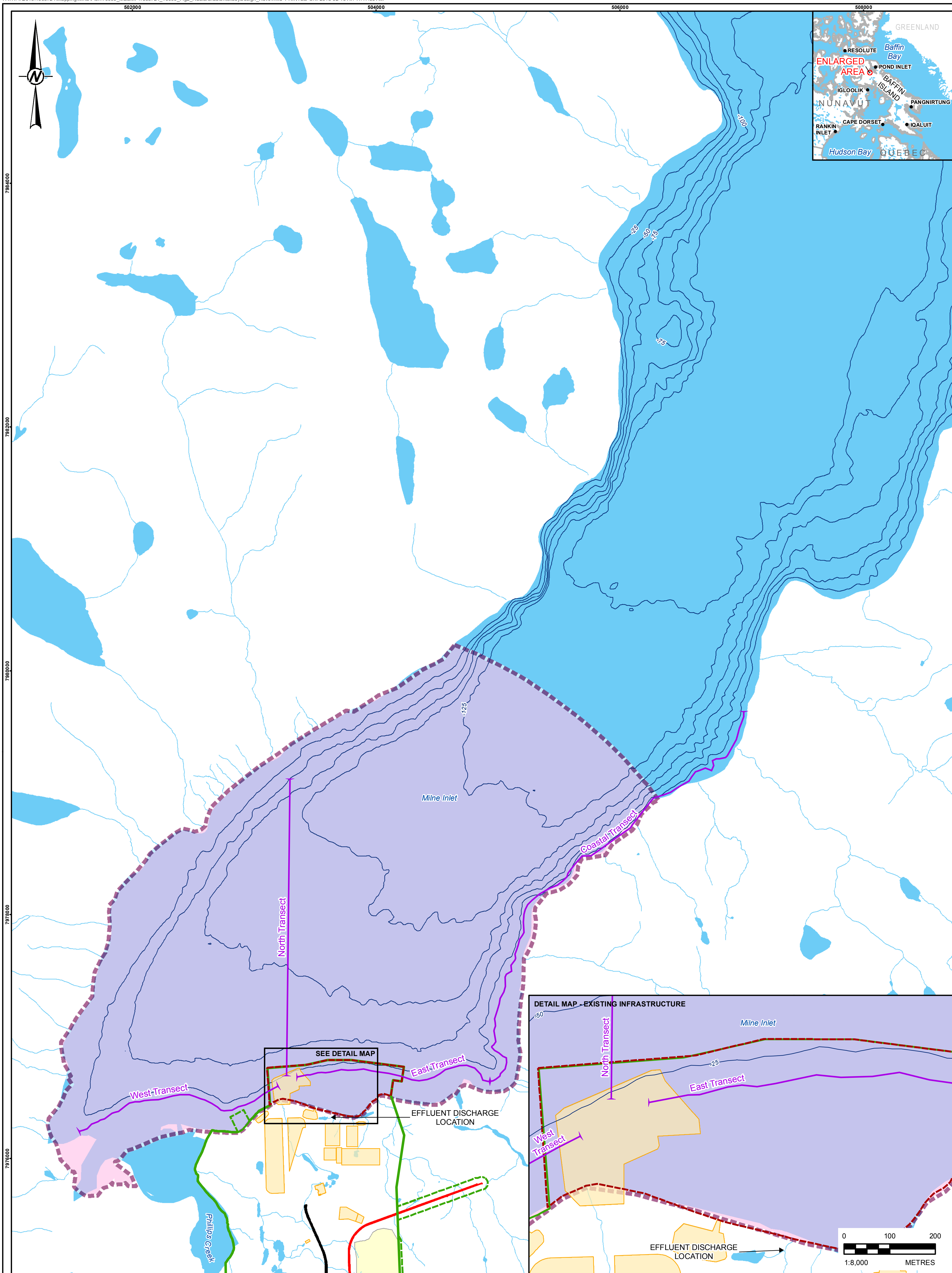

LEGEND

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- TRANSECT
- WATERCOURSE
- AGGREGATE SOURCE (BORROW PIT OR QUARRY)
- EXISTING INFRASTRUCTURE
- INAC FORESHORE LEASE
- LOCAL STUDY AREA
- WATERBODY

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REFERENCE(S)

BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES.
HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017.
MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017.
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PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE
RADIAL GRADIENT STUDY DESIGN

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-02-19
DESIGNED	EG
PREPARED	AA
REVIEWED	JS
APPROVED	PR

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	10000	0	2

2.2 Methods

The 2017 MEEMP and AIS monitoring programs were conducted from 4 August to 13 September by a five person field team composed of Golder biologists, local Inuit field technicians, and a local Inuit vessel operator from Pond Inlet, NU. Field activities were conducted from a 28-foot aluminum vessel and an 11-foot zodiac (tender vessel) based at the Milne Port facility.

2.2.1 MEEMP

2.2.1.1 Water Quality

2.2.1.1.1 Vertical Depth Profiles

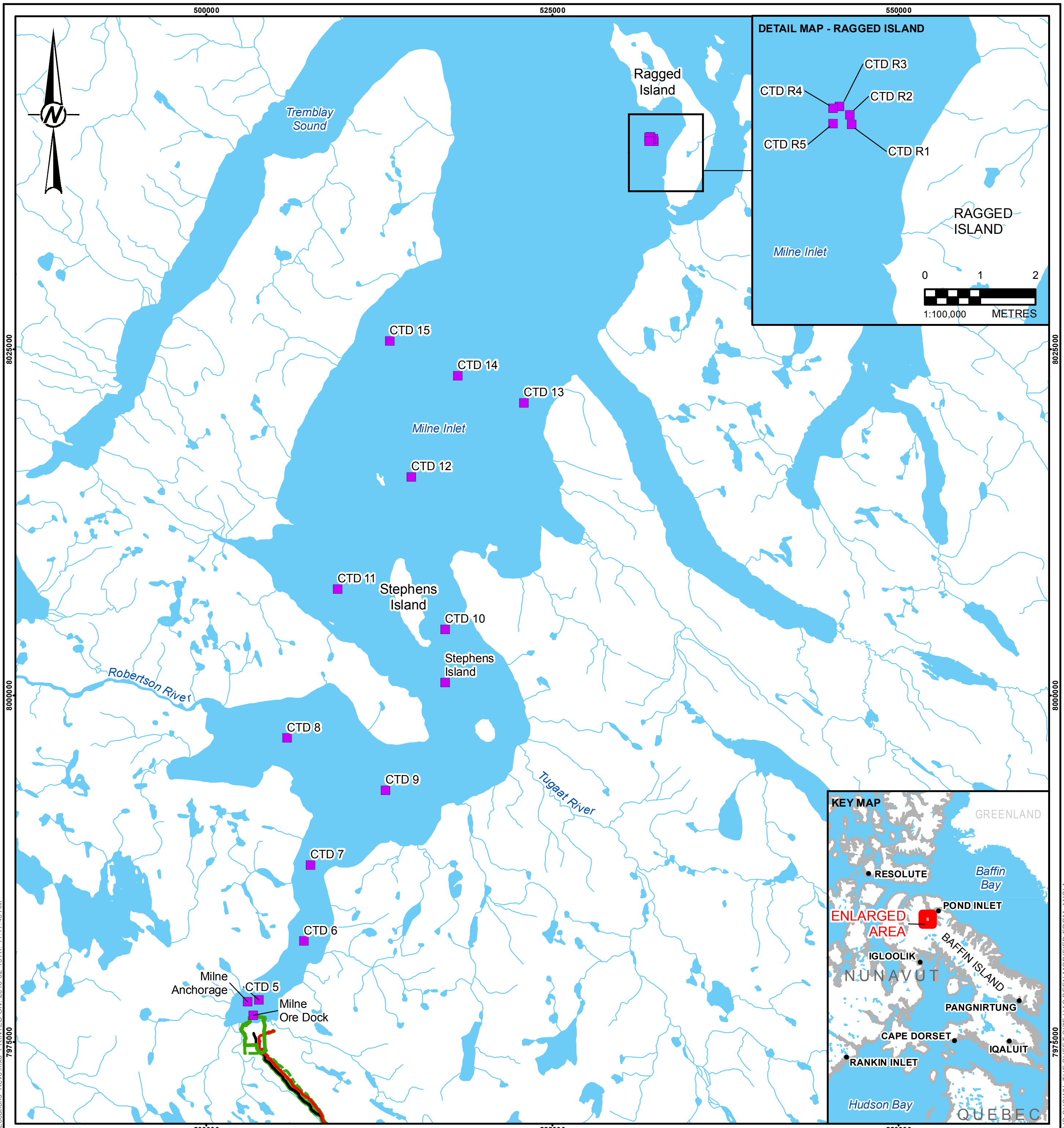
Water column profiling was conducted at 14 stations in Milne Inlet and five (5) stations near Ragged Island using a SeaBird SBE-19plus CTD profiler with integrated external sensors (Wetlab ECO-FI chlorophyll α fluorometer, SeaBird SBE- 43 Dissolved Oxygen sensor, and SeaBird SBE-10 pH sensor). Instrumentation was deployed once per station to collect surface-to-bottom measurements of conductivity, temperature, depth, dissolved oxygen, pH, turbidity and chlorophyll *a* (Figure 3). Sampling was conducted between 31 August and 11 September 2017 (Table 1). Sampling stations near Ragged Island corresponded with existing anchorage locations.

Vertical depth profiles were used to:

- Characterize water column conditions in Milne Inlet, including identification of potential salinity anomalies in the receiving environment.
- Evaluate the physiochemical properties of the marine environment important for biological productivity.
- Determine the depth of the pycnocline (density-based stratification in the water column due to gradient in temperature and /or salinity).
- Characterize water column conditions at existing vessel anchorage sites near Ragged Island.

Table 1: Marine Water Quality - Vertical Depth Profile Sampling Locations (MEEMP 2017)

Area	Station	UTM Zone	Easting (m)	Northing (m)	Date
Milne Inlet	Milne Anchorage	17W	502982	7977892	31 August
	Milne Ore Dock	17W	503379	7976909	31 August
	Stephens Island	17W	517231	8000982	31 August
	CTD 5	17W	503784	7978046	8 September
	CTD 6	17W	507040	7982289	8 September
	CTD 7	17W	507505	7987797	8 September
	CTD 8	17W	505830	7996957	8 September
	CTD 9	17W	512922	7993184	8 September
	CTD 10	17W	517229	8004793	8 September
	CTD 11	17W	509487	8007716	8 September
	CTD 12	17W	514799	8015793	8 September
	CTD 13	17W	522910	8021152	31 August
	CTD 14	17W	518155	8023129	31 August
	CTD 15	17W	513240	8025627	31 August
Ragged Island	CTD R1	17W	532297	8040038	11 September
	CTD R2	17W	532262	8040212	11 September
	CTD R3	17W	532075	8040365	11 September
	CTD R4	17W	531960	8040327	11 September
	CTD R5	17W	531953	8040048	11 September



LEGEND

- 2017 CONDUCTIVITY TEMPERATURE DEPTH (CTD) VERTICAL PROFILE
- MILNE INLET TOTE ROAD
- PROPOSED NORTH RAILWAY
- PDA / QIA COMMERCIAL LEASE
- REVISED PDA FOR PHASE 2 PROPOSAL
- WATERCOURSE
- WATERBODY

0 5 10

1:400,000 KILOMETRES

REFERENCE(S)

MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE
CTD PROFILE LOCATIONS 2017

CONSULTANT

Golder Associates

YYYY-MM-DD	2018-02-19
DESIGNED	EG
PREPARED	VV
REVIEWED	JS
APPROVED	PR

PROJECT NO.	CONTROL	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 25mm

2.2.1.1.2 Discrete Water Quality Sampling

Discrete surface water samples were collected at four sampling stations in Milne Port; one located next to the site discharge point (i.e., Source Site), and three stations located 250 m offshore of the discharge point in a radial pattern (Figure 4). The site drainage discharge system consists of an upland pipe that leads to a ditch and terminates at the shoreline of Milne Inlet. During the sampling events, water was flowing out of the pipe and into an upland ditch where it permeated into the ground. No water was flowing in the ditch to the ocean during the sampling events.

Surface water samples were collected at each station during five distinct sampling events in August and September to account for temporal variability in water quality (Table 2). The 2017 sampling schedule matched that of the 2015 and 2016 sampling programs (SEM 2016a; SEM 2017a). The exact sampling location of the Source Site was adjusted by approximately 57 m (to the East) on 22 August and 31 August because of safety concerns and accessibility issues related to a fuel line in the water.

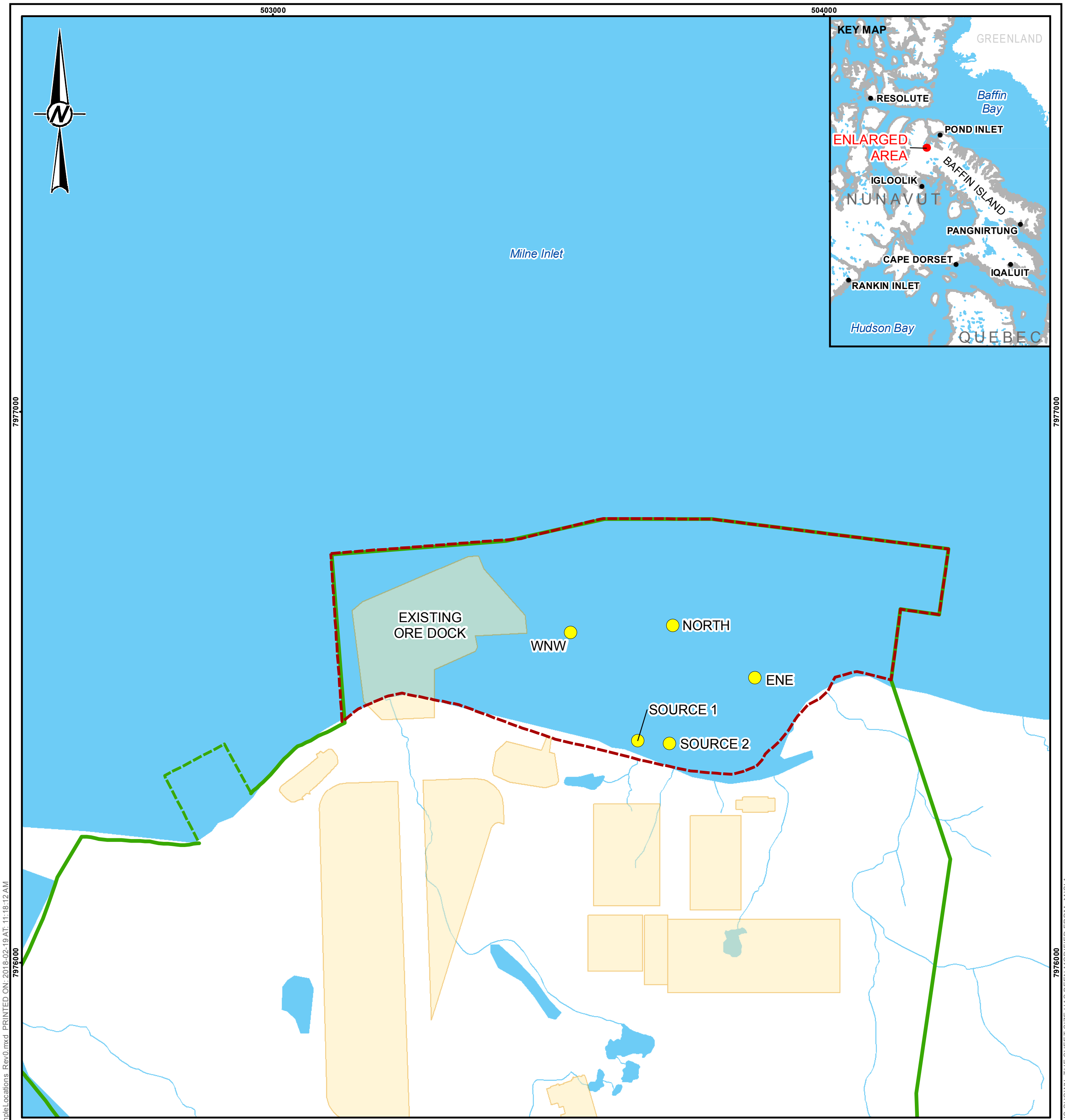
Table 2: Marine Water Quality - Discrete Sampling Locations - MEEMP 2017

Station Name[1]	UTM Zone	Easting (m)	Northing (m)	Date
ENE	17W	503874	7976517	08, 22, 31 August, 05, 10 September
North	17W	503725	7976612	08, 22, 31 August, 05, 10 September
WNW	17W	503540	7976599	08, 22, 31 August, 05, 10 September
Source 1	17W	503662	7976403	08 August, 05, 10 September
Source 2	17W	503719	7976398	22, 31 August

Notes:
[1] Source 1 was moved approximately 57 m to the east on 22 August 2017 due to safety concerns from the proximity of a fuel line in the water.

Water sampling was conducted from a local field vessel using a 5.0 L Niskin Sampler bottle. Samples were collected from surface waters only due to the relatively shallow depth and lack of stratification at the sampling locations. Samples were kept refrigerated in the field until they were shipped (within 48 h from sampling time) to ALS Environmental (ALS), an accredited analytical laboratory. Laboratory analyses of water samples were conducted by ALS and included general chemistry, nutrients, major ions, metals, coliforms, and hydrocarbons. Laboratory analytical results are presented in APPENDIX B-1.

Water quality results were screened against the Canadian Council of Ministers of Environment (CCME) guidelines for the protection of aquatic life for marine environments (CCME 2014). Salinity was calculated using an online calculator from conductivity (i.e. specific conductivity) and temperature (25ºC for specific conductivity). Mean, minimum and maximum concentrations were calculated for each sampling location over the five sampling events. For mean calculations, if results were below detection limit, half the detection limit was used as the value.



LEGEND

- COMMUNITY
- WATER QUALITY SAMPLING LOCATION
- PDA / QIA COMMERCIAL LEASE
- REVISED PDA FOR PHASE 2 PROPOSAL
- WATERCOURSE
- EXISTING INFRASTRUCTURE
- INAC FORESHORE LEASE
- WATERBODY

0 200 400

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REFERENCE(S)

HYDROGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT

BAFFINLAND IRON MINES CORPORATION

PROJECT

MARY RIVER PROJECT - MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE

WATER QUALITY SAMPLING LOCATIONS 2017

CONSULTANT

Golder Associates

YYYY-MM-DD	2018-02-19
DESIGNED	VL
PREPARED	VV
REVIEWED	JS
APPROVED	PR

PROJECT NO.	CONTROL	REV.	FIGURE
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25mm

2.2.1.2 Sediment Quality

Sediment sampling station locations were arranged along four transects (Figure 5). Sampling station locations were similar to those used in 2016 (SEM 2017a) to allow for inter-annual comparison of the repeated measures analysis. The station locations and dates sampled in 2017 are shown in Table 3.

Table 3: Summary of Sediment Sampling Locations, 2017

Station[1]	UTM Zone	Easting (m)	Northing (m)	Date
SW-1	17W	503419	7976660	13 August
SW-2	17W	503147	7976572	14, 10 August
SW-3	17W	502961	7976467	13, 10 August
SW-4	17W	502721	7976424	14 August
SW-5	17W	502264	7976526	13 August
SE-1	17W	503433	7976699	13 August
SE-2	17W	503646	7976741	13 August
SE-3	17W	503832	7976728	13 August
SE-4	17W	504399	7976653	12 August
SE-5	17W	504912	7976638	12 August
SC-2	17W	504987	7976945	12 August
SC-3	17W	505053	7977456	12 August
SC-4	17W	505505	7978260	11, 12 August
SC-5	17W	506964	7979517	11, 12 August
SN-1	17W	503303	7976751	11, 12 August
SN-2	17W	503271	7976947	11, 12 August
SN-3	17W	503271	7977197	11, 12 August
SN-4	17W	503271	7977697	11, 12 August
SN-5	17W	503271	7978697	11 August

Notes:
[1] SW-1 was collected slightly off from the previous year position (2016) and was therefore removed from some analyses.

Sediment samples were collected using a Petite Ponar grab sampler with an area of 0.0225 m^2. Sediment samples were collected with three replicates from each station and each replicate sample consisted of approximately one to two grab samples depending on grab penetration. Each grab sample was examined for acceptability based on the following criteria:

- sediment did not contain large foreign objects;
- grab showed adequate penetration depth and sufficient sediment volume (at least 25% full);
- grab was not overfilled (i.e., sediments did not touch the top of the grab);
- grab was not leaking (i.e., overlying water was present); and
- sample was not disturbed or winnowed (i.e., sediment surface was relatively flat).

Upon acceptance, two terra core samples were taken from the undisturbed sediments and placed into pre-labeled methanol preserved vials to test for volatile organic compounds. The remaining top 5 cm of sediments were removed from the centre of the grab (i.e., sediments from the sides and bottom of the grab were not collected) using a clean stainless steel spoon and transferred to a clean stainless steel bowl. Sediments from all composite grabs were homogenized together until the colour and texture were consistent throughout the sample. Aliquots of the sample of the homogenized sediments were transferred to clean, labelled glass jars. Sediment samples were stored on ice packs in a cooler prior to shipment to the analytical laboratory.

Additional information, including the number of unsuccessful grabs, sediment appearance and odour (if any), presence of debris in sample, presence of live organisms in sample, and deviations from the planned sampling program, were recorded on field data sheets. The date, time, transect name, station number, and GPS coordinates of each sample were recorded. Multiple grabs were generally required for each replicate, to collect sufficient volume of substrate for analysis. All sampling gear was rinsed and scrubbed with brushes with a biodegradable laboratory-grade detergent between sampling collections. Samples were kept in coolers in the field and in refrigeration until sent to ALS for analysis (within 48 h from sampling time). The chemical analysis of sediment included total extractable metals, hydrocarbon, total organic carbon (TOC) and total inorganic carbon (TIC).

Principal Component Analysis (PCA) was conducted on sediment physical and chemical variables of samples. PCA is an ordination technique that examines ecological distances (difference or similarities) between samples and allows plotting of high dimensional data in two or three dimensional graphs so the distances between the samples in the graphs represent the ecological distances. For the analysis, concentrations below the laboratory detection limits were converted into half-detects; all concentrations were transformed into their square roots. Variables with concentrations below detection limits (e.g., hydrocarbons, volatile organic compounds) were excluded from the PCA.

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LEGEND

- 2017 SEDIMENT SAMPLING LOCATION
- POPULATED PLACE
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- MILNE INLET TOTE ROAD
- PROPOSED NORTH RAILWAY
- PDA / QIA COMMERCIAL LEASE
- REVISED PDA FOR PHASE 2 PROPOSAL
- WATERCOURSE
- AGGREGATE SOURCE (BORROW PIT OR QUARRY)
- EXISTING INFRASTRUCTURE
- INAC FORESHORE LEASE
- WATERBODY

0 500 1,000
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REFERENCE(S)

BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES.
HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017.
MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017.
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PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE
SEDIMENT SAMPLING LOCATIONS 2017

CONSULTANT
Golder Associates

YYYY-MM-DD	2/19/2018
DESIGNED	EG
PREPARED	VV
REVIEWED	JS
APPROVED	PR

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	10000	0	5

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

2.2.1.3 Substrate, Macroflora, and Benthic Epifauna

Underwater video surveys were conducted along the West, East, North and Coastal Transects to characterize marine habitat features and document the presence and distribution of macroflora and benthic epifauna in the study area (Figure 6). Transects in 2017 were completed following the methods set out in SEM 2017a, including video collection along the 15 m depth contour on the West, East, and Coastal Transects, and along an increasing depth gradient extending from the ore dock on the North Transect (15 m to 100 m depth). Transect data from analysis of video collected during the underwater video surveys is provided in APPENDIX D-1.

Surveys conducted in 2014, 2015 and 2016 utilized an approach in which video analysis was restricted to a few smaller segments along a pair of replicate transects resulting in a non-continuous dataset with significant data gaps and pseudoreplication[6] (SEM 2017a). In 2017, this approach was adapted to remove the second replicate transect along each of the four established transect lines and to analyze a larger portion (>90%) of each transect to provide a more representative data set of the study area for comparison against previous years (see Section 2.3.1.2 for data analysis methods). As stated in SEM 2017a, the inherent difficulty in maintaining exact vessel position in the field during underwater video surveys (e.g., due to wind, waves, vessel speed, orientation of the camera) and the distance error associated with the on-board GPS system, made it nearly impossible to obtain statistically independent replicates along the same transect line and to avoid counting the same clusters of organisms twice. The approach was revised in 2017 to mitigate for these potential data collection challenges and to provide a continuous dataset from which data could be compared, using distance as a continuous gradient. Data analysis methods are explained in greater detail in Section 2.3.1.2.

Video data was collected using a Deep Blue Pro HD camera system, the same camera system utilized during the 2016 survey (SEM 2017a), composed of a high resolution video camera with integrated WAAS-enabled GPS video overlay. The camera was towed and operated by trained personnel and attached to a deck-mounted video monitor and digital recorder on the charter vessel. Tracking of the vessel and video system was conducted using on-board Raymarine Dragonfly navigational software. The camera was towed at a similar depth above the seafloor as previous years, leading to an approximate field of view of 4 m.

Underwater video was post-processed by a qualified marine biologist. The recorded underwater video footage was analysed frame by frame to record substrate type, according to the classifications identified in Table 4, percent coverage and distribution of attached macroflora, according to the classifications identified in Table 5, and density and distribution of benthic epifauna. Density was estimated from epifauna counts in 2017 and from previous survey data by dividing the total number of epifauna observed by the length of the segment of transect analyzed. Video data was compiled into 5 m increments for statistical analyses to compare abundance and distribution of macroflora and epifauna with previous years. Taxa were identified down to the lowest practical taxonomic level and related to physical habitat features (e.g., substrate) when possible.

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[6] Pseudoreplication refers to a case in which replicates are not statistically independent

Table 4: Substrate Classification Categories

Broad Substrate Category	Detailed Substrate Category	Definition
Bedrock	Bedrock	Continuous solid rock exposed by scouring forces or covered by sediment veneer
Coarse	Boulder/Rip rap	Rocks greater than 250 mm in diameter Large rocks ranging from 130 mm – 250 mm in diameter
Medium	Cobble/Gravel	Rocks ranging from 30 mm – 130 mm Granule size or coarser, 2 mm – 30 mm
Mixed	Boulder/Cobble/Gravel/ Sand/Silt/Mud	A combination of coarse, medium and/or fine substrates in which no particular substrate is greater than 50% coverage
Fine	Sand/Silt/Mud	Fine deposits ranging from 0.06 mm – 2 mm Material encompassing both silt and clay <0.06 mm
Shell	Shell debris	Calcareous remains of shellfish and other invertebrates

Notes: Table adapted from SEM 2017a. Substrates were categorized into broad substrate categories if substrate represented greater than 50% coverage over each 5 m transect length. Substrates for which no category represented greater than 50% coverage were categorized as mixed (previously named "medium/fine" in SEM 2017a). Segments with too much organic debris to view the substrate were considered not classifiable.

The observed macroflora was identified to the lowest practical taxonomic level. Identification to species or genus was not always possible due to water clarity, movement speed, or distance from the sea floor; in those cases, macroflora was recorded as a vegetation class.

Table 5: Macroflora Classification

Macroflora Class	Definition
Red algae	Bladed, branched or filamentous red algae of the phylum Rhodophyta
Brown algae	Bladed brown algae of the Laminariales (kelp), brown alga with a large broad-bladed thallus attached to the substrate by a tough stalk and holdfast
Green algae	Green algae of the phylum Chlorophyta
Rockweed	Fucus sp. – rock weed, *Ascophyllum nodosum* – knotted wrack
Eelgrass	Marine seagrass of the species *Zostera marina*, considered a sensitive habitat which provides shelter for a variety of fish species.
Salt marsh	Aquatic plants developing on wet soil (e.g., tidal or salt marshes)
Other	Any other type of flora not identified in the above categories

Notes: Table adapted from SEM 2017a.

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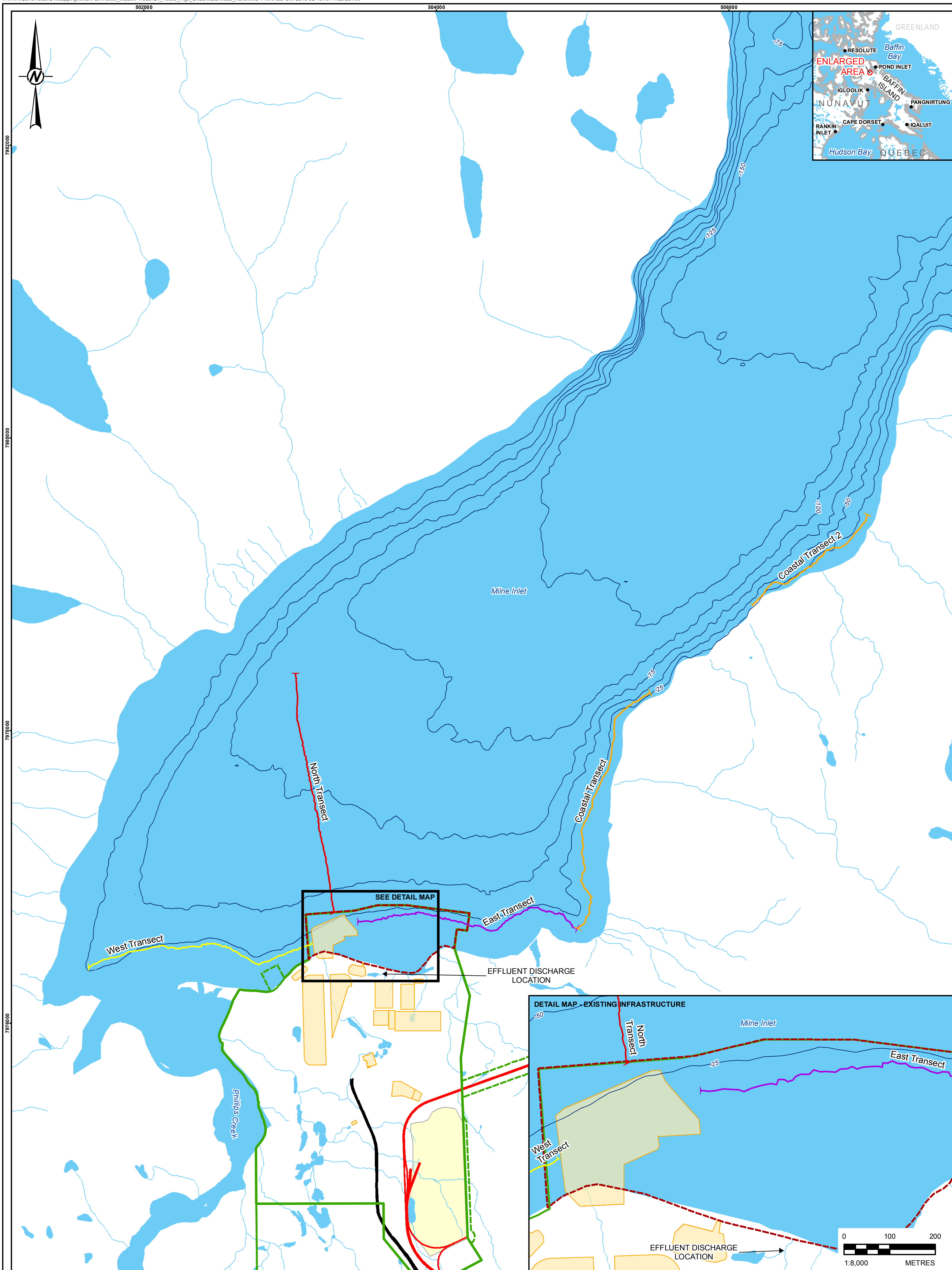

LEGEND

- POPULATED PLACE
- COASTAL TRANSECT
- EAST TRANSECT
- NORTH TRANSECT
- WEST TRANSECT
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- MILNE INLET TOTE ROAD
- PROPOSED NORTH RAILWAY
- PDA / QIA COMMERCIAL LEASE
- REVISED PDA FOR PHASE 2 PROPOSAL
- WATERCOURSE
- AGGREGATE SOURCE (BORROW PIT OR QUARRY)
- EXISTING INFRASTRUCTURE
- INAC FORESHORE LEASE
- WATERBODY

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REFERENCE(S)

BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES.
HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017.
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PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE
UNDERWATER VIDEO TRANSECTS 2017

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-02-19
DESIGNED	JS
PREPARED	AA
REVIEWED	JS
APPROVED	PR

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	10000	0	6

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2.2.1.4 Fish

2.2.1.4.1 Permitting

The following scientific data collection permits were obtained from the Nunavut and federal government prior to the start of the 2017 fish sampling program:

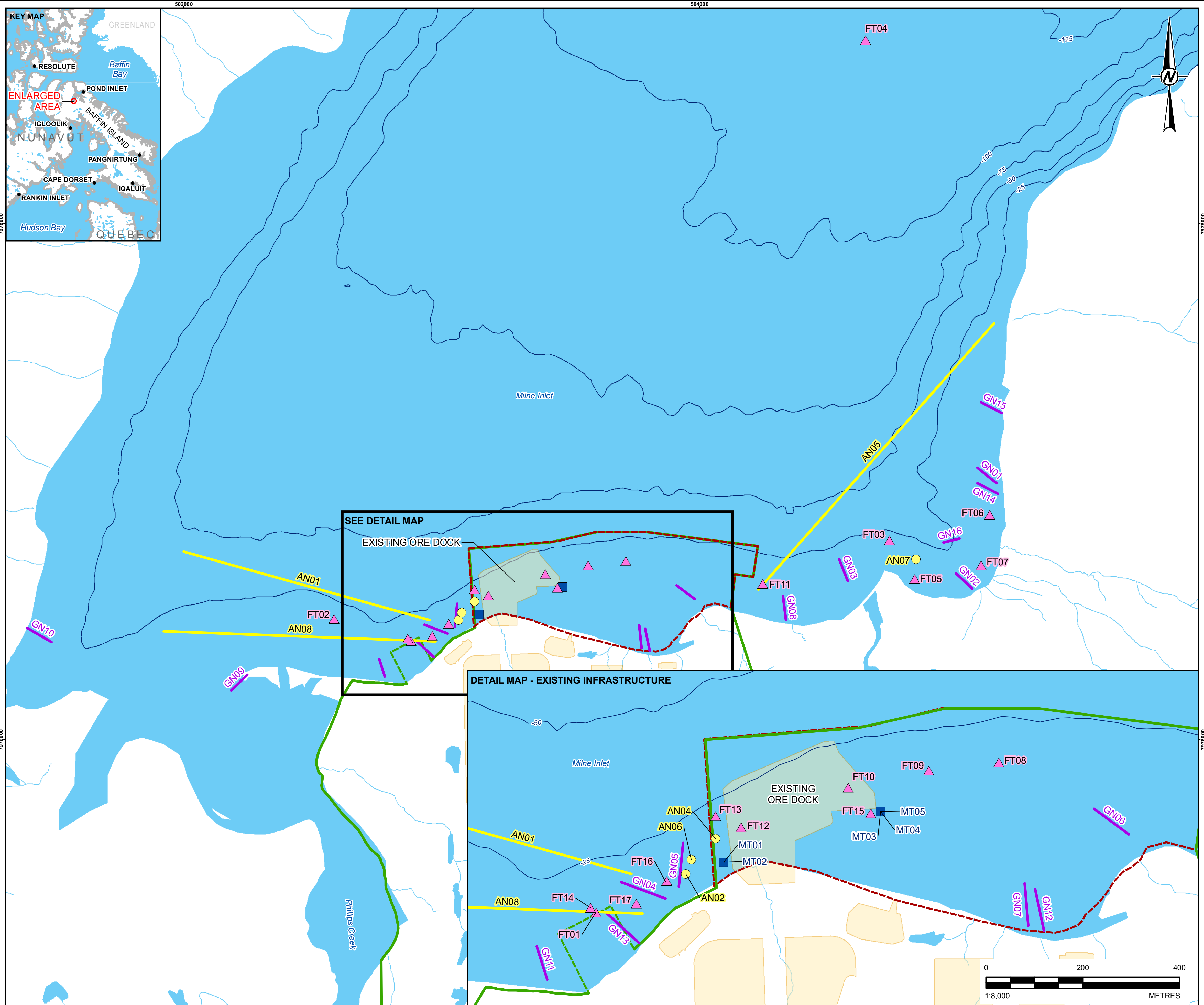
- DFO Licence to Fish for Scientific Purposes Permit #: S-17/18-1036-NU
- DFO Animal Use Protocol Permit # FWI-ACC-2017-044
- Nunavut Research Institute (NRI) Scientific Research Licence #02 039 17R-M

2.2.1.4.2 Fish Collection

Fish sampling was conducted from 25 August to 5 September using both active (gill netting, angling) and passive (Fukui and minnow traps) capture methods in the Milne Port area (Figure 7). Fish sampling sites along the East and West Transects and along the south-north portion of the Coastal Transect were randomly selected using linear Generalized Random Tessellation Stratification (GRTS) in the statistical environment R v. 3.3.3 (R 2017), using the package spsurvey (Kincaid and Olsen 2013). A total of 13 main and 13 oversample points were selected for each transect for gill net locations, and a total of 12 main and 12 oversample points were selected for Fukui trap locations.

Prior to fish sampling, the field team surveyed the GRTS-selected sampling stations to determine if the station was suitable for sampling. If field conditions rendered some pre-selected stations unusable, an oversample station was drawn instead. If all GRTS points were assessed and the field team was short of the expected number of samples, stations were added to the sampling scheme based on close proximity to GRTS station, and station-measured depth.

Angling (jigging and trolling) was conducted over seven days between 25 August and 3 September to sample bottom and demersal fish in the LSA. The duration of sampling was activity dependent; with trolling events occurring between 40 and 60 minutes (n=3), and jigging events occurring between 15 minutes and 4 hours (n=5) (Table 6). Sampling start and end positions were recorded using a Garmin GPS and logged in a field notebook. Jigging occurred from a stationary position with two rod and lines deployed from the vessel. Baited hooks were allowed to hit the bottom and were then flicked upward to attract bottom fish. Trolling occurred along a pre-determined depth contour where lines with spoons (flashers) were cast over the side of the vessel and were allowed to trail behind the vessel at a known depth to attract pelagic fish.



LEGEND

- COMMUNITY
- ANGLING (JIGGING) SAMPLE LOCATION
- FUKUI TRAP SAMPLE LOCATION
- MINNOW TRAP SAMPLE LOCATION
- ANGLING (TROLLING) SAMPLE LOCATION
- GILL NET SAMPLE LOCATION
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- PDA / QIA COMMERCIAL LEASE
- REVISED PDA FOR PHASE 2 PROPOSAL
- WATERCOURSE
- EXISTING INFRASTRUCTURE
- INAC FORESHORE LEASE
- WATERBODY

0 500 1,000

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REFERENCE(S)

BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES. HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT - MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

TITLE
FISHERIES SAMPLING LOCATIONS 2017

CONSULTANT

Golder Associates

YYYY-MM-DD	2/19/2018
DESIGNED	EG
PREPARED	AA
REVIEWED	JS
APPROVED	PR

PROJECT NO.	CONTROL	REV.	FIGURE
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Table 6: Summary of 2017 Fish Sampling - Angling (Jigging and Trolling) Methods

Fishing Type	Station Name	Date	Duration (h:min)	Zone	GPS Coordinates			
					Start		End	
					Easting	Northing	Easting	Northing
Trolling	AN01	25-Aug-17	0:45	17W	502954	7976463	502000	7976729
Jigging	AN02	27-Aug-17	1:00	17W	503066	7976463	n/a	n/a
Jigging	AN03	29-Aug-17	1:00	17W	503078	7976493	n/a	n/a
Jigging	AN04	01-Sep-17	4:00	17W	503128	7976536	n/a	n/a
Trolling	AN05	02-Sep-17	1:00	17W	504229	7976582	505143	7977616
Jigging	AN06	03-Sep-17	0:15	17W	503078	7976493	n/a	n/a
Jigging	AN07	03-Sep-17	1:00	17W	504840	7976700	n/a	n/a
Trolling	AN08	04-Sep-17	0:40	17W	502977	7976381	501923	7976420

Notes: n/a represents not applicable for the activity.

A monofilament gill net was used to sample shallow (i.e., up to 15 m deep) subtidal areas for characterization of pelagic fish communities present in the Milne Port area. Gill net sampling occurred at 16 stations from 26 August to 3 September (Table 7). The gill net consisted of six panels with each panel measuring 15.2 m in length and 2.4 m in width, with mesh sizes of each panel consisting of 2.5 cm, 3.8 cm, 5.1 cm, 6.4 cm, 7.6 cm and 10.2 cm. Soak durations ranged from 1 hour and 15 minutes to 6 hours and 55 minutes. The gill net was deployed at 14 sampling stations in the LSA, in a shore-perpendicular orientation (smallest mesh size closest to shore) and suspended just below the water surface. At two of the sampling stations, weights were attached to the bottom of the net to minimize drift effects. The gill net was set for a maximum of two hours prior to being checked for fish presence. The net was then re-deployed in the same location and rechecked every two hours over the course of the day. Sampling locations were recorded using a Garmin GPS and logged in a field notebook.

Table 7: Summary of 2017 Fish Sampling – Gill Net

Station	Date	Total Duration (h:min)	Number of checks[1]	Zone	GPS Coordinates			
					Start		End	
					Easting	Northing	Easting	Northing
GN01	26-Aug-17	2:30	3	17W	505152	7976994	505078	7977054
GN02	26-Aug-17	3:30	3	17W	505058	7976585	504995	7976645
GN03	27-Aug-17	1:15	1	17W	504575	7976615	504541	7976701
GN04	27-Aug-17	3:50	2	17W	503024	7976412	502933	7976446
GN05	27-Aug-17	3:40	3	17W	503052	7976437	503061	7976527
GN06	28-Aug-17	5:05	4	17W	503983	7976545	503911	7976598
GN07	28-Aug-17	6:15	4	17W	503775	7976356	503767	7976443
GN08	28-Aug-17	4:05	4	17W	504335	7976464	504324	7976556
GN09	29-Aug-17	6:55	4	17W	502247	7976252	502184	7976191
GN10	29-Aug-17	6:20	4	17W	501393	7976433	501487	7976379
GN11	29-Aug-17	6:30	4	17W	502780	7976245	502758	7976313
GN12	02-Sep-17	4:57	3	17W	503807	7976346	503789	7976431
GN13	02-Sep-17	5:30	3	17W	502970	7976320	502903	7976382
GN14	03-Sep-17	5:00	4	17W	505157	7976954	505078	7976995
GN15	03-Sep-17	5:25	4	17W	505172	7977266	505093	7977308
GN16	03-Sep-17	5:05	3	17W	504947	7976764	505009	7976780

Notes: [1] Number of checks represents the number of times the field team checked the net and sampled fish with the net remaining in the same location.

Fukui traps were baited and set to sample bottom and demersal fish. Fukui trap sampling occurred at 17 stations from 25 August to 1 September 2017 and were left in place for one to two days (Table 8). The traps measured 61 cm x 46 cm x 20 cm, with 1.25 cm stretch mesh and were baited with sardines and bait scent. Five traps were set at each location along a line to increase probability of fish capture. Once retrieved, bait containers were checked and refilled prior to redeployment. The fishing locations were captured using a Garmin GPS and recorded in a field notebook.

Table 8: Summary of 2017 Fish Sampling – Fukui Trap

Station	Date		Duration (h:min)	Zone	GPS Coordinates	
	Set	Pull			Easting	Northing
FT01	25-Aug-17	26-Aug-17	24:10	17W	502881	7976384
FT02	25-Aug-17	26-Aug-17	23:40	17W	502583	7976469
FT03	26-Aug-17	28-Aug-17	45:40	17W	504737	7976774
FT04	26-Aug-17	28-Aug-17	45:35	17W	504644	7978713
FT05	26-Aug-17	28-Aug-17	45:10	17W	504835	7976624
FT06	26-Aug-17	28-Aug-17	44:30	17W	505126	7976872
FT07	26-Aug-17	28-Aug-17	42:10	17W	505092	7976677
FT08	28-Aug-17	29-Aug-17	18:20	17W	503714	7976694
FT09	28-Aug-17	29-Aug-17	22:35	17W	503569	7976677
FT10	28-Aug-17	30-Aug-17	46:45	17W	503402	7976642
FT11	28-Aug-17	30-Aug-17	25:45	17W	504246	7976605
FT12	29-Aug-17	30-Aug-17	23:10	17W	503181	7976560
FT13	29-Aug-17	30-Aug-17	23:15	17W	503128	7976583
FT14	29-Aug-17	30-Aug-17	23:00	17W	502869	7976393
FT15	30-Aug-17	01-Sep-17	48:40	17W	503449	7976589
FT16	30-Aug-17	01-Sep-17	48:10	17W	503027	7976449
FT17	30-Aug-17	01-Sep-17	48:00	17W	502964	7976402

Minnow traps were deployed at five sampling stations along the riprap apron of the existing ore dock in Milne Port to sample reef dwelling bottom fish. Sampling was conducted between 2 September and 5 September (Table 9). At each station, two minnow traps were deployed with bait containers of sardine and bait scent. Minnow traps were left in place for approximately three days, after which time they were retrieved and sampled. Sampling locations were recorded using a Garmin GPS and logged in a field notebook.

Table 9: Summary of 2017 Fish Sampling – Minnow Trap

Station	Date		Duration (h:min)	Zone	GPS Coordinates	
	Set	Pull			Easting	Northing
MT01	02-Sep-17	05-Sep-17	74:55	17W	503145	7976487
MT02	02-Sep-17	05-Sep-17	74:55	17W	503145	7976487
MT03	02-Sep-17	05-Sep-17	74:20	17W	503469	7976592

Station	Date		Duration (h:min)	Zone	GPS Coordinates	
	Set	Pull			Easting	Northing
MT04	02-Sep-17	05-Sep-17	74:20	17W	503469	7976592
MT05	02-Sep-17	05-Sep-17	74:20	17W	503469	7976592

2.2.1.4.3 Fish Processing and Analysis

All fish collected were transferred to aerated buckets with station water prior to processing. Representative photographs were taken for each species and life stage at each station. Fish were identified to species, measured for length and weight and returned to aerated buckets to allow for recovery prior to release to the approximate area of capture.

Incidental fish mortalities were retained for aging, body burden analysis, stomach content analysis, and toxicology. The laboratory assessments are provided in more detail in APPENDIX E-1, APPENDIX E-2, and APPENDIX E-3. Whole fish were kept frozen until they were packaged and shipped in a cooler to Biologica Environmental Services (Biologica) in Victoria, British Columbia.

The stomach assessment was conducted prior to dissection. The percent fullness and percent digestion of each stomach was recorded. The stomach was separated from the intestines anterior of the pyloric caecae and discarded. A longitudinal incision was made with a scalpel, avoiding damage to the contents, to reveal the food bolus. At this time stomach fullness was estimated by considering two factors: the degree of distention of the stomach, and the weight of the bolus relative to the size of the fish. The bolus was dissected, working anterior-posterior, and its identifiable components weighed to the nearest 0.01mg nearest 0.0001g. Prey items were identified to the lowest practicable taxonomic level (species when possible). Digested and unidentifiable material were categorized (e.g., Unidentified parts, digested tissue, non-food, etc.). Each identifiable unit (taxon or category) was placed in small drops of water on petri dish to prevent desiccation during the identification process. All prey categories (taxa and unidentifiable categories) were blotted and weighed to the nearest 0.01mg of wet weight.

Whole fish were examined for lesions or tumors. As described above, the internal organs and head were removed prior to tissue collection to prevent contamination of the tissue, should an organ be punctured during tissue removal. The tissue was removed from the dorsal musculature with a knife, rinsed and wrapped in new food-grade aluminum foil and placed in clean labeled bags. Samples were kept frozen until delivery to Maxxam Analytics (Maxxam) in Victoria, BC in a cooler with ice packs for analysis. Maxxam analyzed the wet weight tissue samples by atomic spectroscopy. The certificate of analysis and chain of custody between Biologica and Maxxam are provided in APPENDIX E-4 and APPENDIX E-5 and results are provided in APPENDIX E-6.

For fish aging, the sagittal otoliths were removed from each fish head, cleaned and placed in labelled vials. Whole otoliths were placed in glass petri dish with distilled water and examined over a black background using a dissecting scope (10-40x magnification). Incomplete or weak bands were considered malformed or damaged and were not processed.

2.2.2 Aquatic Invasive Species (AIS)

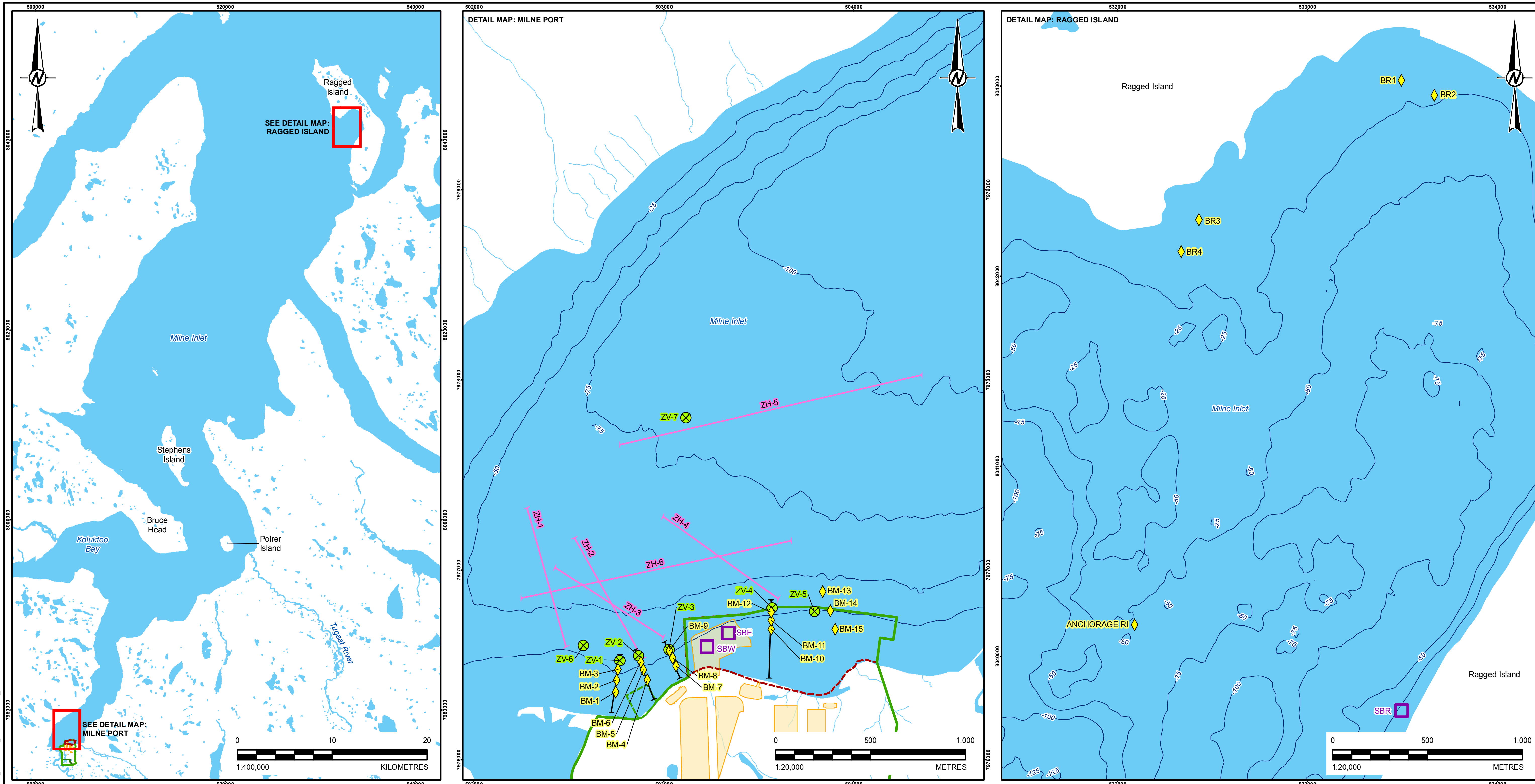
2.2.2.1 Zooplankton

Zooplankton samples were collected in 2017 at Milne Port and at Ragged Island using a combination of vertical hauls and horizontal oblique tows (Figure 8; Table 10). Vertical hauls were conducted at each of the four AIS sampling stations in Milne Port previously established by SEM in 2014, and at three new sampling stations in Milne Port. Additionally, vertical hauls were conducted at four sampling stations near the vessel anchorage sites at Ragged Island (no previous sampling for zooplankton has occurred at Ragged Island. Vertical hauls were conducted by lowering a 0.3 m diameter plankton net (63 μm mesh size) to several metres above the bottom and then raising the net by hand to the surface at a rate of approximately 1 m/s. Three replicate hauls were conducted at each station and combined into a single composite sample following methodology from previous years (SEM 2017a).

Horizontal oblique tows were conducted along each of the four AIS transects in Milne Port previously established by SEM in 2014, and along two new transects in Milne Port. A higher number of samples were collected in 2017 than in previous years to capture a larger portion of the zooplankton community and a greater number of rare species. SEM noted in their 2017 monitoring report that sampling in each year in 2014 through 2016 was, on its own, insufficient to characterize the full extent of the zooplankton community in the study area (SEM 2017a). Horizontal oblique tows were conducted by towing a 0.5 m diameter net (50 μm mesh size) at a speed of approximately 8-10 km/h for a period of at least ten minutes per tow. Tows were conducted near the surface in a sinusoidal fashion by means of regular transitions in tow speed (1 minute towing, 1 minute idling) which allowed the weighted net to periodically sink and rise during active sampling. This helped to avoid sampling only in the upper few metres of the water column. Tows were collected as a single composite sample for each transect.

In general, zooplankton sampling methods in 2017 were similar to those used in previous years (SEM 2017a), with the exception of net mesh size (63 μm vs. 80 μm for vertical hauls, 250 μm vs. 243 μm for oblique tows), using a sinusoidal oblique tow approach to catch a more representative sample of zooplankton in the water column, and towing the oblique tow at higher speeds (8 to 10 km/h vs. ~2.5 km/h) to catch faster moving larvae (e.g., fish larvae, larger crustaceans).

All zooplankton samples were preserved in 5% formalin and submitted to Biologica for taxonomic identification and enumeration. An inventory of zooplankton species collected in 2017 was created and species lists from previous years. If new species were identified, they were further investigated to determine if they were invasive. In addition, taxa were compared against a global invasive species database (Molnar et al. 2008), as well as a known invasive species list within the National Risk Assessment for Introduction of Aquatic Nonindigenous Species to Canada by Ballast Water (Casas-Monroy et al. 2014).



LEGEND

- BENTHIC INFAUNA SAMPLE LOCATION
- ZOOPLANKTON VERTICAL HAUL SAMPLE LOCATION
- SETTLEMENT BASKET SAMPLE LOCATION
- UNDERWATER VIDEO
- ZOOPLANKTON OBLIQUE TOW SAMPLE LOCATION
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- PDA / QIA COMMERCIAL LEASE
- REVISED PDA FOR PHASE 2 PROPOSAL
- WATERCOURSE
- EXISTING INFRASTRUCTURE
- INAC FORESHORE LEASE
- WATERBODY

REFERENCE(S)

BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES. HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – MARINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-02-19
DESIGNED	EG
PREPARED	AA
REVIEWED	JS
APPROVED	PR

TITLE
AQUATIC INVASIVE SPECIES SURVEY LOCATIONS

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	10000	0	8

Table 10: Summary of Zooplankton Sampling (Horizontal Oblique and Vertical Tows) – 2017 AIS Program

Station[1]	UTM Zone	Start Coordinates		End Coordinates[2]	
		Latitude (m)	Longitude (m)	Latitude (m)	Longitude (m)
ZH-1	17 W	502484	7976593	502278	7977327
ZH-2	17 W	502888	7976532	502527	7977169
ZH-3	17 W	502999	7976642	502425	7977013
ZH-4	17 W	503604	7976846	502995	7977281
ZH-5	17 W	504360	7978026	502767	7977657
ZH-6	17 W	502247	7976849	503673	7977153
ZV-1	17 W	502768	7976524	n/a	n/a
ZV-2	17 W	502866	7976548	n/a	n/a
ZV-3	17 W	503028	7976580	n/a	n/a
ZV-4	17 W	503570	7976801	n/a	n/a
ZV-5	17 W	503793	7976782	n/a	n/a
ZV-6	17 W	502576	7976603	n/a	n/a
ZV-7	17 W	503115	7977802	n/a	n/a

Notes: [1] ZH = zooplankton horizontal oblique tow; ZV = zooplankton vertical haul
[2] n/a represents not applicable for the activity.

2.2.2.2 Benthic Invetebrate Infauna

Benthic invertebrate samples were collected at three depth strata (3-15m, 15-25m, and 25-35m) along the four previously established AIS transects, plus one additional transect added in 2017 (Table 11). The samples were collected using a Petite Ponar grab sampler with an area of 0.0225 m^2, consistent with previous sample collection efforts (SEM 2015; 2016a; 2017a).

Table 11: Summary of Benthic Infaunal Sampling – 2017 AIS Monitoring Program

Area	Station	UTM Zone	Latitude, N	Longitude, W	Depth range (m)	Date
Milne Port	BM-1	17W	502746	7976358	3-15	18 August
	BM-2	17W	502752	7976420	15-25	18 August
	BM-3	17W	502759	7976475	25-35	19 August
	BM-4	17W	502913	7976421	3-15	19 August
	BM-5	17W	502893	7976474	15-25	21 August
	BM-6	17W	502878	7976514	25-35	21 August
	BM-7	17W	503064	7976495	3-15	21 August
	BM-8	17W	503046	7976537	15-25	22 August
	BM-9	17W	503030	7976576	25-35	22 August
	BM-10	17W	503565	7976688	3-15	16 August
	BM-11	17W	503565	7976735	15-25	16, 18 August
	BM-12	17W	503565	7976778	25-35	18 August
	BM-13	17W	503836	7976886	25-35	16 August
	BM-14	17W	503876	7976786	15-25	16 August
	BM-15	17W	503902	7976688	3-15	16 August
Ragged Island	BR-1	17W	533494	8043032	3-13	11 September
	BR-2	17W	533667	8042953	15-25	11 September
	BR-3	17W	532427	8042298	15-25	11 September
	BR-4	17W	532336	8042130	3-15	11 September

Notes: Three replicates were collected at each station.

Benthic infaunal samples were collected in triplicate from each station, with each replicate sample consisting of one to six grab samples, depending on grab penetration. Each benthic sample was examined for acceptability, based on the following criteria:

- sediment did not contain large foreign objects
- grab showed adequate penetration depth and sufficient sediment volume (at least 25% full to half full)
- grab was not overfilled (i.e., sediments did not touch the top of the grab)
- grab was not leaking (i.e., overlying water was present)
- sample was not disturbed or winnowed (i.e., sediment surface was relatively flat)

Upon acceptance, contents of the grab sampler were transferred to an aluminum sieving table. The contents were gently rinsed through a 0.5 mm mesh sieve with filtered seawater. Larger organisms were removed using forceps and all material remaining on the sieve was placed in pre-labeled 1 L wide mouth HDPE sample jars. Containers were filled to no more than half-full with filtered sea water. A volume of 100 mL of a 100% solution of buffered formalin was added to the sample and the sample bottle with additional filtered seawater was added to preserve tissues in a solution of 10% buffered formalin. The containers were then sealed and inverted several times to promote homogenization with the formalin. Containers were labeled internally (water-resistant labels) and externally. Field observations (e.g., sediment characteristics) were recorded on field data sheets. Samples were sent to Biologica for analysis of taxonomic composition (identified to the lowest practical taxonomic levels) and biomass. A greater level of detection was expected from samples collected in 2017 compared to previous years as no sample sorting occurred in the field in 2017[7]. Taxonomic and biomass data was used to estimate community indices including density (org/m^2), biomass, relative abundance and relative biomass of main taxa, diversity and richness.

The benthic infauna species list previously developed by SEM was updated and examined for presence of new species identified in 2017. If new species were identified, they were further investigated to determine if they were invasive. In addition, taxa were compared against a global invasive species database (Molnar et al. 2008), as well as a known invasive species list within the National Risk Assessment for Introduction of Aquatic Nonindigenous Species to Canada by Ballast Water (Casas-Monroy et al. 2014).

2.2.2.3 Macroflora and Benthic Epifauna

Macroflora and benthic epifauna data were collected using underwater video surveys conducted along the length of each of the four previously established AIS transects, following methods described in Section 2.2.1.3. The collected underwater video footage was examined to identify macrofloral and epifaunal species to the lowest practical taxonomic level. Data recorded included presence only, rather than enumeration, since relative abundance of species was not of interest for the AIS monitoring program.

[7] Samples collected in previous years were sorted in the field prior to shipment for taxonomic analysis (SEM 2017a).

2.2.2.4 Fish and Mobile Epifauna

Fish were collected at various depths along the four previously established AIS transects using Fukui traps (Figure 7). In addition, fish collected as part of the MEEMP (Section 2.2.1.4) were also used to update the AIS fish database.

2.2.2.5 Encrusting Epifauna

Golder recovered three settlement baskets deployed in 2016 by SEM from the southwest corner of the ore dock near the caisson to allow for colonization by encrusting epifauna (SEM 2017b) (Figure 8). The baskets were placed by SEM along the rock armouring at the base of the ore dock for a continuous 12-month period, tethered to the dock to allow for future retrieval and to limit displacement of the baskets from ice movement during the shoulder seasons. Each basket measured 16.5 cm in diameter and 28 cm in length, and was filled with cobble ranging from 8 to 12 cm in diameter.

Upon recovery of the baskets in 2017, it was determined that the amount of colonization on the settlement baskets was insufficient for analysis, so no processing of the samples occurred. The settlement baskets were cleaned and re-deployed in the same location on the southwest corner of the existing ore dock. In addition to the settlement baskets, a string of five plastic pail lids was tied to the rope just above the baskets. The plastic lids served as additional platforms for encrusting epifauna to colonize. The plastic material was deemed to be a better surface than cobble to effectively remove colonized organisms without damaging them to allow for better taxonomic identification. The field crew also installed one additional string of settlement baskets on the northeast side of the ore dock and one string of settlement baskets at Ragged Island for recovery during future AIS monitoring programs (Figure 8). Baskets were identical to the previous sampling baskets and deployed in a similar manner including co-deployment of the string of five plastic pail lids.

2.3 EEM Analysis

Environmental effects monitoring (EEM) analysis was conducted using a multiple year comparison of benthic habitat data collected during MEEMP studies. Sediment particle size distribution (percent fines), iron concentrations and percent macroflora cover and epifauna abundance were used as indicators of potential Project-related effects on the marine environment.

2.3.1.1 Sediment Quality

Percent fines were analyzed using an ANCOVA, accounting for distance from transect origin, year of sampling, and sampling transect. Both percent fines and distance from dock were log-transformed to linearize the relationship. While percent data are limited to the 0-100% range, and the preferred transformations are logit (or arcsine square root), the collected data of percent fines were generally in the intermediate range of values, not at the 0% or 100% limits. This allowed the use of log-transformation, which linearized the data better than the logit transformation used in preliminary analyses. Residuals were examined for normality and heteroscedasticity, and, if needed, statistical outliers (studentized residuals >3.5) were removed and weights added to account for heteroscedasticity as function of sampling year, sampling transect, or fitted values. The choice of weight addition was based on Akaike's information criterion, corrected for small sample size (AICc). The model with the lowest

AIC among the set of candidate models was interpreted to have the strongest support, given the set of examined models and the collected data (Burnham and Anderson 2002). Following the ANCOVA, multiple comparisons between years were performed at preselected distances from the transect origin (0 m, 500 m, 1,000 m, and 1,500 m for all transects, and 4,000 m for the Coastal Transect). The multiple comparisons were calculated separately within each transect, to account for the interaction between transect, year, and distance. Test *P* values were adjusted using the Tukey method to account for multiple comparisons. The analysis was performed in R v.3.4.2 (R 2017).

Iron concentration in sediment was used to assess the effect of Project activities on sediment quality. The deposition of iron dust is expected to decrease with an increasing distance from Milne ore dock. Gradients of iron in sediments were analysed using an ANCOVA, accounting for distance from dock, year of sampling, and sampling transect. Iron content was analyzed using an ANCOVA, accounting for distance from dock, year of sampling, and sampling transect, as well as for percent fines. Iron content, percent fines, and distance from transect origin were log-transformed to linearize the relationship. The ANCOVA included all possible interactions between year, transect, and distance, while percent fines was used as a main effect only. Residuals were examined for normality and heteroscedasticity, and, if needed, statistical outliers (studentized residuals >3.5) were removed and weights added to account for heteroscedasticity as function of sampling year, sampling transect, or fitted values. The choice of weight addition was based on Akaike's information criterion, corrected for small sample size (AICc). The model with the lowest AIC among the set of candidate models was interpreted to have the strongest support, given the set of examined models and the collected data (Burnham and Anderson 2002). Following the ANCOVA, multiple comparisons between years were performed at preselected distances from the transect origin (0 m, 500 m, 1,000 m, and 1,500 m for all transects, and 4,000 m for the Coastal Transect). The multiple comparisons were calculated separately within each transect, to account for the interaction between transect, year, and distance. In the multiple comparisons, the average percent fines for each transect/year was used as the covariate's value. Test *P* values were adjusted using the Tukey method to account for multiple comparisons. The analysis was performed in R v.3.4.2 (R 2017).

Analysis of petroleum hydrocarbons as function of distance from the ore dock and time was not conducted due to low concentrations of hydrocarbons in all sediment samples collected in 2017 (see Section 3.1.2), and during baseline surveys and previous years during Project operation (SEM 2017a).

2.3.1.2 Substrate, Macroflora, and Benthic Epifauna

Due to the non-linear relationship between macroflora cover (and epifauna abundance) and distance from transect origin, it was not possible to use ANCOVA to analyze year effects on the two variables. Instead, the analysis of percent macroflora cover and epifauna abundance in 2014 to 2017 was performed using ANOVA, with distance binned into 250 m intervals. The discretization of continuous data usually renders data less informative. However, in the case of percent macroflora and epifauna abundance, data collected in 2014-2016 did not have sufficient spatial (i.e., distance) coverage to allow the use of distance as a continuous covariate. In comparison, the 2017 dataset provided essentially continuous information along each transect's length. The difference in distance gradient resolution between sampling years resulted in an inability to compare changes to macroflora cover and epifauna abundance with distance as continuous gradients, necessitating discretization. The 2017 North Transect data were omitted from analysis, since no macroflora was observed in the entirety of the transect, and since epifauna abundance was very high in two distinct parts of the transect. These two high-abundance segments of the transect had a very high density of smaller brittle stars, likely following a large settlement event. The large difference in abundance along the transect rendered the comparison of epifauna abundance between distances or between years impossible. The data for both variables were plotted to provide a complete account of the 2017 findings.

A two-way ANOVA was performed for each transect, with distance bin and sampling year as the explanatory variables. Percent macroflora cover data were transformed using a logit transformation, so that data were not limited to the 0-100% range. Epifauna abundance data were log-transformed to reduce the variability of data, especially when high values are observed (i.e., reduce the mean-variance relationship). Residuals were examined for normality and heteroscedasticity, and, if needed, statistical outliers (studentized residuals >3.5) were removed and weights added to account for heteroscedasticity as function of sampling year, distance bin, or fitted values. The choice of weight addition was based on Akaike's information criterion, corrected for small sample size (AICc). The model with the lowest AIC among the set of candidate models was interpreted to have the strongest support, given the set of examined models and the collected data (Burnham and Anderson 2002). Following the ANOVA, multiple comparisons between years within transect were performed at distance bins that had data from all years (0-250 m, 250-500 m, 1,000-1,250 m, 1,250-1,500 m, and 1,500 – 1,750 m for the West Transect, all distance bins between 0 m and 1,250 m for the East Transect, and 0-250 m, 500-750 m, 1,500-1,750 m, and 3,750-4,000 m distance bins for the Coastal Transect). Test *P* values were adjusted using the Tukey method to account for multiple comparisons.

In addition to the ANOVA on 2014-2017 data with discrete distance bins, a generalized additive model (GAM) was constructed for both percent macroflora and epifauna abundance, using 2017 data only and continuous distance from transect origin as an explanatory variable. The GAMs allowed evaluation of the overall trends in either variable with distance, as well as the inclusion of all transects in a single model. For epifauna abundance, a negative binomial distribution was used and the response variable was not transformed. The analysis was performed in R v.3.4.2 (R 2017). If future data are collected in a manner similar to 2017, the GAM approach can be extended to estimate differences between years at the full distance gradient.

2.4 Quality Management

2.4.1 MEEMP

2.4.1.1 Water Quality

2.4.1.1.1 Vertical Depth Profiles

Maintenance and calibration of the SBE-19plus CTD profiler and associated sensors are performed annually by the manufacturer (completed immediately prior to the 2017 sampling program). No field quality checks (QC) of any of the parameters was required beyond the cast acceptability check and range checks. DO, pH, pressure offset, and transmissivity performance were carefully monitored and calibrated prior to and immediately following the 2017 MEEMP program.

Immediately following data collection, all data were checked for erroneous values, and to be certain that all data and configuration files were present and properly named. This check was verified and documented by two field personnel. All data were reviewed graphically for outliers as well as trends, and to confirm that all sensors were functioning properly during the deployment. All profile data, datasheets and field notes were saved to a laptop computer and backed up on an external hard drive.

2.4.1.1.2 Discrete Water Quality Sampling

Quality assurance/quality control (QA/QC) measures were implemented to minimize possible contamination of the collected water samples. Industry standard sampling protocols were followed including collection, handling and shipping procedures. Samples were collected in laboratory-sterilized water bottles including collection and analysis of duplicate samples, travel blanks, and field blanks. For field blanks, sample containers were filled with de-ionized water in the laboratory and then processed in the field in the same manner as the collected samples (i.e., uncapped, treated with preservative, re-capped). Field blanks were analyzed to identify potential sources of contamination during field sampling. For travel blanks, sample containers were filled with de-ionized water in the laboratory and then remained sealed in the field, allowing for an assessment of contamination during transport and storage periods.

Duplicate water samples were randomly taken at 10% of the stations during each field trip. For each pair of QA/QC field duplicate water samples, the relative percent differences (RPD) were calculated, using the following formula:

$$RPD = \left(\frac{sample - duplicate}{(sample + duplicate)/2}\right) \times 100$$

The RPD between the duplicates is a measure of the variability inherent in field sampling (environmental heterogeneity, sampler handling leading to contamination). It is suggested that any field duplicates with RPD values exceeding 20% should be noted and the data should be interpreted accordingly (BCMOE 2013). Where concentrations are within five times the method detection limit (MDL), no RPD calculation is required as long as the difference between replicates is within a value equal to two times the MDL. This is due to the RPD being more sensitive to variation as values approach the analytical detection limit.

2.4.1.2 Sediment Quality

To confirm sample integrity, the following QA/QC measures were undertaken:

- Samples were collected and processed by qualified experienced personnel.
- Samples were collected in such a way that no foreign material was introduced to the sample.
- Sample handling or contact with contaminated materials/surfaces was minimized.
- Samples were placed in appropriate clean containers in such a way that no material of interest was lost due to adsorption, degradation, or volatilization.
- Sufficient sediment volumes were collected so that required detection limits can be met and quality control samples can be analyzed.
- Equipment including the grab sampler, stainless steel bowls and spoons were washed with laboratory-grade biodegradable detergent between each station to prevent cross-contamination. Equipment was rinsed between grab samples.

- Six stations (Duplicate A to F; approximately 10% of total number of stations) were selected at random in the field to be sampled in duplicate (APPENDIX C-4). The field duplicates were discrete homogenized sample from a separately collected grab (as opposed to a split sample). To assess variability between field duplicates, the RPD was calculated as follows:

$$RPD = \left(\frac{sample - duplicate}{(sample + duplicate)/2}\right) \times 100$$

- In accordance with the BC Field Sampling Manual (BC MOE 2013a), an RPD value of ±50% for values were used to identify differences between original and duplicate samples. Values less than five times the DL were not included in the RPD calculations because analytical variability near the DL is higher and does not provide a good measure of variability associated with the collection of field samples.
- Field data sheets were reviewed by the field supervisor at the end of each day for completeness and accuracy.
- Chain-of-custody documentation were used to track sample shipments to the individual subcontractor laboratories.
- Samples were packaged and shipped to the laboratory in accordance with holding times and storage conditions in an effort for analyses to be met.
- Laboratory QA/QC for sediment samples included recommended sample holding times and the analysis of laboratory control samples, method blanks, laboratory duplicates, and spiked samples to assess precision and accuracy of analytical methods. Laboratory QA/QC reports were reviewed upon receipt to confirm that the laboratory data quality objectives (DQOs) had been met and that the appropriate QA/QC information had been reported.

2.4.1.3 Substrate, Macroflora and Benthic Epifauna

Underwater video was viewed in real-time to ensure appropriate depth and visual representation of the sea bottom features. Video footage from each survey was post-processed by a marine biologist with local Arctic experience. Epibenthic organisms were identified to the lowest practical taxonomic level using a variety of species identification keys and databases. A subset of images used to identify organisms was checked by a second observer to confirm species identifications.

2.4.1.4 Fish

The following QA/QC measures were implemented by field staff during the fish sampling activities.

- Standard Working Instructions (SWIs) were reviewed and followed by all field members.
- Prior to fishing activities, all field members were briefed on sampling protocol/methods and made aware of their role in data collection. Each activity was performed at each station/ location in the same manner to maintain consistency throughout the field program.

- Data was collected in Project-specific notebooks and were reviewed by the team lead at the end of each day to ensure quality and completeness. The notebook pages were scanned and saved on an external hard drive at the field office as a backup.
- Fish identification was recorded to species. Any identification that was questionable in the field was verified using fish field guides. One fish was also sent to a laboratory for fish identification.
- Field instruments such as weigh scales were appropriately cleaned and calibrated prior to use.
- All data transcribed by hand in field notebooks were entered into Microsoft Excel and verified accurate and complete by a second team member. These documents were saved to the desktop as well as saved to an external hard drive as a backup.
- All samples were kept on ice, in fridge or in freezer, where appropriate, and labeled (station, date, time, samplers, and contents). All samples were shipped appropriately wrapped and kept on ice in coolers with appropriate documentation for receivers and sent with chain of custody forms.

2.4.2 Aquatic Invasive Species (AIS)

2.4.2.1 Zooplankton

Zooplankton collection was standardized to minimize the introduction of sampling error during sample collection. Nets were rinsed using the same rinsing techniques and samples were subject to the same preservation methods to ensure consistency. Zooplankton analysis was conducted by Biologica Environmental Services Ltd., which identified organisms down to the lowest practical taxonomic level. Results of QA/QC measures implemented by the taxonomic laboratory are reported in APPENDIX F-1.

Data was checked thoroughly and no errors or omissions were found. Species distributions within each collected sample are believed to be representative of the zooplankton community at each sampling location.

2.4.2.2 Benthic Invertebrate Infauna

Field QA/QC procedures are discussed in Section 2.4.2.2. Laboratory QA/QC measures included an assessment of sorting recovery, identification error, and precision/accuracy of sub-sampling. The taxonomic laboratory identified organisms to the lowest practical taxonomic level. Laboratory procedures included sample sorting measures, spot-checks, preliminary counting of major groups, and collaborative identification to accurately identify species to their lowest taxonomic level. Results of QA/QC measures implemented by the taxonomic laboratory are reported in APPENDIX G-1.

Benthic data was checked and no obvious signs of error in sample analysis were found. Meiofauna, including copepod and nematode species, were removed from benthic analysis because these species often fall through the 500 µm mesh sieve used to separate benthic infauna from sediments in the field. Numbers of these species collected within samples would not be representative of the true population numbers at each station and would otherwise bias station comparisons of total abundance, relative abundance, and species diversity.

Biologica developed a subsampling strategy that would maximize the detection of large and rare individuals while also enumerating smaller organisms. Large organisms (>1 cm) where first sorted, enumerated, and removed from the whole sample. The remaining debris was then spread evenly on a Caton grid and subsampled via sequential quadrat sorting. The subsample was sorted until a minimum 400 organisms were counted.

2.4.2.3 Macroflora and Benthic Epifauna

QA/QC measures for underwater video surveys conducted along the AIS transects are described in Section 2.4.1.3. Epibenthic organisms were identified to the lowest practical taxonomic level using a variety of species identification books; a subset of images used to identify organisms was checked by a second observer to confirm species identifications.

2.4.2.4 Fish, Mobile Epifauna, and Encrusting Epifauna

QA/QC measures for fish and mobile epifauna are described in Section 2.4.1.4. No samples of encrusting epifauna were collected during the 2017 sampling program.

3.0 RESULTS

The 2017 MEEMP and AIS Monitoring Programs were undertaken between 4 August and 13 September by a five-person field team composed of Golder marine biologists, local Inuit field technicians, and a local Inuit vessel operator from Pond Inlet, NU. Field activities were conducted from a 28-foot aluminum vessel and an 11-foot zodiac (tender vessel) based at the Milne Port facility. The following sections presents the results of the 2017 MEEMP and AIS Monitoring Programs by study component.

3.1 MEEMP

3.1.1 Water Quality

3.1.1.1 Vertical Depth Profiles

Oceanographic conditions in Milne Inlet are known to be primarily tidal driven. The water column structure, however, is also influenced by freshwater input, winds, atmospheric conditions and heat fluxes. Most of the variability occurring in the water column is shown to occur in the upper surface water layers.

Vertical depth profiles in the Milne Port area showed a strong vertical gradient in the physical properties of the water column (Figure 9). Surface water in Milne Inlet was relatively warm ranging in temperature from 1.6ºC to 5.5ºC depending on the tide. Temperature decreased with depth reaching its average minimum of -1.4ºC at an average depth of 78 m. Minimum salinities in Milne Inlet were observed between the surface and depth of 5 m and ranged, depending on the tide, between 7 PSU and 28 PSU. Salinity increased with depth and the halocline (steeply rising salinity layer) was approximately 50 m deep. Below the halocline, salinity was above 31 PSU and reached a maximum of 33 PSU below 200 m depth. Vertical salinity and temperature gradients resulted in a vertical density gradient with relatively “lighter” warmer and less saline water floating on top of heavier colder and more saline water. The pycnocline (steeply increasing density layer) was approximately 35 to 60 m deep (Figure 10).

Vertical depth profiles at Ragged Island were collected in relatively shallow water (14 to 21 m depth). At these depths, there was no considerable change in temperature and salinity between the surface and bottom of the water column (Figure 11). Temperature ranged from 2.0ºC at the depth of 21 m to 2.8ºC at the surface; salinity ranged from 26.4 PSU at the surface to 27.5 PSU at a depth of 21 m. The resulting density difference between the surface and the bottom was less than 1 unit of σ_T[8] (Figure 12).

Dissolved oxygen (DO) concentrations at the surface (up to 1 m depth) in Milne Inlet ranged from 7.3 mg/L to 8.9 mg/L and percent saturation ranged from 64% to 77% (Figure 13). Maximum oxygen saturation in Milne Inlet occurred at depths between approximately 35 and 70 m or at the depths of the pycnocline and ranged between 78 and 84% (9 and 10 mg/L). Below the pycnocline, dissolved oxygen decreased with depth reaching an average minimum of 5.8 mg/L, or 49% saturation, below 150 m.

DO levels in surface waters at Ragged Island ranged from 7.4 mg/L (65% saturation) to 8.1 mg/L (72% saturation (Figure 14). Maximum dissolved oxygen concentrations occurred at depths between 6 m and 18 m and ranged between 8.2 mg/L (72% saturation) and 8.3 mg/L (73% saturation).

[8] σ_T or sigma-t is a measure seawater density. It is obtained by subtracting 1,000 from the water density expressed in kg/m^3; it has no units.

Water in Milne Inlet was clear throughout the water column with slightly higher turbidity at the surface; surface turbidity values ranged between 0.2 NTU and 1.9 NTU (Figure 15). Turbidity was higher at the surface at station CTD-8 reaching a maximum of 3.6 NTU. Turbidity below the surface decreased with depth and was steadily low below the pycnocline with an average value of 0 NTU. Turbidity slightly increased near the bottom, most likely due to the proximity of seabed sediment.

Turbidity varied little from station to station or with depth at the five Ragged Island vertical profile stations (Figure 16). Turbidity at Ragged Island ranged between 1 NTU and 1.5 NTU.

Chlorophyll *a* concentrations were relatively low throughout Milne Inlet, generally less than 0.7 µg/L in the upper 30 m of the water column and less than 0.1 µg/L at depths below 30 m.

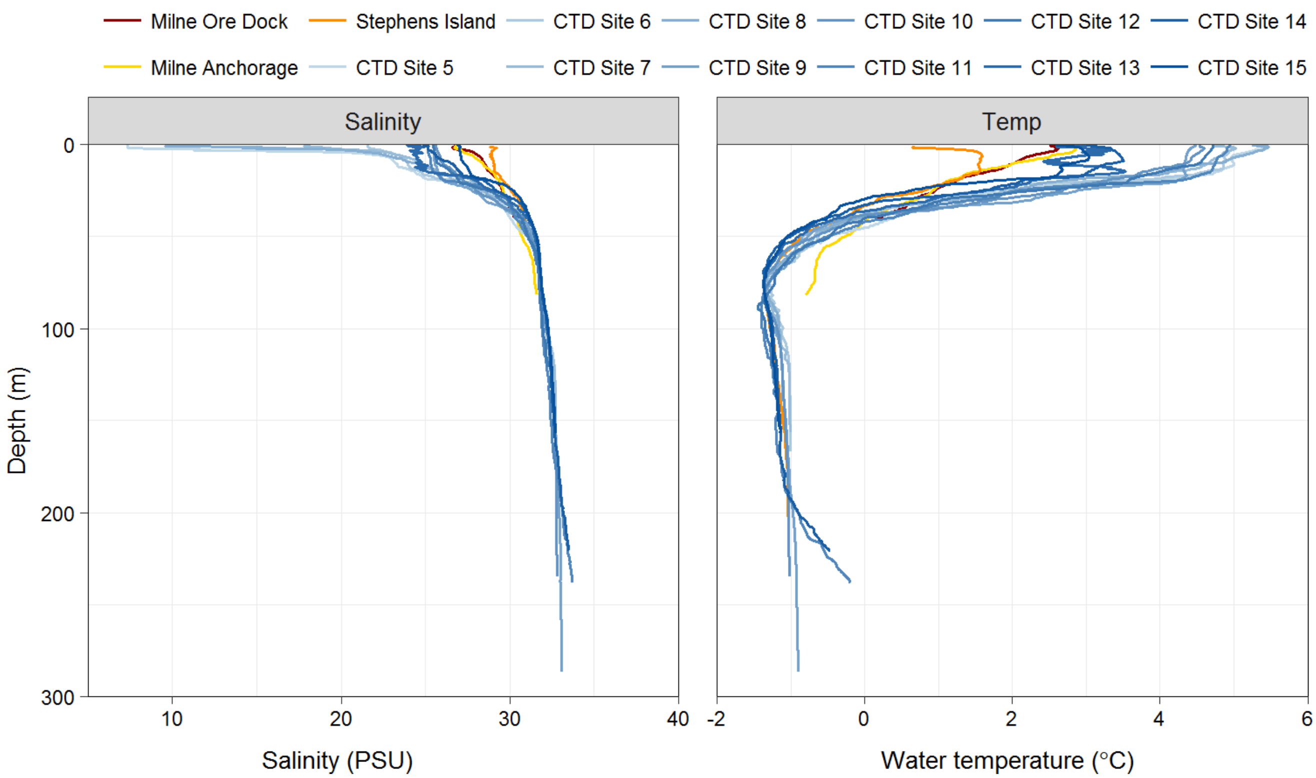


Figure 9: Temperature and Salinity in Milne Inlet, 2017

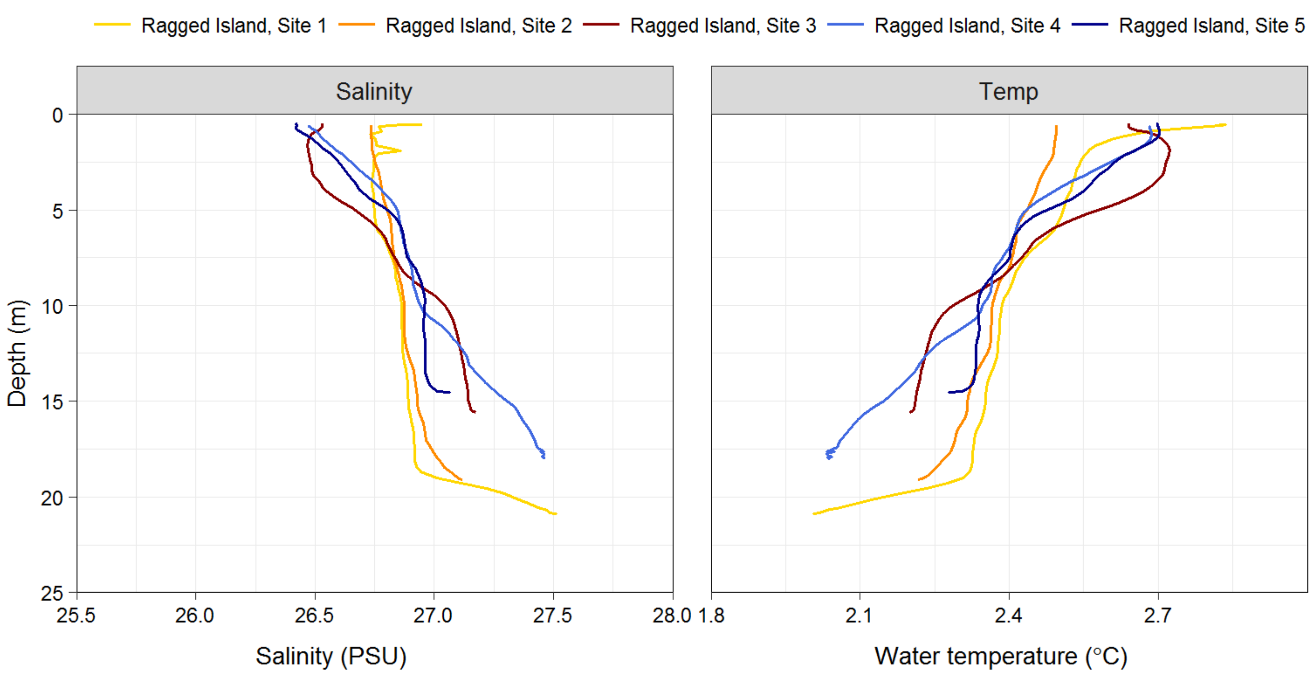


Figure 10: Temperature and Salinity at Ragged Island, 2017

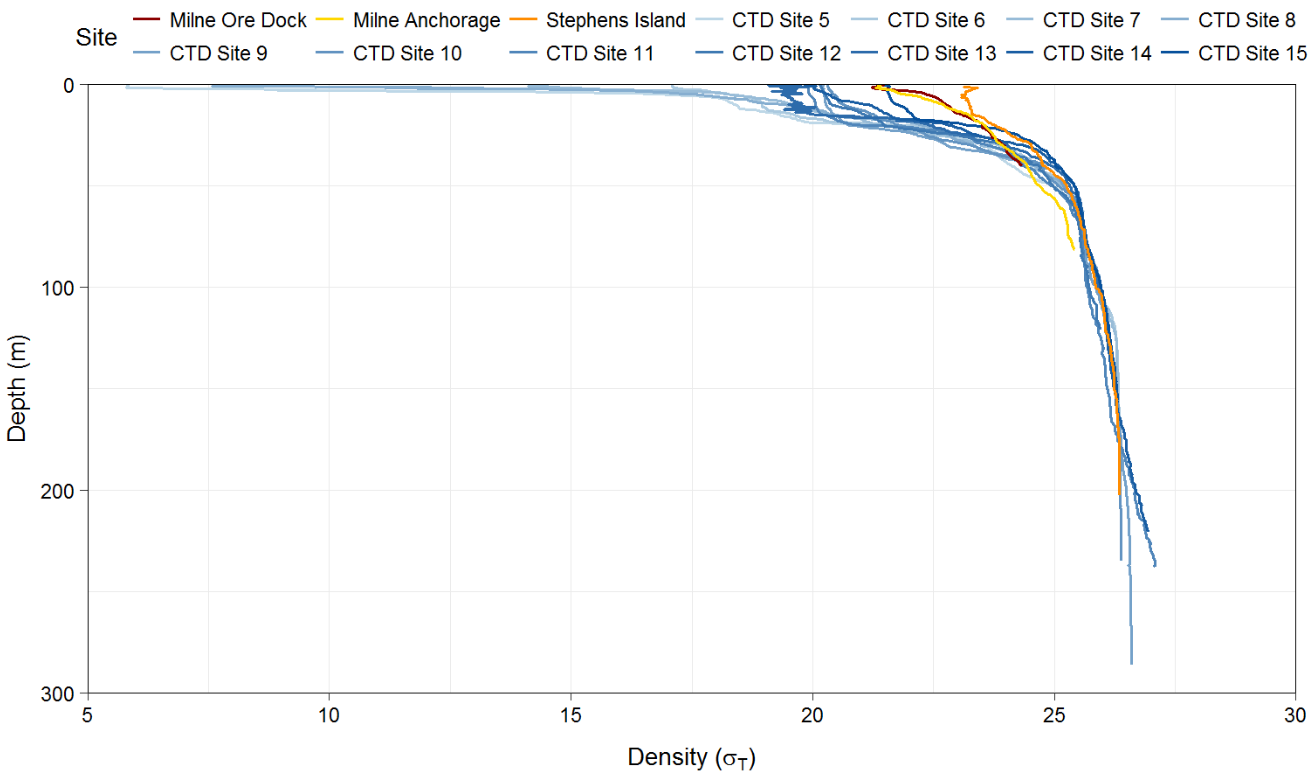


Figure 11: Water Density (σ_T) in Milne Inlet, 2017

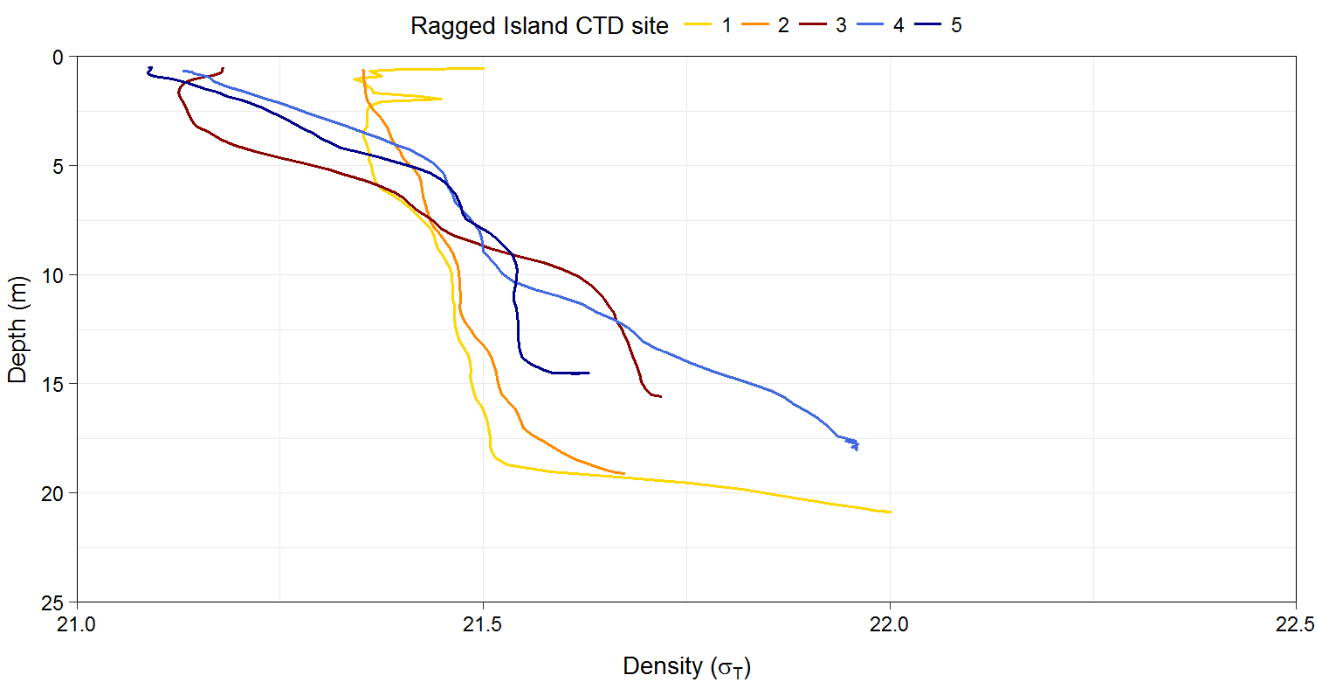


Figure 12: Water Density (σ_T) at Ragged Island, 2017

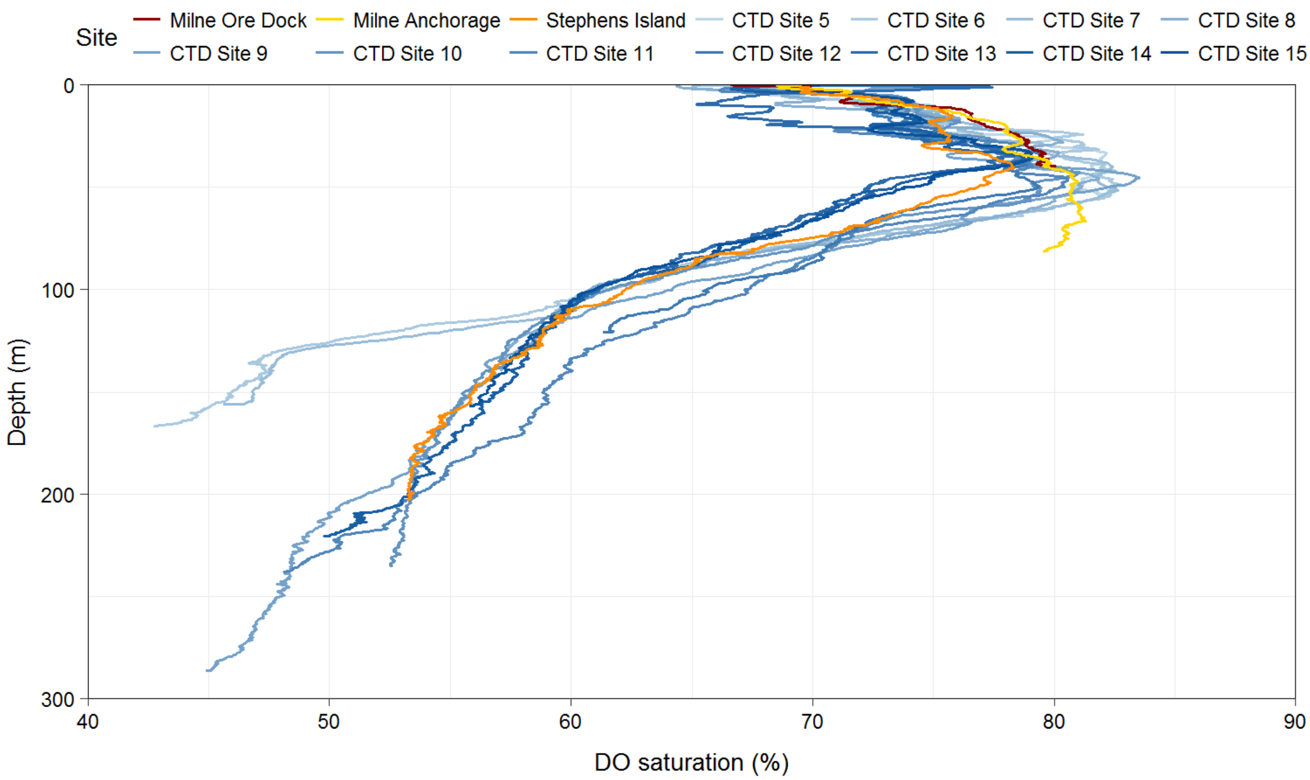


Figure 13: Dissolved Oxygen Saturation (%) in Milne Inlet, 2017

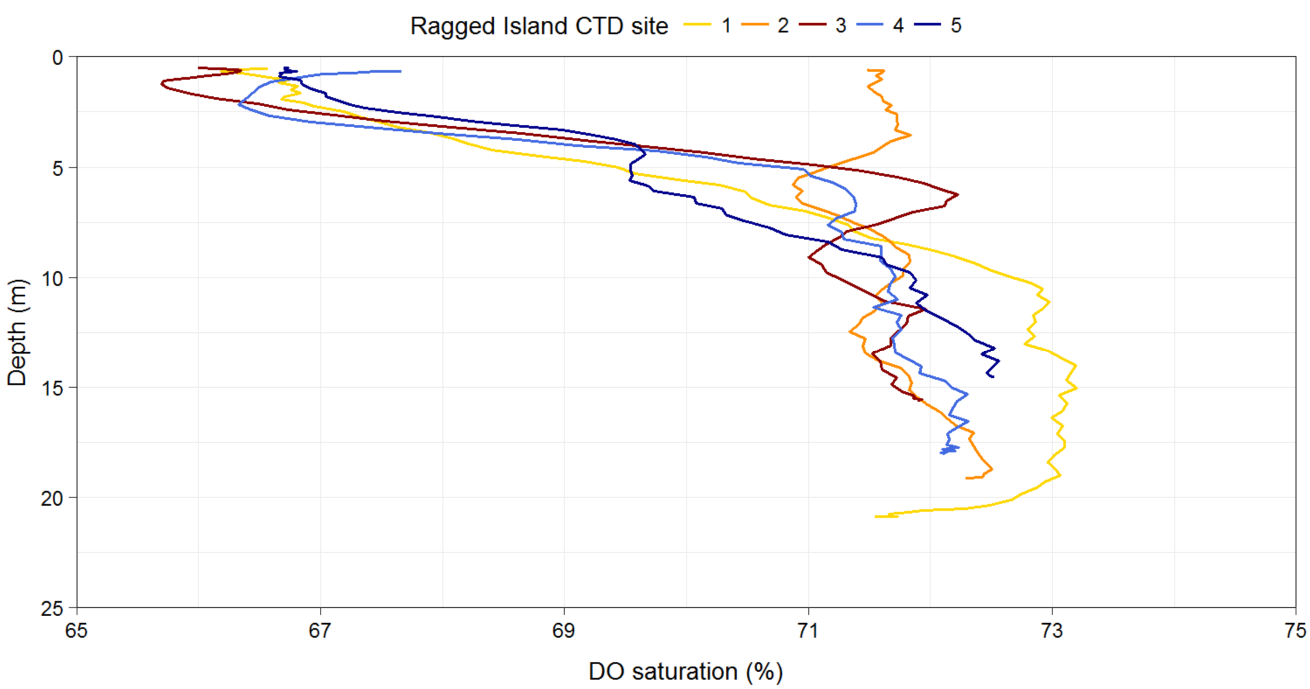


Figure 14: Dissolved Oxygen Saturation (%) at Ragged Island, 2017

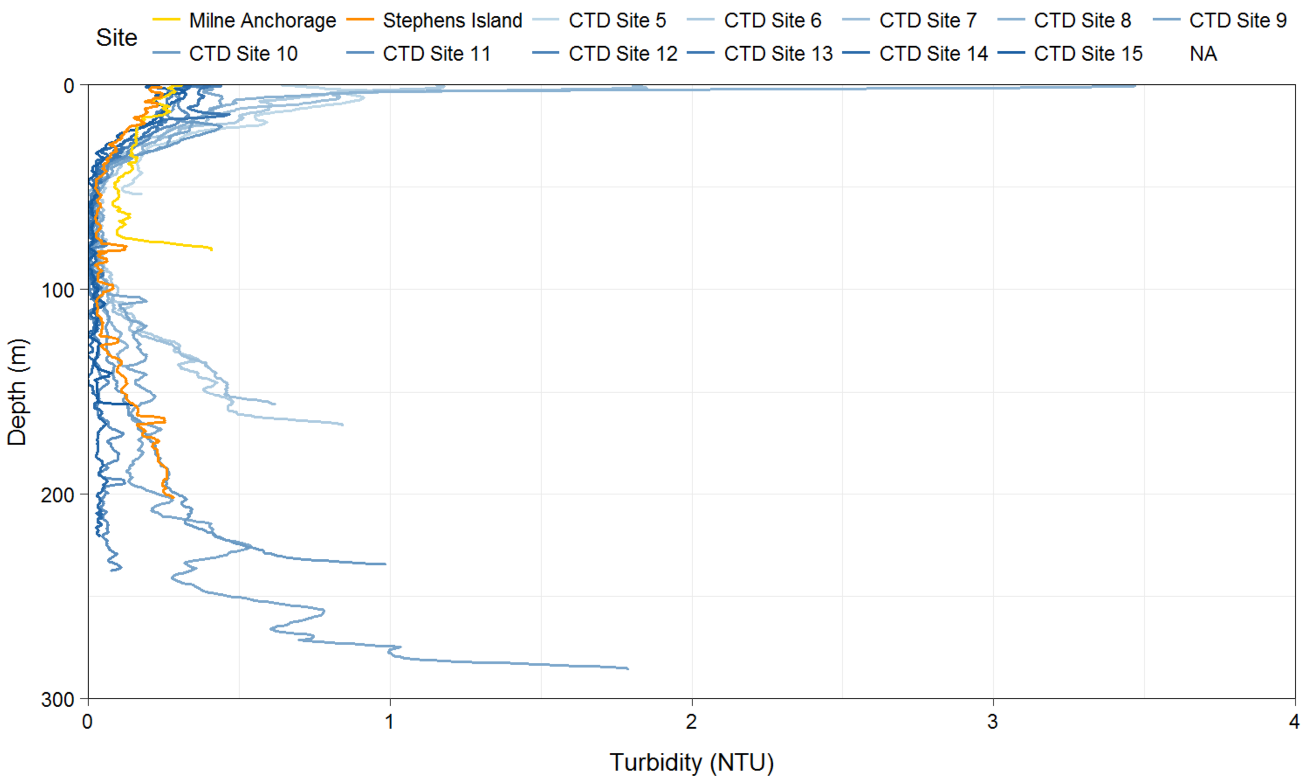


Figure 15: Turbidity (NTU) in Milne Inlet, 2017

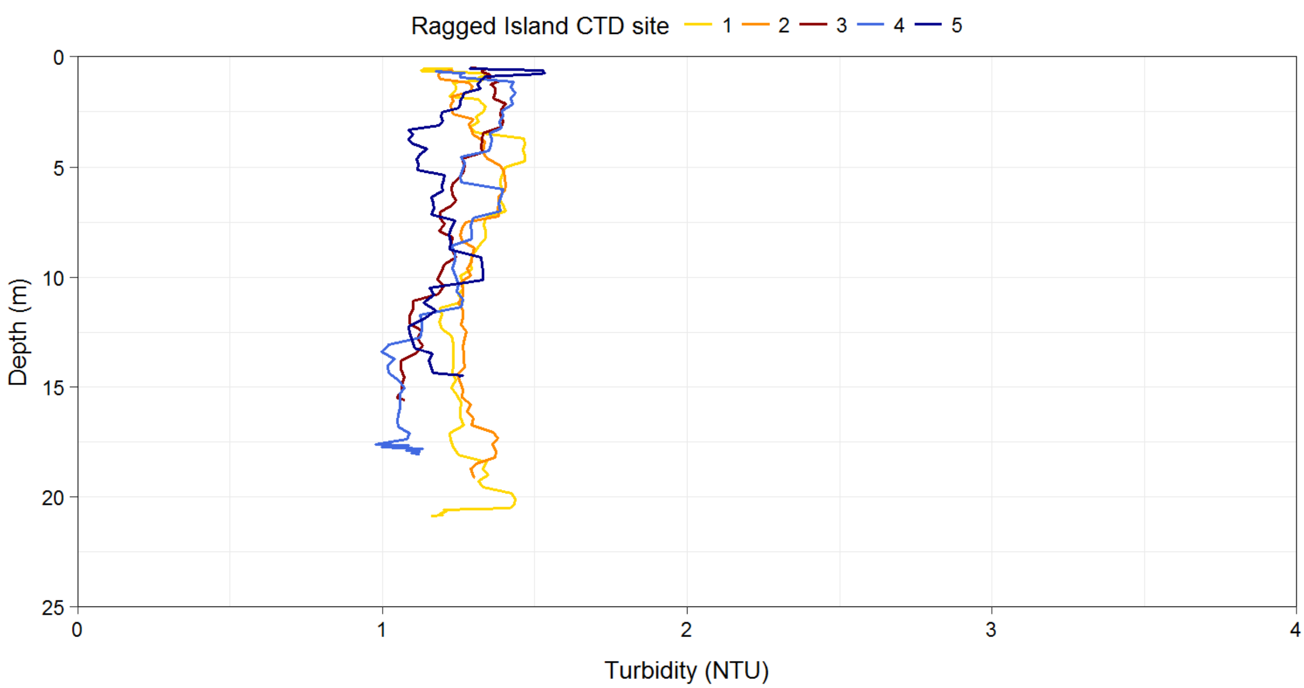


Figure 16: Turbidity (NTU) at Ragged Island, 2017

3.1.1.2 Discrete Water Quality Sampling

Water quality laboratory results are presented in Appendix B. Summary statistics for the 2017 water quality program are presented in Table 12 and a comparison to previous survey years is provided in Table 13.

Salinity concentrations ranged from 4.1 to 24.4 ppt for all samples collected in 2017, which is reflective of a brackish environment. Mean salinity concentrations at ach sampling location ranged from 13.3 ppt to 14.6 ppt. Salinity concentrations for all samples were higher during the 31 August and 10 September sampling events.

Concentrations of pH ranged from 7.0 to 8.0 for all samples collected in 2017, which are within the CCME WQG (7.0 – 8.7). pH values reported in 2015 (7.5 to 7.9; SEM 2016a) and in 2016 (7.7 and 7.9; SEM 2017a) were also within the CCME WQG.

Total suspended solids (TSS) ranged from <2 to 25.5 mg/L for all samples collected in 2017. The maximum observed TSS value (25.5 mg/L) occurred at the Source[9] station on 10 September during a storm event when heavy wave action was observed to be re-suspending sediment from the seafloor at the nearshore sampling site. TSS concentrations at the offshore sampling stations on this day ranged from 3.6 to 4.6 mg/L. The 25.5 mg/L value exceeded the clear flow long term CCME WQG, but not the clear flow short term guideline[10] when 4.6 mg/L was used as the background level (max TSS value from other sampling locations on 10 September 2017). TSS at all locations, including the Source, was <2 mg/L during the two other sampling events in which TSS was measured. In 2016, TSS ranged from 1 to 3 mg/L (SEM 2017a) for all samples. In 2015, TSS ranged from 0.50 to 2.20 mg/L for all samples (SEM 2016a). The higher concentration of TSS observed at the Source location on 10 September 2017 was therefore assumed to be representative of sediment re-suspension in the water column during sample collection, and not related to effluent discharge

Turbidity levels ranged from 1.06 to 9.60 NTU for all samples collected in 2017. The highest turbidity value (9.60 NTU) was from the Source station during the 10 September sampling event. The 9.60 NTU value at the Source sampling location exceeded the clear flow long term CCME WQG, but not the clear flow short term guideline[11] when 1.8 NTU was used as background (max turbidity value from other locations on 10 September 2017). As noted above, the high turbidity value recorded at the Source station on 10 September was assumed to be reflective of sediment re-suspension due to the storm event. Turbidity values measured at the Source during all other sampling events in 2017 were similar to the other sampling stations. In 2016, turbidity ranged from 0.10 to 0.99 NTU (SEM 2017a). In 2015, turbidity ranged from 0.05 to 0.92 (SEM 2016a).

Nitrate concentrations were <0.5 mg/L for all samples collected in 2017, which is below the short term (1500 mg/L) and long term (200 mg/L) CCME WQG. Nitrate concentrations reported in 2015 and 2016 were also below CCME WQG. In 2016, nitrate concentrations ranged from 0.05 to 0.58 mg/L (SEM 2017a). In 2015, nitrate concentrations ranged from 0.03 to 0.16 mg/L (SEM 2016a).

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[9] Results for the Source 1 and Source 2 locations have been combined for presentation purposes due to proximity and similarity of results.

[10] The long term TSS guideline for clear flows is defined as "maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d)". The short term guideline for clear flows is defined as "maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period)" (CCME 2002).

[11] The long term turbidity guideline for clear flows is defined as "Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period)". The short term turbidity guideline for clear flows is defined as "maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period)" (CCME 2002).

Fecal coliform bacteria analysis was undertaken for water samples collected on 5 September. Levels ranged from 1 to 2 CFU/100 mL. Fecal coliform levels were not tested for in 2015 or 2016 (SEM 2016a; SEM 2017a).

Metal concentrations for total arsenic, cadmium, chromium, mercury, and silver were below detection limits and below CCME WQG for all samples collected in 2017. In 2016, concentrations for the same suite of metals were below CCME WQG (SEM 2017a). In 2015, metal concentrations for total arsenic, cadmium, chromium, and silver were below CCME WQG; but total mercury levels exceeded the CCME WQG (0.000016 mg/L) for all samples collected on 30 August 2015 (with concentrations ranging from 0.000023 to 0.000025 mg/L). Mercury was below detection limits and below CCME WQG during all other sampling events in 2015.

Total aluminum concentrations ranged from 0.0077 to 0.142 mg/L for all samples collected in 2017. There is no CCME WQG for aluminum. The maximum observed aluminum value (0.142 mg/L) occurred at the Source station on 10 September during the previously described storm event and is thought to be reflective of sediment resuspension in the nearshore as a result of wind-induced wave action, and not related to effluent discharge. The highest aluminum values occurred at the same time as the higher TSS/turbidity event on 10 September. In 2016, total aluminum ranged from 0.009 to 0.025 mg/L for all samples and dates (SEM 2017a). In 2015, total aluminum ranged from <0.05 to 0.05 mg/L (SEM 2016a).

Total iron concentrations ranged from <0.010 to 0.286 mg/L for all samples collected in 2017. There is no CCME WQG for iron in the marine environment. The maximum observed iron value (0.286 mg/L) occurred at the Source station on 10 September during the previously described storm event and is thought to be reflective of sediment resuspension in the nearshore as a result of wind-induced wave action, and not related to effluent discharge. Removing this outlier sample resulted in a mean iron concentration of 0.018 mg/L at the Source station, which is comparable to and slightly below mean iron concentrations at each of the other sampling stations. In 2015 and 2016, total iron was below detection limits for all samples; however, the detection limit for analysis of iron concentrations was higher (0.5 mg/L) than all of the recorded values in 2017 except for the one outlier on 10 September (SEM 2017a).

PAHs were below the detection limit for all samples during all sampling events in 2017, 2016 and 2015. Naphthalene was also below the CCME WQG for all samples in 2017. Naphthalene was not tested for in 2016 and 2015.

Table 12: Water Quality Summary Statistics for Each Sampling Location over Five Sampling Events in 2017.

Parameter	CCME Marine WQG for Protection of Aquatic Life		Source			WNW			North			ENE		
	Short Term	Long Term	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Physical														
Salinity (ppt)	-	-	13.4	5.4	23.6	13.3	4.1	23.3	14.2	6.3	23.4	14.6	6.5	24.4
pH	-	**7.0-8.7**	7.8	7.1	8.0	7.75	7.01	7.99	7.77	7.14	7.97	7.76	7.12	8.0
TSS (mg/L)	<25 mg/L above background	**< 5mg/L above background**	10.7	<2	**25.5**	1.9	<2	3.6	2.2	<2.0	4.6	1.9	<2.0	3.6
Turbidity (NTU)	<8 NTU above background	**<2 NTU above background**	2.28	0.34	**9.60**	0.60	0.27	1.08	0.65	0.38	1.53	0.71	0.32	1.81
Nutrients (mg/L)														
Nitrate	1500	**200**	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bacteria (CFU/100mL)														
F. Coliform	-	-	1	1	1	1	1	1	1	1	1	2	2	2
Total Metals (mg/L)														
Aluminum	-	-	0.041	0.011	0.142	0.0197	0.0081	0.0330	0.0184	0.0077	0.0376	0.0222	0.0077	0.0498
Arsenic	-	**0.0125**	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Cadmium	-	**0.00012**	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Chromium	-	**0.0015 (Cr(VI))**	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	-	-	0.071	<0.010	0.286	0.025	0.010	0.050	0.022	<0.010	0.051	0.026	<0.010	0.052
Mercury	-	**0.000016**	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Silver	0.0075	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
PAHs (mg/L)														
Naphthalene	-	**0.0014**	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Table 13: Water Quality Summary Statistics for 2015, 2016 and 2017 at all Sampling Locations.

Parameter	CCME Marine WQG for Protection of Aquatic Life		2015			2016			2017		
	Short Term	Long Term	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Physical											
Salinity (ppt)	-	-	-	-	-	-	-	-	13.9	4.1	24.4
pH	-	7.0-8.7	7.83	7.52	7.91	7.85	7.67	7.94	7.77	7.01	8.0
TSS (mg/L)	<25 mg/L above background	< 5mg/L above background	1.20	0.50	2.20	1.61	1	3	4.2	<2	25.5
Turbidity (NTU)	<8 NTU above background	<2 NTU above background	0.23	0.05	0.92	0.43	0.10	0.99	1.06	0.27	9.60
Nutrients (mg/L)											
Nitrate	1500	200	0.04	0.03	0.16	0.16	0.05	0.58	<0.5	<0.5	<0.5
Bacteria (CFU/100mL)											
F. Coliform	-	-	-	-	-	-	-	-	1.25	1	2
Total Metals (mg/L)											
Aluminum	-	-	-	<0.05	0.05	0.016	0.009	0.025	0.02533	0.0077	0.142
Arsenic	-	0.0125	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0020	<0.0020	<0.0020
Cadmium	-	0.00012	<0.00001	<0.00001	<0.00001	0.000016	0.000013	0.000018	<0.000050	<0.000050	<0.000050
Chromium	-	0.0015 (Cr(VI))	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.00050	<0.00050	<0.00050
Iron	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.036	0.01	0.286
Mercury	-	0.000016	0.00001	0.00001	0.00003	<0.000013	<0.000013	<0.000013	<0.000010	<0.000010	<0.000010
Silver	0.0075	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010
PAHs (mg/L)											
Naphthalene	-	0.0014	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050

3.1.1.3 Quality Management

For Duplicate A (duplicate of Source) collected on 22 August 2017, the RPD for all parameters was below 20%. For Duplicate B (duplicate of Source) collected on 10 September 2017, there were several parameters where the RPD was above 20%. Parameters exceeding 20% RPD included TSS, turbidity, TOC, total iron and total manganese. During the collection of duplicate samples at the Source on 10 September, a large amount of wind-induced wave action was observed re-suspending sediment from the seafloor at the sampling location. The variability in the two samples collected is likely a result of the difficulty faced in obtaining representative duplicate samples in the field at this location, as depths were shallow (~1 m) and strong waves were re-suspending sediment from the seafloor into the water column during sample collection. As a result, differences between duplicate samples collected at the Source location on 10 September are believed to be caused by environmental factors during sample collection and should not be interpreted as affecting the overall reliability of the water quality dataset.

3.1.2 Sediment Quality

Analyses of the physical and chemical composition of sediments were conducted on samples collected from a total of 19 stations along four transects. Results of the analyses are presented in APPENDIX C-1. Sediment quality results were compared to CCME Interim Sediment Quality Guideline (ISQGs) and Probable Effect Level (PELs) for the protection of aquatic life in the marine environment (CCME 2014) (APPENDIX C-2). Concentrations of some variables fell below analytical detection limits. Half of the detection limit values were used for non-detected concentrations in the graphs and for statistical calculations. Principal component analysis (PCA), a multivariate statistical test, was used to help data interpretation. The test was conducted using SYSTAT 13 program (APPENDIX C-3).

PCA showed four components with eigenvalues >1 that accounted for 92% of the total variance. The first two components explained the highest percentage of the variance in the original data (84%), with PC1 and PC2 accounting for 77% and 7% of the variance respectively. The other two principal components accounted for the remaining 16% of the explained variance and will not be discussed further. Details of the PCA, including the eigenvalues, factor loading matrix, factor scores, and correlation matrix, are presented in Appendix C-3.

PC1 positively correlated strongly with fine fractions of sediments (silt and clay), and concentrations of metals and total organic carbon (loading coefficient ≥0.9). PC1 negatively correlated (loading coefficient ≤-0.4) with sand, gravel and pH. PC2 positively correlated with concentrations of molybdenum, selenium, and antimony loading coefficient ≥0.3), and negatively correlated with calcium, arsenic, phosphorus, magnesium and TOC.

PC1 and PC2 were plotted to identify where samples lie in two-dimensional ordinal space, therefore, allowing for further interpretation of the data (Figure 17). The right half in the figure represents high silt and clay content and high concentrations of metals and higher pH; the left half of the figure represents higher sand and gravel content, lower pH and lower concentrations of metals. The upper half of the figure represents higher concentrations of molybdenum, selenium, and antimony; the lower half of the figure represents higher calcium, arsenic, phosphorus, magnesium and TOC concentrations. Most of the samples are clumped in the centre of the graph. Samples from the Coastal Transect (SC) are located in upper-right part of the graph, with higher content of fines and metals. Samples from SW-1 and SW-2 are located in the upper-left, with lowest concentrations of most metals with some exceptions. SW-4 and SW-5 samples are located in the lower-central part of the graph with relatively moderate concentrations of most metals, except arsenic, calcium and magnesium.

As in previous years, sediment physical composition in samples collected in 2017 varied among stations and transects (Figure 18; top). Sediment in the West and East Transects predominantly consisted of gravel and sand, particularly at stations near the ore dock, while the Coastal and North Transects had higher proportions of finer classes (silt and clay). In the North Transect, differences in particle size composition seemed to be related to depth, with higher proportion of fines (silt and clay) found in deeper areas. Sediment physical composition distribution among transects in 2017 was consistent with that recorded during surveys in 2014 to 2016 (Figure 18; bottom).

Concentrations of metals, in general, correlated with sediment physical composition. Some metals were found in low levels: concentrations of tin were below the DL (2 mg/kg) in all samples; bismuth and silver were detected only in one sample (SC-4-1); and antimony and selenium were found in less than 50% of the samples. Where detected, metal concentrations were, in general, higher in areas with higher proportion of fines. For instance, aluminum and iron concentrations were highest (14,700 mg/kg and 28,900 mg/kg respectively) in sample SC-4-1 from the Coastal Transect where the highest proportion of fines (77%) was found (Figure 19). The lowest concentrations of aluminum and iron (797 mg/kg and 1,970 mg/kg respectively) as well as of other metals were found at station SW-1 where the lowest proportion of fines (1%) was found. Sediment metal distribution among transects in 2017 was, in general, consistent with that found in 2014 to 2016 (Figure 20).

Arsenic concentrations in sediment samples collected in 2017 exceeded the CCME ISQG (7.24 mg/kg) at three stations: SW-4, SN-2 and SN-3 (Figure 21; top). The highest arsenic concentration (10.3 mg/kg) was found at SW-4-3. High arsenic concentrations in sediment are not associated with ore from the Mary River and are most likely naturally occurring. Similar arsenic exceedances were observed during previous sampling efforts (2014-2016) (SEM 2015; 2016; 2017). In general, arsenic concentrations in 2017 were similar to those reported in previous surveys (Figure 21). Arsenic concentrations recorded in 2017 did not exceed the CCME Probable Effect Level (PEL) (41.6 mg/kg).

No other metals exceeded CCME ISQG or PEL during the 2017 sediment program.

Volatile organic compounds, F1 - F4 hydrocarbons, and PAHs were below detection limits and below CCME ISQG and PEL for all sediment samples collected in 2017.

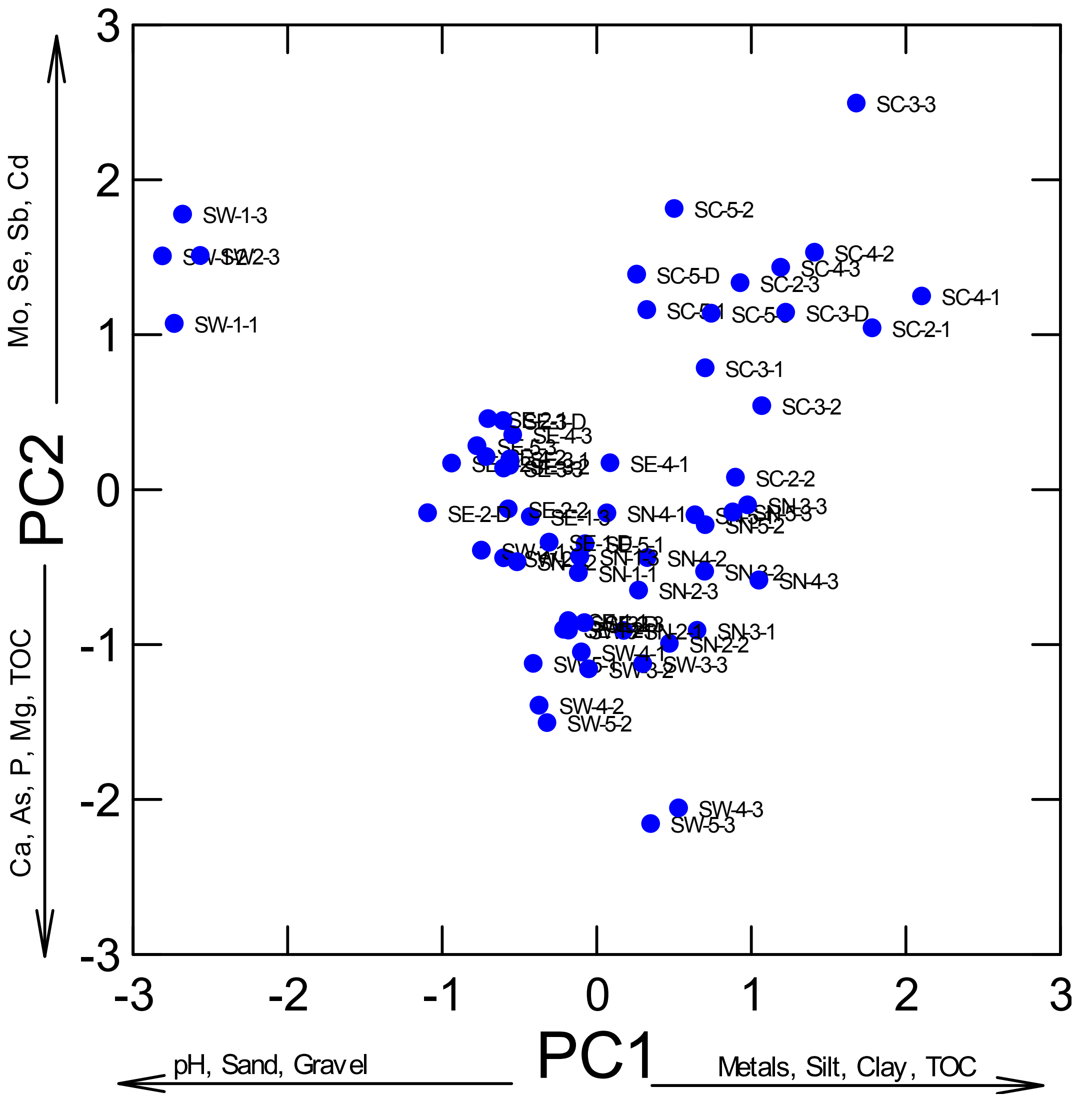
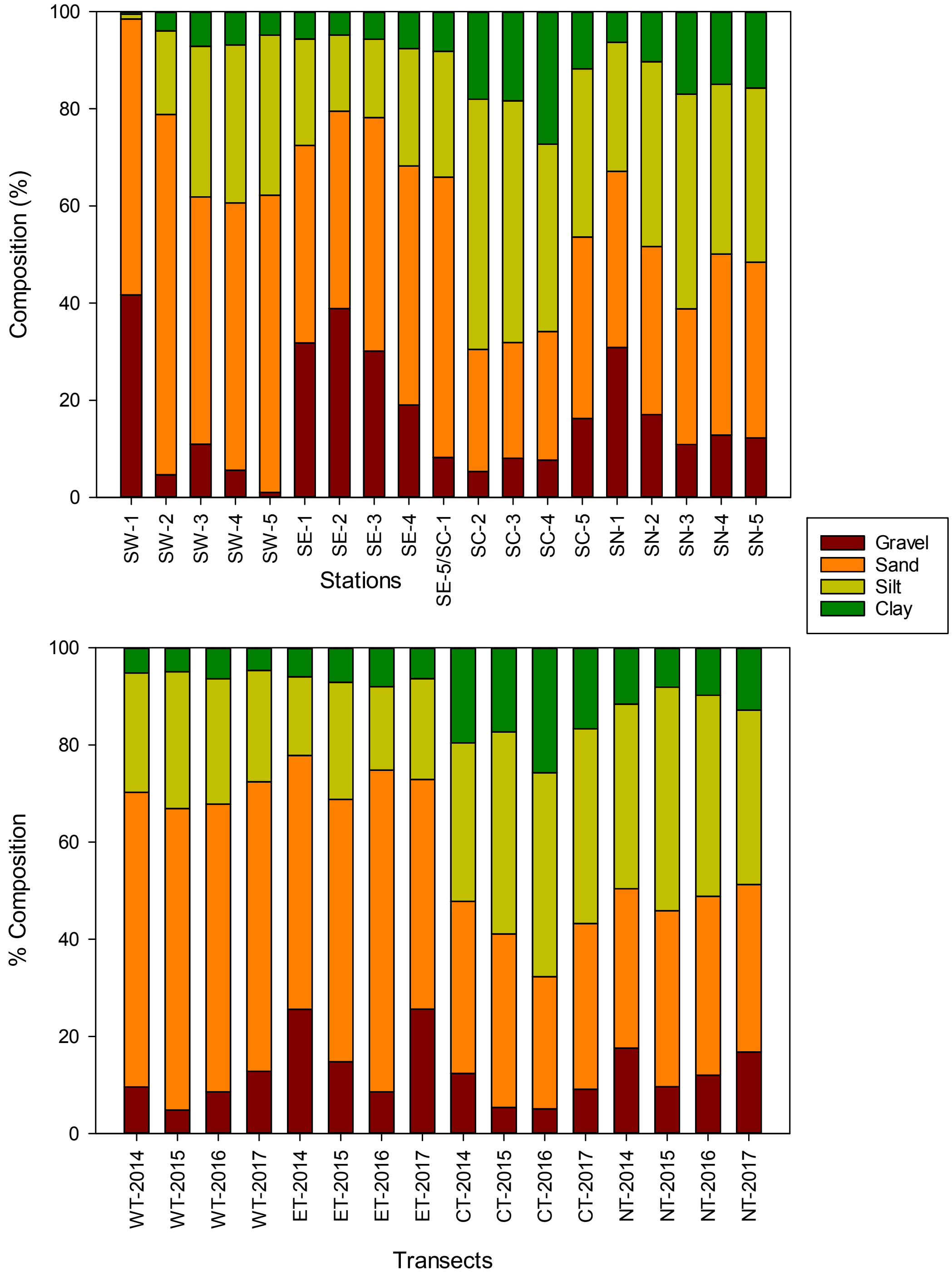
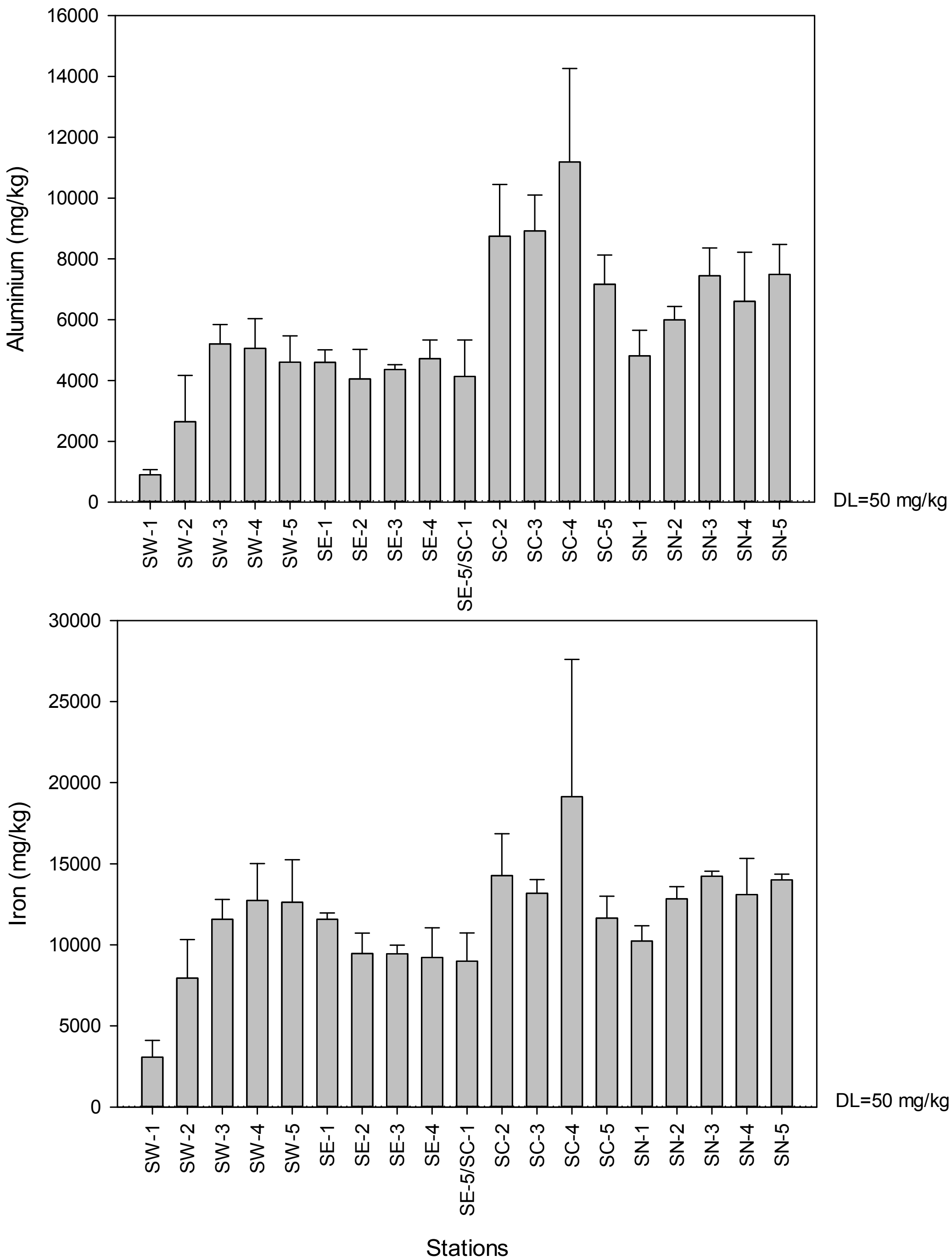


Figure 17: Principal Component Analysis (PCA) of Sediment Samples, 2017



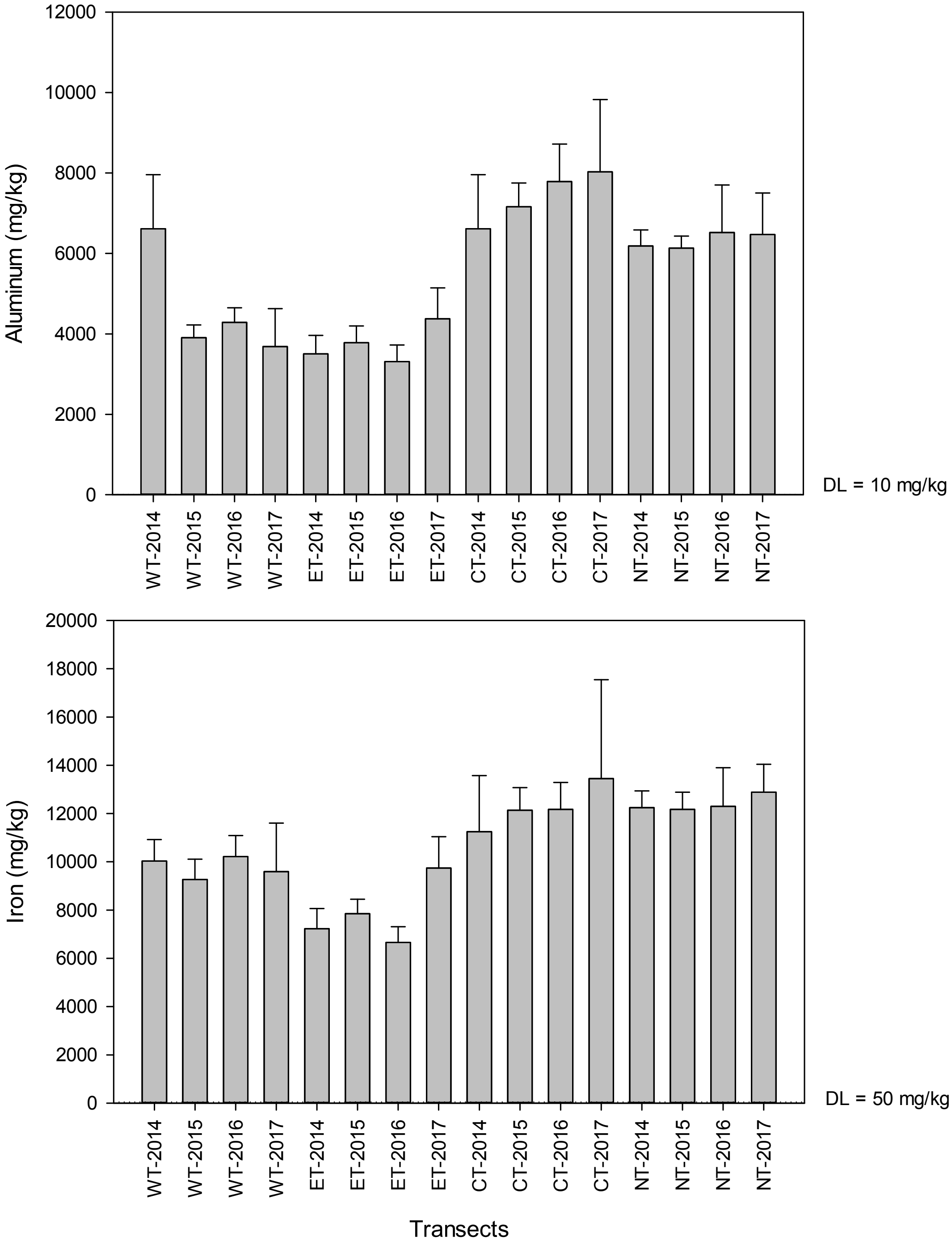
Notes: WT - West Transect; ET - East Transect; CT - Coastal Transect; NT - North Transect

Figure 18: Mean Sediment Particle Size Composition among Stations in 2017 (top) and among Transects and Years (2014-2017; bottom).



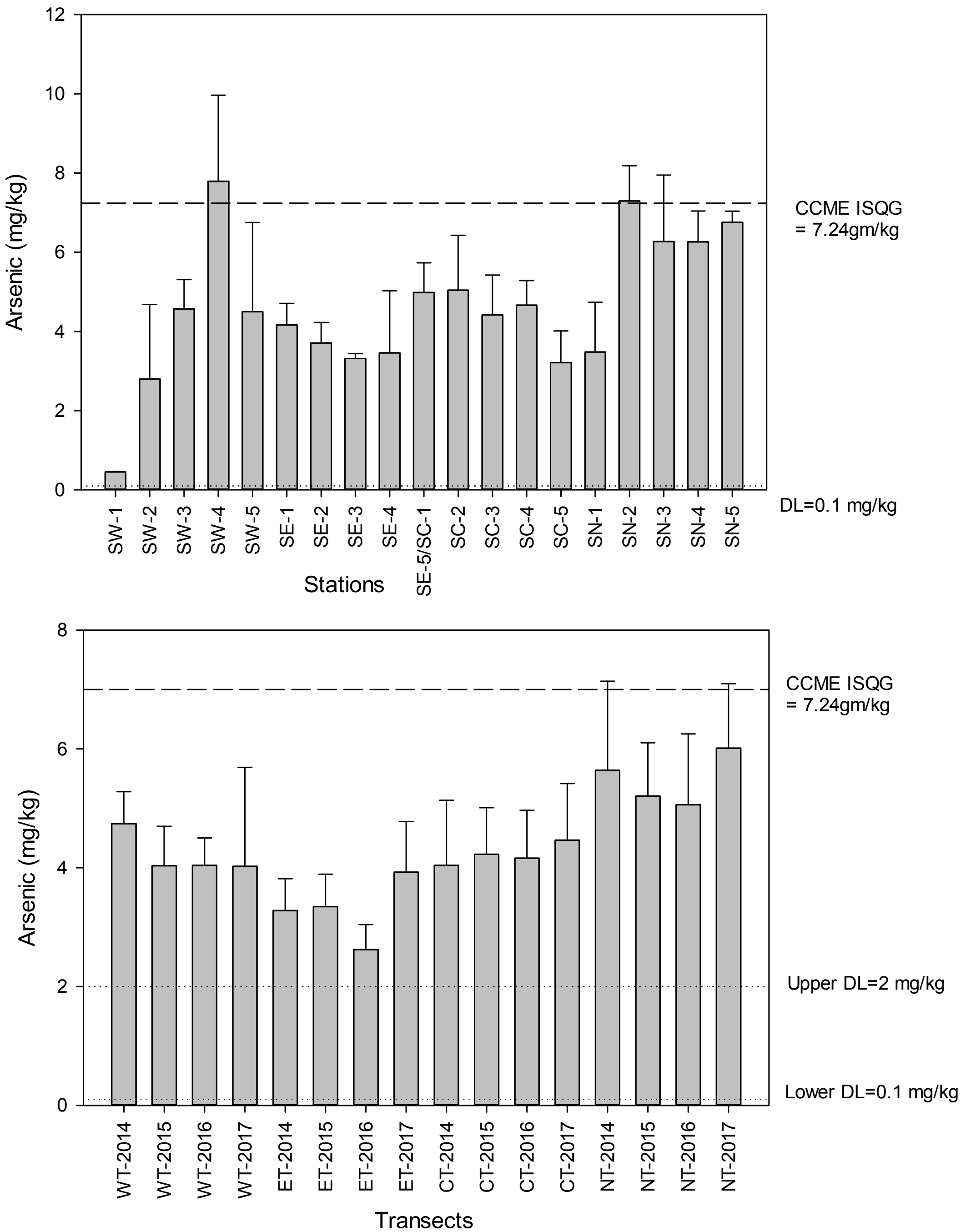
Notes: DL - detection limit
Error bars represent standard deviation

Figure 19: Mean Iron and Aluminum Concentrations in Sediments per Station, 2017



Notes: WT - West Transect; ET - East Transect; CT - Coastal Transect; NT - North Transect
DL - detection limit
Error bars represent standard deviation

Figure 20: Mean Aluminum and Iron Concentrations in Sediments per Transect, 2014 to 2017



Notes: WT - West Transect; ET - East Transect; CT - Coastal Transect; NT - North Transect
DL - detection limit
Error bars represent standard deviation
ISQG - Interim Sediment Quality Guidelines

Figure 21: Mean Arsenic Concentrations in Sediments per Station in 2017 (top) and per Transect in 2014 to 2017 (bottom)

3.1.2.1 EEM Analysis – Content of Fines

The percentage of fines in sediment samples was analyzed using a single ANCOVA model, with main effects of distance from transect origin, year (as discrete factor), and transect, and all possible interactions. The model explained 63% of the data variability, and the three-way interaction was statistically significant, indicating differences in the relationship between fines and distance under different years and transects (Table 14).

On the West Transect, no significant differences in fines content at the 0 m distance from dock were found between years (Table 15). However, note that the 2017 SW-1 station was removed from the test, and the 2017 estimate used for multiple comparisons is an extrapolation of the existing data. At farther distances along the West Transect, a significant increase in fines was found between 2014 and 2017 at 500 m, 1,000 m, and 1,500 m distances (although measurements in 2015 and 2016 were not significantly different from either 2014 or 2017). On the East Transect, estimates of fines at 0 m distance from the dock were significantly lower in 2016 than in either 2014 or 2015, but significantly higher in 2017 relative to 2014 and 2016. At father distances, the 2017 estimates were not significantly different from 2014 or 2015 data for the remainder of the distances, but were significantly higher than 2016 at 500 m and significantly lower than 2016 at 1,500 m. On both the Coastal and North Transects, none of the multiple comparisons suggested significant differences in fines content between years at any of the distances (Table 15).

Table 14: ANOVA Summary of Percent Fines in Sediments by Year and Transect

Adj. R^2	Parameter	Df	*F* value	*P* value
0.63	Distance from transect origin	1	42.7	<0.001
	Year	3	4.9	0.003
	Transect	3	111.9	<0.001
	Distance × Year	3	1.0	0.406
	Distance × Transect	3	18.2	<0.001
	Year × Transect	9	1.7	0.101
	Distance × Year × Transect	9	3.4	0.001

Notes: Adj. R^2= Adjusted R square value; Df= degress of freedom

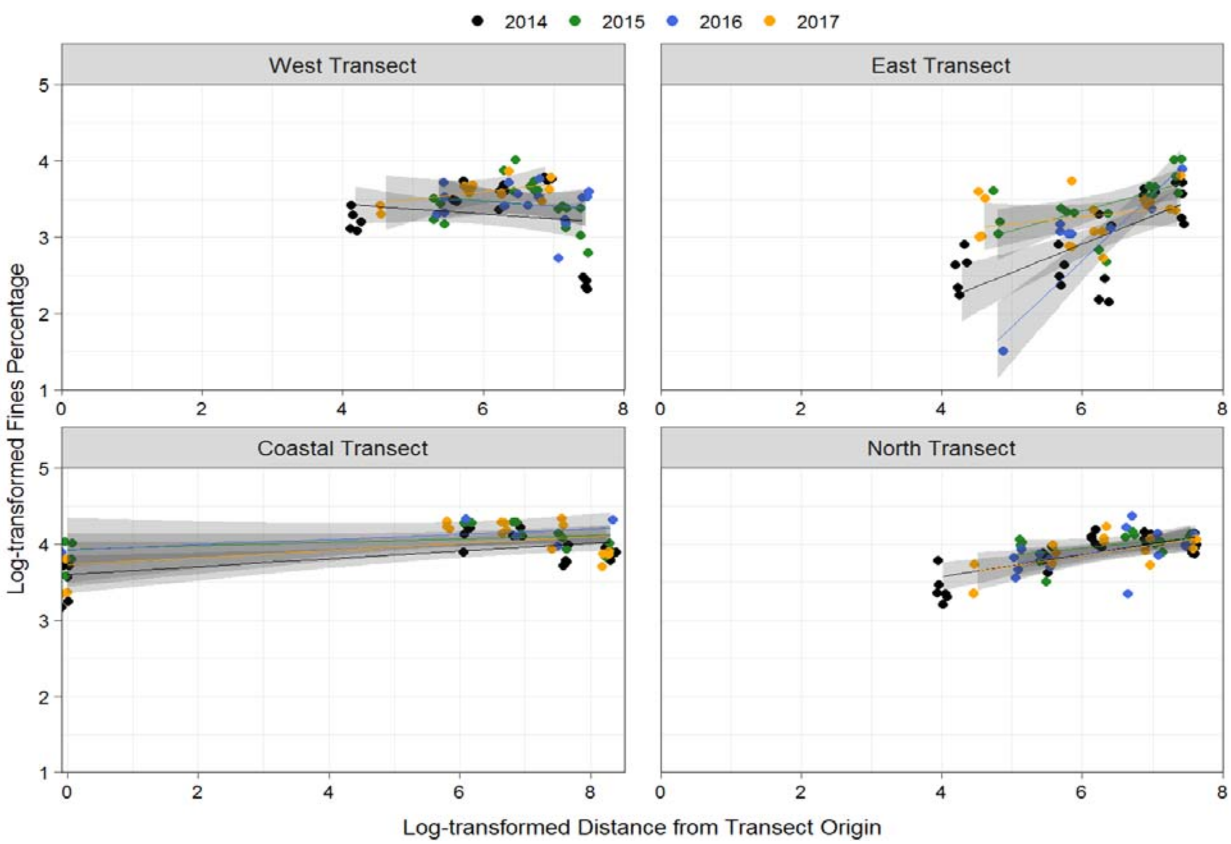
Table 15: Comparison of Statistical Trends in Percent Fines by Distance, Transect and Year

Distance from Transect Origin (m)	West Transect				East Transect				Coastal Transect				North Transect			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
0	a	a	a	a	b	bc	a	c	a	a	a	a	a	a	a	a
500	a	ab	ab	b	ab	c	a	bc	a	a	a	a	---	---	---	---
1,000	a	ab	ab	b	a	b	ab	ab	a	a	a	a	a	a	a	a
1,500	a	ab	ab	b	a	ab	b	a	a	a	a	a	a	a	a	a
4,000	---	---	---	---	---	---	---	---	a	a	a	a	---	---	---	---

Notes: Years with different letters (within transect) depict significantly different estimates with "a" representing the lowest estimate among distance bins, "b" representing the next highest estimate, and "c" representing the highest estimate (e.g., significant increasing trends in percent cover are evidenced by a change from "a" to "b" or from "b" to "c"); grey shading depicts decreasing trends (e.g., lower percent cover than previous year). Multiple letters (e.g., "ab") represent data which is not significantly different than "a" or "b".

The slopes for the relationship between fines (log-transformed) and distance (also log-transformed) were overall similar within each transect, with the exceptions of 2017 on the West Transect and 2016 on the East Transect (Figure 22). On the West Transect, fines decreased with distance in 2014, 2015 and 2016, but increased with distance in 2017. No inter-annual differences were observed in percent fines at sampling stations located near the dock but percent fines were shown to increase significantly at the far-field sampling stations (500 m, 1,000 m, and 1,500 m) from 2014 to 2017 (although measurements in 2015 and 2016 were not significantly different from either 2014 or 2017) (Table 15). On the East Transect, fines increased with distance in all four sampling years, with a higher slope in 2016 than in other sampling years. At 0 m distance from the dock, the 2016 content of fines was significantly lower than the estimates from all other sampling years. While the 2017 fines content was significantly higher at 0 m relative to 2014 and 2016 data, the difference decreased with distance – at 500 m, the 2017 data only differed from 2016 data, and at 1,000 m, 2017 data were not significantly different from any of the previous sampling years. Further discussion relating significant effects to Project activities is provided in Section 4.2.

On the Coastal Transect, modeled fines content increased gradually with distance from the transect origin (Figure 22). However, the model slightly underestimated fines at the intermediate distances and slightly overestimated fines at the farthest station. On the North Transect, all four years had a similar pattern of increase in fines with distance from the transect origin.



Notes: 2014 to 2017 surveys (small points), with estimated means (large squares) and 95% confidence intervals (error bars).

Figure 22: Percent Fines in Sediment Relative to Sampling Station, 2014-2017

3.1.2.2 EEM Analysis – Iron Concentrations

The content of iron in sediment samples was analyzed using a single ANCOVA model, with main effects of distance from transect origin, year (as discrete factor), transect, and log-transformed percentage of fines; in addition, the model contained all possible interactions between distance, year, and transect. The model explained 90% of the data variability, and the three-way interaction was statistically significant, indicating differences in the relationship between iron and distance under different years and transects (Table 16). Percent fines was a significant explanatory variable of iron content ($P < 0.001$), and was retained as a covariate in the model.

On the West Transect, significant increases in iron content (adjusted for fines) were estimated between 2015, 2016, and 2017 at 500 m from the transect origin, and between 2016 and 2017 at 1,000 and 1,500 m from the transect origin (Table 17). However, the 2017 estimates at all four distances selected for multiple comparisons were not significantly different from the 2014 estimates suggesting that no significant differences in iron content as a result of potential Project-related effects have been observed between 2014 (baseline) and 2017.

On the East Transect, significant increases in iron (adjusted for fines) were estimated at 0 m and 500 m distances, but not farther along the transect. On the Coastal Transect, no significant differences between years were estimated in any of the four depths selected for multiple comparisons. On the North Transect, a significant increase was estimated between 2015 and 2017 at the 500 m distance, but not at any of the other distances or years.

Table 16: ANOVA Summary of Iron Content in Sediments by Year and Transect

Adj. R^2	Parameter	Df	F value	P value
0.90	Distance from transect origin	1	43.4	<0.001
	Year	3	37.0	<0.001
	Transect	3	39.3	<0.001
	Percent fines	1	346.4	<0.001
	Distance × Year	3	2.6	0.052
	Distance × Transect	3	14.8	<0.001
	Year × Transect	9	7.2	<0.001
	Distance × YearFac × Transect	9	5.9	<0.001

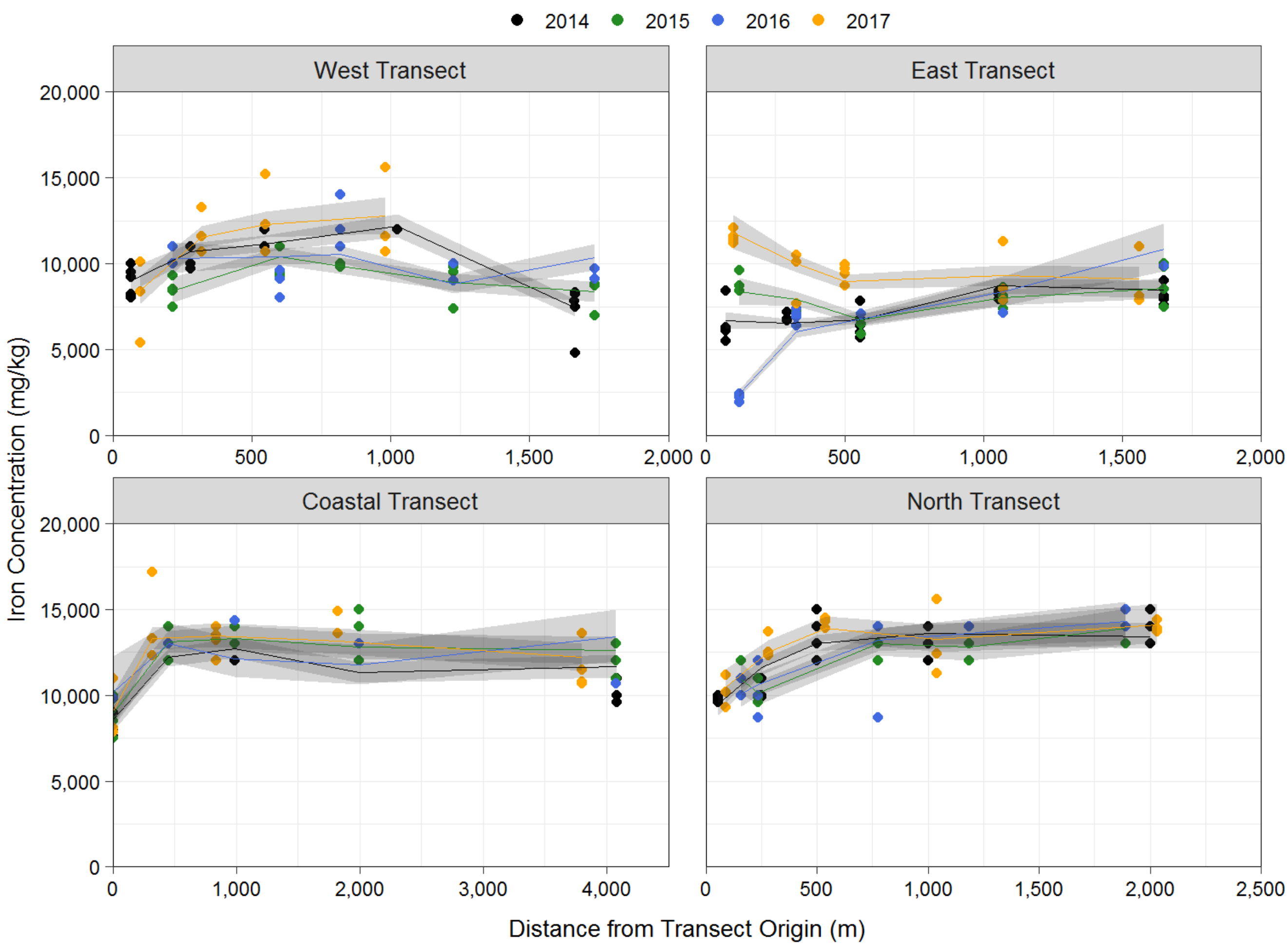
Notes: Adj. R^2= Adjusted R square value; Df= degrees of freedom. Distance, percent fines and iron concentrations were log-transformed.

Table 17: Comparison of Statistical Trends in Iron Content in Sediments by Distance, Transect and Year

Distance from Transect Origin (m)	West Transect				East Transect				Coastal Transect				North Transect			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
0	a	a	a	a	b	b	a	c	a	a	a	a	a	a	a	a
500	bc	a	b	c	b	ab	a	c	a	a	a	a	ab	a	ab	b
1,000	bc	a	ab	c	a	a	ab	b	a	a	a	a	a	a	a	a
1,500	bc	a	ab	c	ab	a	b	b	a	a	a	a	a	a	a	a
4,000	---	---	---	---	---	---	---	---	a	a	a	a	---	---	---	---

Notes: Years with different letters (within transect) depict significantly different estimates with "a" representing the lowest estimate among distance bins, "b" representing the next highest estimate, and "c" representing the highest estimate (e.g., significant increasing trends in percent cover are evidenced by a change from "a" to "b" or from "b" to "c"); grey shading depicts decreasing trends (e.g., lower percent cover than previous year). Multiple letters (e.g., "ab") represent data which is not significantly different than "a" or "b".

On the West, North and Coastal Transects, iron content increased with distance up to an intermediate distance from the transect origin (Figure 23). On the West Transect, the relationship changed to a decreasing trend at approximately 750 to 1,000 m from the transect origin. On the North and Coastal Transects, iron content remained stable from 500 m from the transect origin until the last station. On the East Transect, iron content increased with distance in 2014 and 2016. However, in 2015 and 2017, iron content decreased between transect origin and approximately 500 m from the transect origin, then increased with distance until the end of the transect (Figure 23). On both the West and East Transects, 2017 iron values were higher than previous years' data at most distances, although this increase was not always statistically significant (Table 17). Further discussion relating significant effects to Project activities is provided in Section 4.2.



Notes: 2014 to 2017 surveys (small points), with estimated means (large squares) and 95% confidence intervals (error bars); regression included percent fines as a covariate, and predictions are shown for mean percent fines at each distance.

Figure 23: Iron Content Sediment Relative to Distance from Transect Origin, 2014-2017

3.1.2.3 *Quality Management*

RPDs were calculated for all six field duplicates and are presented in APPENDIX C-4. The calculated RPDs were less than 50% for all analyses.

3.1.3 Substrate, Macroflora, and Benthic Epifauna

A total of four continuous underwater video transects were completed along the West, East, North and Coastal Transects. A total of 8,211 m of benthic habitat was surveyed in 2017, from which 7,481 m of habitat was analyzed from the video footage (Table 18). The remaining video was either not interpretable[12] or beyond the area analyzed during previous surveys (e.g., the westernmost portion of the West Transect) and not analyzed due to time constraints. Tabulated results of the habitat surveys for each transect including substrate, epifauna and macroflora identified during the video analysis are provided in APPENDIX D-1. Still images from the underwater video are included in APPENDIX A. Statistical analyses and discussion of Project-related effects on macroflora and benthic epifauna in the study area is provided in Section 4.1.3 (Discussion) using transect segment data (5 m distance segments) provided in APPENDIX D-2.

Table 18: Summary of Underwater Video Collection in Milne Port, 2017

Transect	UTM Coordinates				Total Video Length (m)	Video Length Analyzed (m)	Video Analyzed (%)	Not Interpretable (%)
	Start		End					
	Easting	Northing	Easting	Northing				
West	503148	7976545	501623	7976447	1,645	1,591	96.7	0.3
East	503460	7976689	504929	7976654	1,567	1,275	81.4	11.8
North	503492	7978355	503300	7976750	1,626	1,565	96.3	3.8
Coastal	504929	7976654	506947	7979471	3,373	3,050	90.4	4.7
Total					**8,211**	**7,481**	**91.1**	**5.0**

A summary of results for each transect is provided below (Sections 3.1.3.1 through 3.1.3.4).

3.1.3.1 *West Transect*

Substrate

The dominant substrate category along the West Transect was fine substrates (68.7%) consisting mostly of sand with gravel and scattered shell debris (Table 19). A greater proportion of coarse material and shell debris was observed along the easternmost portion of the transect extending from 0 to ~700 m west of the ore dock. As the transect approached the outflow from Phillips Creek, substrates transitioned to predominantly sand with lower amounts of gravel and shell and eventually became almost exclusively sand. No bedrock or substrates containing greater than 50% coarse materials (e.g., boulder/rip rap) were observed. A small portion (0.3%) of the substrate along the West Transect was not classifiable due to the camera being too far above the seafloor.

[12] Video footage was deemed not interpretable for instances where video was not suitable to identify major substrate, macroflora and/or epifauna classes (e.g., camera too high above the seafloor, poor resolution, technical issues with recording etc.).

Table 19: Substrate Percent Cover, West Transect

Broad Substrate Category	Percent Coverage (%)	Comments
Bedrock	–	Substrates dominated by sand with gravel and scattered shell debris. Greater proportion of coarse material observed along the eastern portion of the transect (0-700 m) with more fine substrates along the western portion (700 – 1600 m).
Coarse	–	
Medium	9.7	
Mixed	21.3	
Fine	68.7	
Shell	–	
Not Classifiable	0.3	

Notes: Substrates categorized into broad substrate categories based on greater than 50% coverage of particular substrate type. Areas where substrates were less than 50% of any given type were categorized as mixed substrate (correlates with "medium/fine" category in SEM 2017a).

Macroflora

Approximately 48.1% of the West Transect contained no macroflora (48.1%). Substrate along this transect consisted primarily of sand with low amounts of coarse material (Table 20). The easternmost portion of the transect contained a greater amount of macroflora which was mostly dominated by brown algae[13] (42.3%) while a few areas were dominated by red algae of the genus *Chondrus* (8.2%). Of the macroalgae taxa observed, sour weed (*Desmarestia* sp.) was the most abundant comprising 67.2% of the total macroalgae percent cover along the transect. Sea colander (*Agarum* sp.) and Irish moss (*Chondus* sp.) were also somewhat abundant and often occurred concurrently with sour weed but at a lower percent cover.

Table 20: Macroflora Percent Cover, West Transect

Taxa	Common Name	Time Viewed (s)	Relative Percent (%)
Macroflora			
Desmarestia sp.	sour weed	1,021	67.2
Laminaria sp.	bladed brown kelp	17	1.1
Agarum sp.	sea colander	152	10
Chondrus sp.	Irish moss	328	21.6
Chlorophyta	green algae	2	0.1
Total Macroflora		**1,520***	**100**
Dominant Macroflora Class			
Brown Algae	–	893	42.3
Red Algae	–	173	8.2
Green Algae	–	2	0.1
Rockweed	–	–	–
Not Classifiable	–	28	1.3
No Flora	–	1016	48.1
Total		**2,112**	**100**

Notes: Analysis of macroflora cover followed the methods outlined in SEM 2017a. Total time viewed for each macroflora taxa does not align with time viewed by dominant macroflora class as many taxa were observed concurrently; dominant macroflora class represents only the dominant macroflora observed within each frame by percent cover.

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[13] The term dominant refers to the percent of the total transect for which a particular macroflora class was dominant in terms of percent cover.

Epifauna

A total of 3,962 benthic epifaunal organisms were observed during video surveys along the West Transect in 2017 (Table 21). The dominant taxa observed were sea urchins (Echinoidea) and brittle stars (*Ophiura* sp.) which represented a combined 85.3% of total abundance along the transect. Several large aggregations of urchins were observed along the transect and were commonly associated with minor depressions in the seafloor (see APPENDIX A). A variety of bivalve species were moderately abundant including deep-sea scallop (*Placopecten magellanicus*), Iceland scallop (*Chlamys islandica*), wrinkled rock borer (*Hiatella arctica*) and several unidentified clams. Other epifauna taxa observed included sea butterfly (*Limacina helicina*), whelks of the family Buccinidae, marine polychaete worms of the family Terebellidae, tunicates, sea spiders, and sea stars.

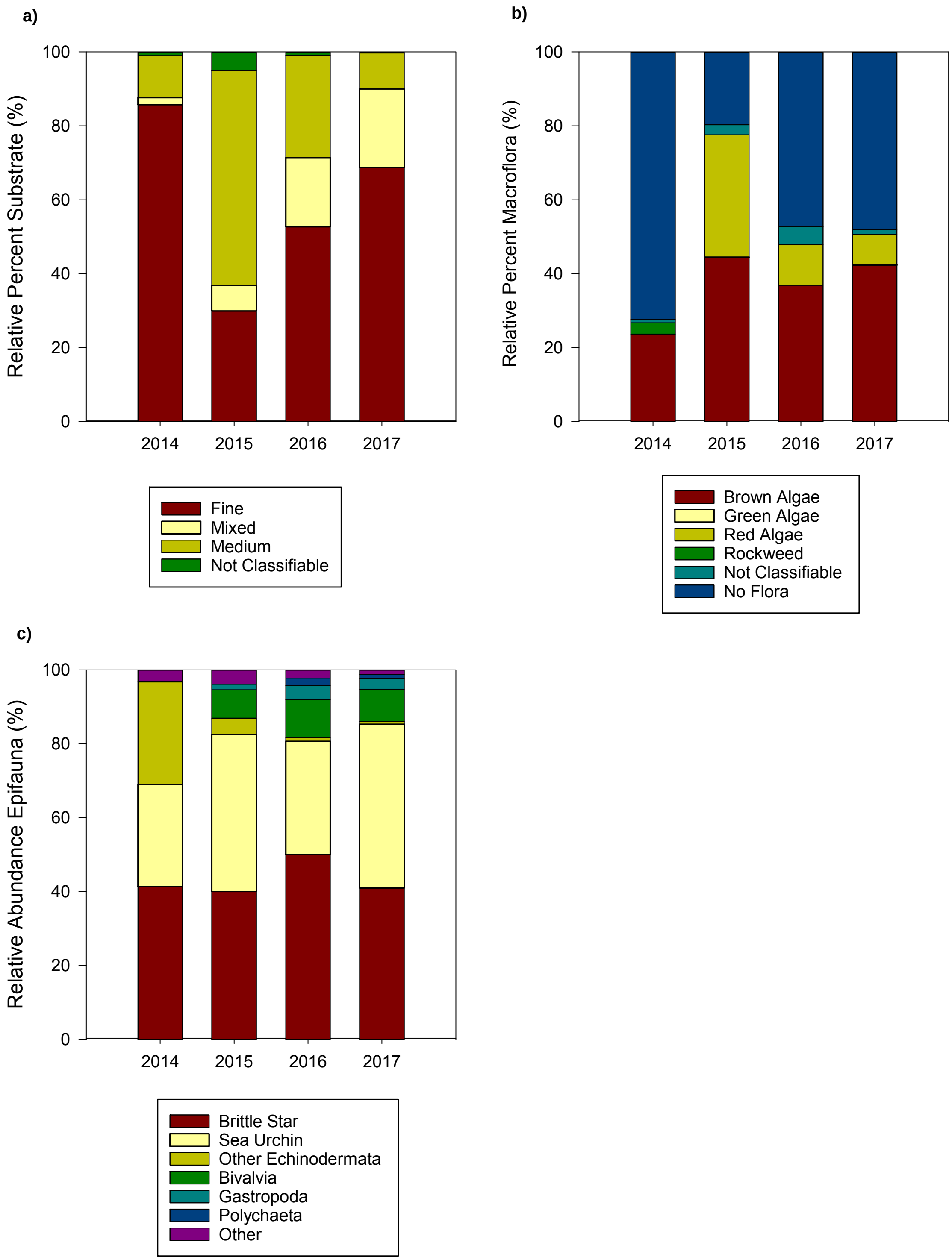
Table 21: Epifauna Relative Abundance, West Transect

Taxa	Common Name	Count	Major Group†	Relative Abundance by Major Group (%)
Ophiura sp.*	brittle star	1,624	Brittle star	40.9
Echinoidea	sea urchin	1,758	Sea urchin	44.4
Asteroidea	sea star	28	Other Echinodermata	0.7
Placopecten magellanicus	deep-sea scallop	279	Bivalvia	8.7
*Chlamys islandica**	Iceland scallop	22		
*Hiatella arctica**	wrinkled rock borer	5		
Bivalvia	unidentified bivalve	39		
Buccinidae*	whelk	24	Gastropoda	2.9
Limacina helicina	sea butterfly	90		
Terebellidae*	marine polychaete worm	45	Polychaeta	1.1
Nymphon sp.*	sea spider	3	Other	1.2
Actinaria	sea anemone	6		
Anonyx sp.*	marine amphipod	2		
Polycarpa sp.	tunicate	26		
Cnidaria	unidentified jelly fish	3		
Cottidae	unidentified sculpin	8		
Total		**3,962**	**–**	**100**

Notes: †Major groups determined by relative abundance across transects and survey years using data in SEM 2015, 2016, 2017a for comparative purposes; *denotes taxa identified by Biologica in epifauna samples sent for analysis from angling catch.

Summary

In general, the overall composition of substrate, macroflora and benthic epifauna along the West Transect were not substantially different in 2017 from 2016 (Figure 24). A greater amount of fine substrate was observed in 2017 than in 2016; however, the proportion of fine, mixed and medium substrates appeared to fluctuate between years and may be largely due to observer bias in how substrates were classified from the video data. The relative percent cover of macroflora was mostly unchanged from 2016 with no flora observed along 48.1% of the transect in 2017, compared with 47.2% of the transect in 2016. Brown algae was the dominant macroflora class in both years. The relative abundance of epifauna was also similar, though sea urchins were the dominant epifauna taxa in 2017 and 2015 compared with brittle stars as the dominant taxa in 2016 and 2014.



Notes: a) Relative percent composition of aggregated substrate classes; b) Relative percent coverage of aggregated macroalgae classes; c) Relative percent abundance of major epifauna groups. Data for previous years taken from SEM 2015, 2016, 2017a.

Figure 24: Relative Percent Substrate, Macroflora, and Epifauna and Total Epifauna Density along West Transect

3.1.3.2 East Transect

Substrate

The dominant substrate category along the East Transect was medium substrate (67.7%) consisting mostly of gravel with cobble and shell debris (Table 22). A small amount of fine substrate (6.6%) was observed approximately 200-300 m east of the ore dock[14], which transitioned into mostly mixed substrate.

Table 22: Substrate Percent Cover, East Transect

Broad Substrate Category	Percent Coverage (%)	Comments
Bedrock	–	Substrates dominated by gravel with cobble and shell debris intermixed with sand. A few scattered boulders observed interspersed throughout the transect.
Coarse	–	
Medium	67.7	
Mixed	24.6	
Fine	6.6	
Shell	–	
Not Classifiable	1.1	

Notes: Substrates categorized into broad substrate categories based on greater than 50% coverage of particular substrate type. Areas where substrates were less than 50% of any given type were categorized as mixed substrate (correlates with “medium/fine” category in SEM 2017a).

Macroflora

The East Transect was dominated mostly by brown algae cover (68.5%) with a few areas dominated by red algae (6.7%) and the majority of the remaining area containing no macroalgae cover (24.8%) (Table 23). Areas with coarser substrates (e.g., gravel, cobble, boulder) contained a greater amount of macroalgae cover. Of the macroalgae taxa observed, sour weed was the most abundant representing 65.5% of the total macroalgae cover. Similar to the West Transect, sea colander (13.4%) and Irish moss (16.9%) were also somewhat abundant. Encrusting coralline algae was observed on the majority of boulders and cobble observed along the transect.

Table 23: Macroflora Percent Cover, East Transect

Taxa	Common Name	Time Viewed (s)	Relative Percent (%)
Macroflora			
Desmarestia sp.	sour weed	2,056	65.5
Laminaria sp.	bladed brown kelp	14	0.4
Agarum sp.	sea colander	422	13.4
Chondrus sp.	Irish moss	530	16.9
–	encrusting corraline algae	114	3.6
Chlorophyta	green algae	4	0.1
Total Macroflora		**3,140***	**100**
Dominant Macroflora Class			
Brown Algae	–	2,272	68.5
Red Algae	–	223	6.7
Green Algae	–	1	0.03
Rockweed	–	–	–
Not Classifiable	–	–	–
No Flora	–	821	24.8
Total		**3,317**	**100**

Notes: Analysis of macroflora cover followed the methods outlined in SEM 2017a. Total time viewed for each macroflora taxa does not align with time viewed by dominant macroflora class as many taxa were observed concurrently; dominant macroflora class represents only the dominant macroflora observed within each frame.

[14] The first 185 m of the East Transect was not recorded due to technical difficulties; however, this section of the transect was not analyzed by SEM in 2014-2016.

Epifauna

A total of 5,366 benthic epifauna were observed along the East Transect in 2017 Table 24. Brittle stars were the most abundant taxa with 2,944 organisms representing 54.8% of the total taxa observed followed by urchins with 1,948 organisms representing 36.3%. Bivalves were the next most abundant epifauna group (4.4%) consisting mostly of deep-sea scallops (147 organisms). Other taxa observed included mud star (*Ctenodiscus crispatus*), sun star (*Crossaster papposus*), sea butterfly, tunicates, sea anemones and marine polychaete worms.

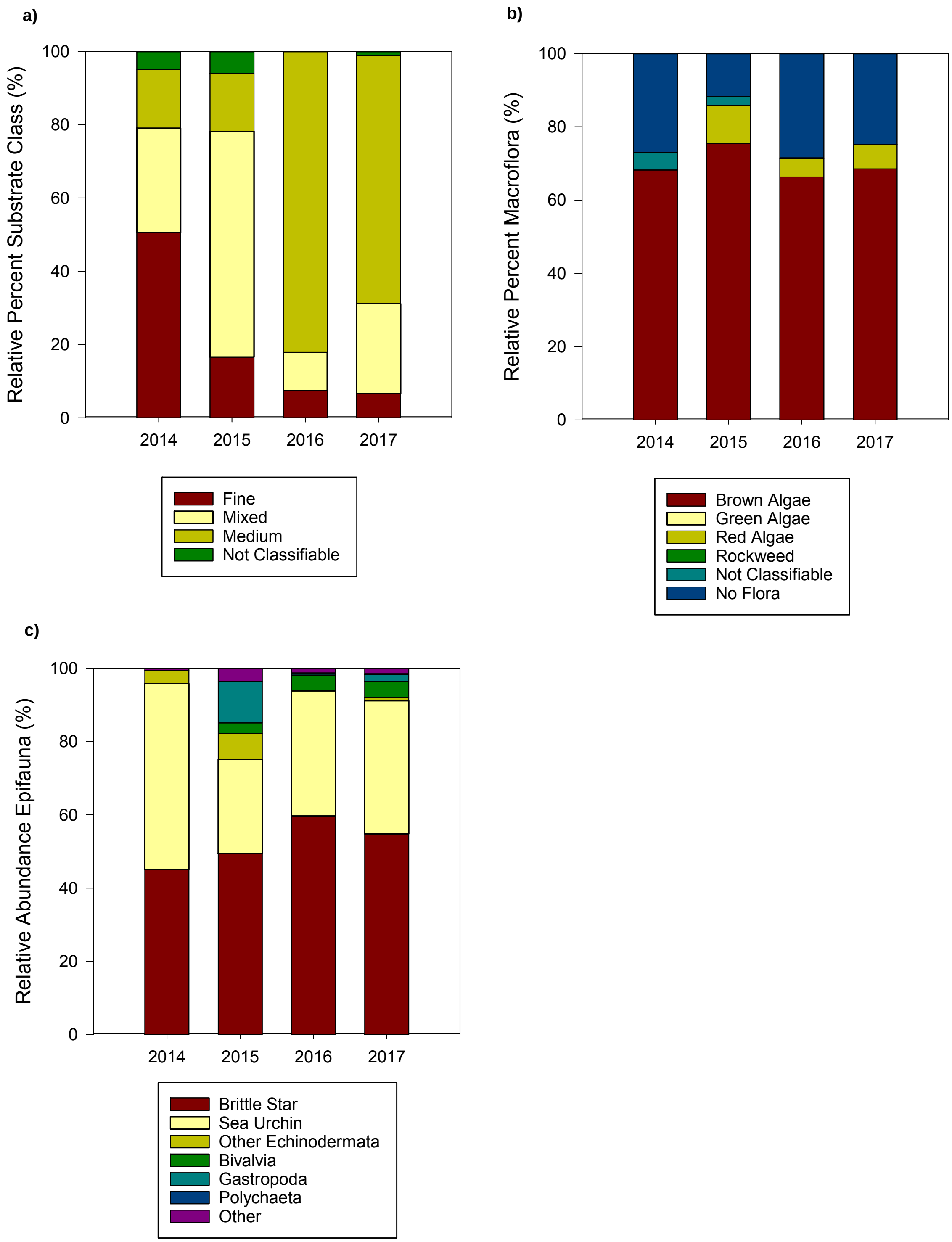
Table 24: Epifauna Relative Abundance. East Transect

Taxa	Common Name	Count	Major Group†	Relative Abundance by Major Group (%)
Ophiura sp.*	brittle star	2,944	Brittle star	54.8
Echinoidea	sea urchin	1,948	Sea urchin	36.3
Asteroidea	sea star	46	Other Echinodermata	1.0
Ctenodiscus crispatus	mud star	3		
Crossaster papposus	sun star	1		
Placopecten magellanicus	deep-sea scallop	147	Bivalvia	4.4
*Chlamys islandica**	Iceland scallop	13		
*Hiatella arctica**	wrinkled rock borer	4		
Bivalvia	unidentified bivalve	72		
Limacina helicina	sea butterfly	24	Gastropoda	1.8
Gastropoda	unidentified gastropod	73		
Terebellidae	marine polychaete worm	11	Polychaeta	0.2
Polycarpa sp.	Tunicate	72	Other	1.7
Actinaria	sea anemone	6		
Cnidaria	unidentified jelly fish	3		
Cottidae	unidentified sculpin	10		
Total		**5,366**	–	**100**

Notes: †Major groups determined by relative abundance across transects and survey years using data in SEM 2015, 2016, 2017a for comparative purposes; *denotes taxa identified by Biologica in epifauna samples sent for analysis from angling catch.

Summary

As with the West Transect, the overall composition of substrates, macroflora and benthic epifauna along the East transect were not substantially different in 2017 than 2016 (Figure 25). A greater amount of mixed substrate was observed than in 2016 but the combined proportion of fine and mixed substrates was more similar to 2016 than to 2014 and 2015, for which much higher proportions of fine and mixed substrates were recorded. The relative percent cover of macroflora was also similar, with brown algae dominant between 66 % and 75% of the East Transect across all years. The relative abundance of benthic epifauna was similar to previous years with brittle stars the dominant taxa followed by sea urchins. Bivalves were the next most abundant taxa in 2016 and 2017 with a notably large proportion of gastropods observed in 2015.



Notes: a) Relative percent composition of aggregated substrate classes; b) Relative percent coverage of aggregated macroalgae classes; c) Relative percent abundance of major epifauna groups. Data for previous years taken from SEM 2015, 2016, 2017a.

Figure 25: Relative Percent Substrate, Macroflora, and Epifauna and Total Epifauna Density along East Transect

3.1.3.3 Coastal Transect

Substrate

Substrate along the Coastal Transect consisted mostly of gravel and cobble (58.4%) and mixed substrates with gravel and sand (Table 25). Only a few small areas were dominated by fine substrates (2.3%) as there was a much larger proportion of gravel, cobble and boulder than along the East and West Transects. Substrates along a relatively large portion of the transect (12.1%) were not classifiable due to a large abundance of macroalgae in some areas and areas where wind and wave action lifted the camera too far above the seafloor.

Table 25: Substrate Classification for the Coastal Transect

Broad Substrate Category	Percent Coverage (%)	Comments
Bedrock	–	Comparatively high proportion of gravel, cobble and boulder. Large amount of attached macroalgae in some areas led to substrate not being classified.
Coarse	–	
Medium	58.4	
Mixed	27.2	
Fine	2.3	
Shell	–	
Not Classifiable	12.1	

Notes: Substrates categorized into broad substrate categories based on greater than 50% coverage of particular substrate type. Areas where substrates were less than 50% of any given type were categorized as mixed substrate (correlates with “medium/fine” category in SEM 2017a).

Macroflora

The Coastal Transect contained the highest amount of macroflora coverage among the study area Table 26. A total of 94% of the transect was covered by brown algae, while only 2.5% of the transect contained no flora. Sour weed was again the dominant macroflora taxa comprising 74.7% of the total percent cover. Sea colander was also moderately abundant at 19.1% while red algae and brown bladed kelp were notably less abundant (<5%). The only occurrence of rockweed (*Fucus* sp.) in the study area was observed in the northern portion of the Coastal Transect.

Table 26: Macroflora Percent Cover, Coastal Transect

Taxa	Common Name	Time Viewed (s)	Relative Percent (%)
Macroflora			
Desmarestia sp.	sour weed	3,056	74.7
Laminaria sp.	bladed brown kelp	112	2.7
Agarum sp.	sea colander	780	19.1
Chondrus sp.	Irish moss	130	3.2
Fucus sp.	Rockweed	11	0.2
Total Macroflora		**4,089***	**100**
Dominant Macroflora Class			
Brown Algae	–	4,155	94
Red Algae	–	13	0.3
Green Algae	–	–	–
Rockweed	–	–	–
Not Classifiable	–	141	3.2
No Flora	–	110	2.5
Total		**4,419**	**100**

Notes: Analysis of macroflora cover followed the methods outlined in SEM 2017a. Total time viewed for each macroflora taxa does not align with time viewed by dominant macroflora class as many taxa were observed concurrently; dominant macroflora class represents only the dominant macroflora observed within each frame.

Epifauna

A total of 9,190 benthic epifauna were observed during video surveys along the Coastal Transect in 2017 Table 27. The dominant taxa observed were brittle stars (7,105 organisms) followed by sea urchins (1,803 organisms). Bivalves were the next most abundant group consisting of deep-sea scallops, Iceland scallop, wrinkled rock borer and unidentified clams. Sea cucumbers (Holothuroidea) were only observed along the Coastal Transect during the benthic habitat surveys.

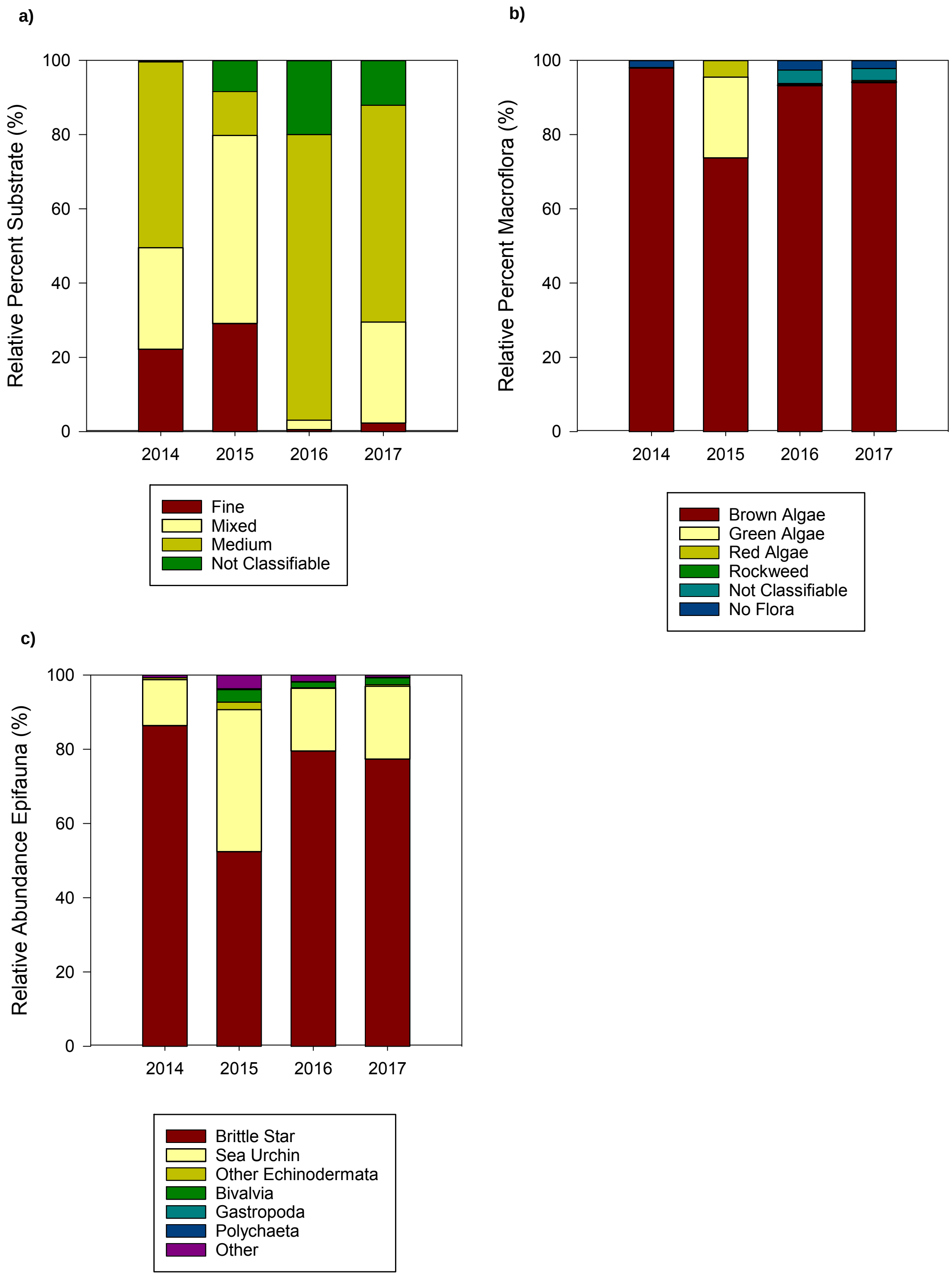
Table 27: Epifauna Relative Abundance, Coastal Transect

Taxa	Common Name	Count	Major Group†	Relative Abundance by Major Group (%)
Ophiura sp.*	brittle star	7,105	Brittle star	77.3
Echinoidea	sea urchin	1,803	Sea urchin	19.6
Asteroidea	sea star	31	Other Echinodermata	0.4
Holothuroidea	sea cucumber	5		
Placopecten magellanicus	deep-sea scallop	102	Bivalvia	1.9
*Chlamys islandica**	Iceland scallop	5		
*Hiatella arctica**	wrinkled rock borer	8		
Bivalvia	unidentified clam	59		
Buccinidae*	whelk	3	Gastropoda	0.2
Limacina helicina	sea butterfly	1		
Gastropoda	Unidentified gastropod	14		
Actinaria	sea anemone	13	Other	0.6
Anonyx sp.*	marine amphipod	22		
Polycarpa sp.	tunicate	11		
Cnidaria	unidentified jelly fish	5		
Cottidae	unidentified sculpin	3		
Total		**9,190**	–	**100**

Notes: †Major groups determined by relative abundance across transects and survey years using data in SEM 2015, 2016, 2017a for comparative purposes; *denotes taxa identified by Biologica in epifauna samples sent for analysis from angling catch.

Summary

Substrate composition was slightly different in 2017 than in previous reporting years, while the relative abundance of macroflora and epifauna were very similar (Figure 26). Substrate conditions in 2017 contained a greater proportion of mixed substrate than in 2016 and a slightly larger proportion of fine material, though fines were still much lower than what was recorded in 2014 and 2015. Brown algae were by far the most abundant macroflora taxa in all years ranging between 74% in 2015 and 98% in 2014. Brittle stars were the most abundant epifauna in all years (52 to 84%) followed by sea urchins and bivalves.



Notes: a) Relative percent composition of aggregated substrate classes; b) Relative percent coverage of aggregated macroalgae classes; c) Relative percent abundance of major epifauna groups. Data for previous years taken from SEM 2015, 2016, 2017a.

Figure 26: Relative Percent Substrate, Macroflora, and Epifauna and Total Epifauna Density along Coastal Transect

3.1.3.4 North Transect

Substrate

The North Transect contained primarily fine substrates (71.4%) with a few areas of mixed (20.3%) and medium (7.6%) sized substrates (Table 28). Fine substrates consisted mostly of silt and mud at depth (40-100 m), which transitioned to coarser material (e.g., sand, gravel) at shallower depths (10-40 m) closer to the ore dock. No bedrock or substrates containing greater than 50% coarse materials (e.g., boulder/rip rap) were observed. Approximately 0.7% of the substrate along the North Transect was not classifiable due to poor video resolution.

Table 28: Substrate Classification for the North Transect

Broad Substrate Category	Percent Coverage (%)	Comments
Bedrock	–	Predominantly fine sediments dominated by silt and mud at depth and transitioning to sand with gravel at shallower depths.
Coarse	–	
Medium	7.6	
Mixed	20.3	
Fine	71.4	
Shell	–	
Not Classifiable	0.7	

Notes: Substrates categorized into broad substrate categories based on greater than 50% coverage of particular substrate type. Areas where substrates were less than 50% of any given type were categorized as mixed substrate (correlates with “medium/fine” category in SEM 2017a).

Macroflora

No attached macroflora were observed along the North Transect in 2017. A few pieces of detrital macroflora were observed at deeper depths during the survey (below the photic zone); however, the macroalgae was not attached to the seafloor and was not classified as macroflora.

Epifauna

An estimated total of 36,789 organisms[15] were identified along the North Transect in 2017 (Table 29). Abundance was overwhelmingly dominated by brittle stars (~35,750 organisms) which comprised 97.1% of total epifauna abundance. The remaining abundance consisted mostly of marine polychaete worms (515 organisms), sea urchins (282 organisms) and unidentified sea stars (161 organisms). All other epifauna observed were relatively in low abundance. Taxa observed only along the North Transect included feather stars of the class Crinoidea and eelpouts of the family Zoarcidae.

[15] Brittle stars were estimated in groups of 50 organisms due to very high abundance

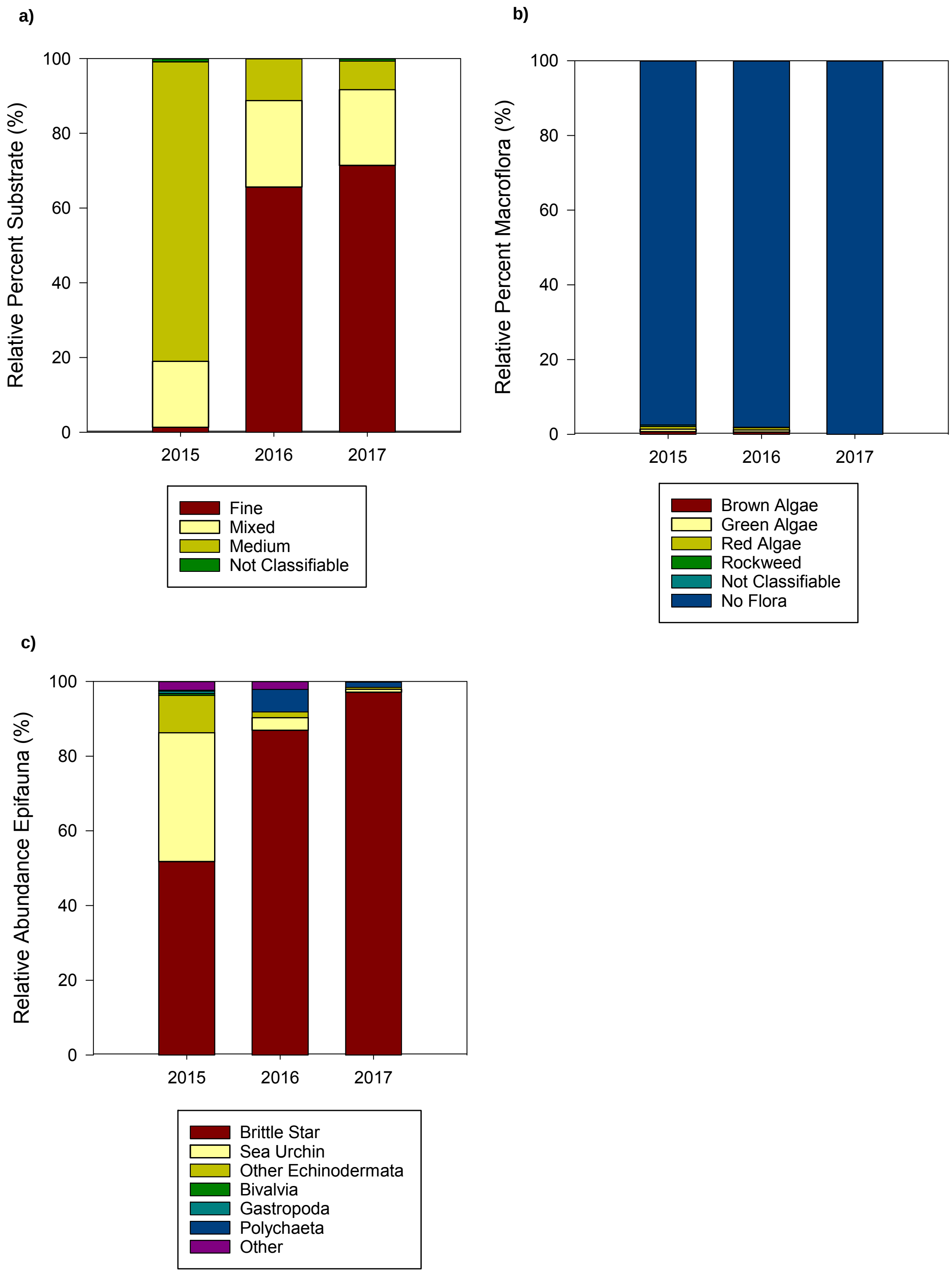
Table 29: Epifauna Relative Abundance. North Transect

<table>
<tr><th>Taxa</th><th>Common Name</th><th>Count</th><th>Major Group†</th><th>Relative Abundance by Major Group (%)</th></tr>
<tr><td>Ophiura sp.*</td><td>brittle star</td><td>35,750**</td><td>Brittle star</td><td>97.1</td></tr>
<tr><td>Echinoidea</td><td>sea urchin</td><td>282</td><td>Sea urchin</td><td>0.8</td></tr>
<tr><td>Asteroidea</td><td>sea star</td><td>161</td><td rowspan="4">Other Echinodermata</td><td rowspan="4">0.5</td></tr>
<tr><td>Ctenodiscus crispatus</td><td>mud star</td><td>1</td></tr>
<tr><td>Crossaster papposus</td><td>sun star</td><td>2</td></tr>
<tr><td>Crinoidea</td><td>feather star</td><td>8</td></tr>
<tr><td>Placopecten magellanicus</td><td>deep-sea scallop</td><td>3</td><td rowspan="2">Bivalvia</td><td rowspan="2">0.01</td></tr>
<tr><td>Bivalvia</td><td>unidentified clam</td><td>2</td></tr>
<tr><td>Buccinidae*</td><td>Unidentified gastropod</td><td>7</td><td>Gastropoda</td><td>0.02</td></tr>
<tr><td>Terebellidae*</td><td>marine polychaete worm</td><td>515</td><td>Polychaeta</td><td>1.4</td></tr>
<tr><td>Nymphon sp.*</td><td>sea spider</td><td>3</td><td rowspan="6">Other</td><td rowspan="6">0.2</td></tr>
<tr><td>Actinaria</td><td>sea anemone</td><td>13</td></tr>
<tr><td>Polycarpa sp.</td><td>tunicate</td><td>27</td></tr>
<tr><td>Cnidaria</td><td>unidentified jelly fish</td><td>2</td></tr>
<tr><td>Cottidae</td><td>unidentified sculpin</td><td>1</td></tr>
<tr><td>Zoarcidae</td><td>eelpout</td><td>12</td></tr>
<tr><td colspan="2">Total</td><td>36,789</td><td>–</td><td>100</td></tr>
</table>

Notes: †Major groups determined by relative abundance across transects and survey years using data in SEM 2015, 2016, 2017a for comparative purposes; *denotes taxa identified by Biologica in epifauna samples sent for analysis from angling catch; **brittle star counts were estimated in groups of 50 counts due to very high abundance along the North Transect.

Summary

There were notable differences along the North Transect in 2017 compared to previous years, including a slightly greater proportion of fine substrates and a much higher abundance of benthic epifauna (Figure 27). Substrate composition in 2017 was generally similar to 2016; however, both years contained a much greater proportion of fine substrates than in 2015. There was no attached macroflora observed in 2017, which was not a large change from 2015 and 2016 when only a few small pieces of macroflora were observed (SEM 2016, 2017a). Much of the North Transect was below the photic zone and it is possible that several of the observed macroalgae occurrences in previous years were detrital, as many were recorded in the deeper segments of the transects. Total epifauna abundance was considerably higher in 2017 than in previous years due to a very high abundance of brittle stars. Many of the brittle stars observed were small, which may indicate that high abundance was a result of timing and that the survey may have taken place following a major settlement event. Relative abundance across years showed an increasing relative abundance of brittle stars, which correlates with an increasing overall density of epifauna and an increase in the proportion of fine substrates.



Notes: a) Relative percent composition of aggregated substrate classes; b) Relative percent coverage of aggregated macroalgae classes; c) Relative percent abundance of major epifauna groups. Data for previous years taken from SEM 2016, 2017a; underwater video was not collected along the North Transect in 2014.

Figure 27: Relative Percent Substrate, Macroflora, and Epifauna and Total Epifauna Density along North Transect

3.1.3.5 EEM Analysis – Macroflora

In the analysis of percent macroflora coverage, the interaction between year and binned distance from transect origin was significant in all transects (Table 30), suggesting differences in macroflora coverage between years in some distance classes. The models explained between 52% and 63% of the variability in the transformed data. On the West Transect, percent macroflora significantly decreased between 2014 and 2015 in the 250 to 500 m distance bin, and between 2015 and 2016 in the bins between 1,000 and 1,750 m from transect origin (Table 31), with no significant decreases estimated between 2016 and 2017. On the East Transect, significant decreases in percent coverage were estimated at distances spanning from 250 to 1,250. Of these significant decreases, only one (at 750 to 1,000 m) was estimated between 2016 and 2017. On the Coastal Transect, significant decreases in percent coverage were estimated close to the transect origin (0 to 250 m) successively between 2014 and 2016. In addition, a significant decrease in percent coverage was estimated between 2016 and 2017 at the 500 to 750 m bin and between 2014 and 2015 at the 1,500 to 1,750 m bin.

Table 30: ANOVA Summary of Macroflora Percent Cover by Year and Transect

Transect	Adj. R^2	Parameter	Df	*F* value	*P* value
West Transect	0.63	Binned distance	6	17.3	<0.001
		Year	3	179.1	<0.001
		Distance × Year	11	56.4	<0.001
East Transect	0.53	Binned distance	5	83.1	<0.001
		Year	3	38.6	<0.001
		Distance × Year	12	18.5	<0.001
Coastal Transect	0.52	Binned distance	12	64.5	<0.001
		Year	3	137.6	<0.001
		Distance × Year	14	10.4	<0.001
North Transect	–	Not analyzed			

Notes: Adj. R^2= Adjusted R square value; Df= degress of freedom

Table 31: Comparison of Statistical Trends in Macroflora Percent Cover by Distance, Transect and Year.

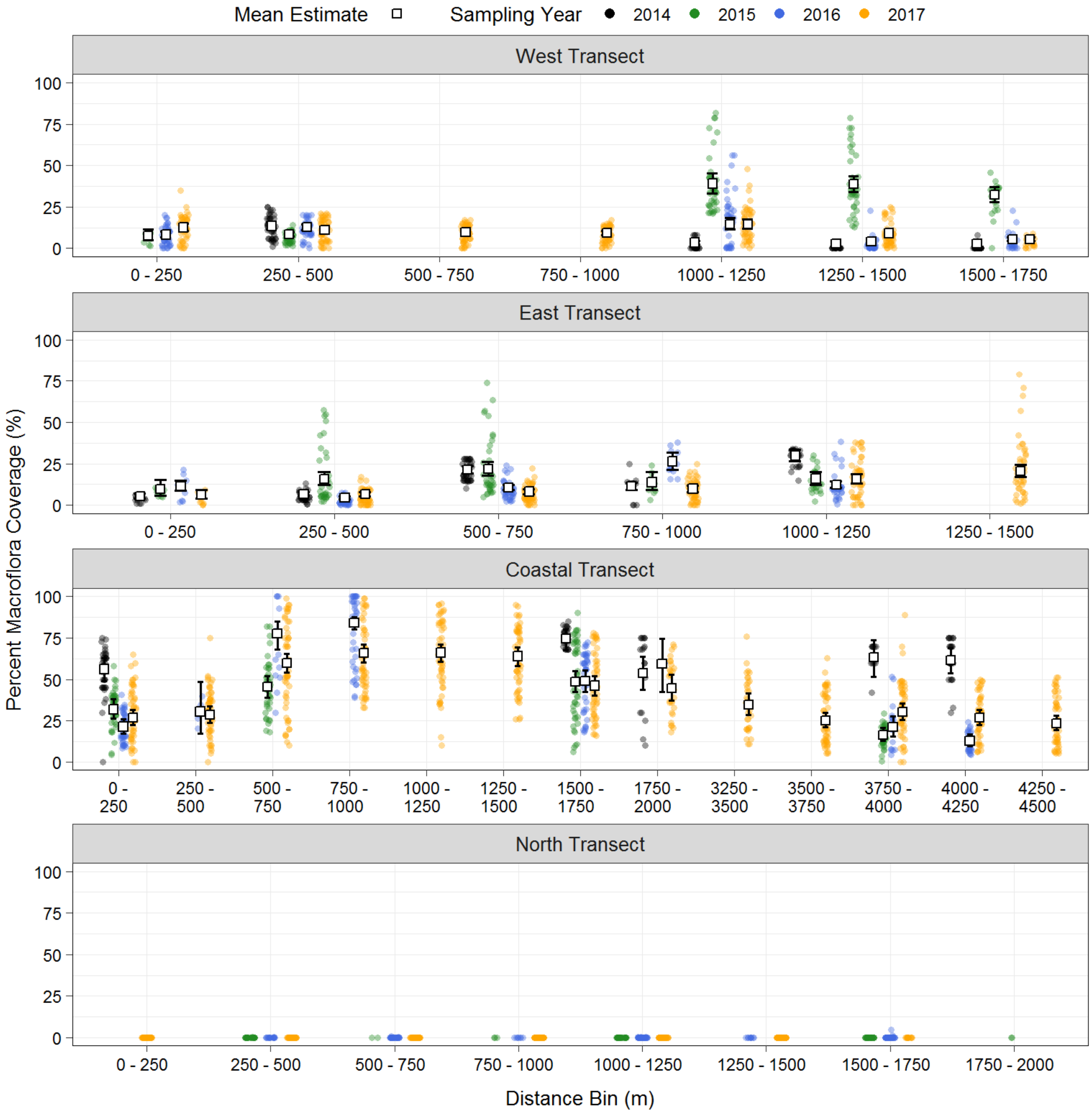
Distance (m)	West Transect				East Transect				Coastal Transect			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
0 - 250	---	ab	a	b	a	ab	b	ab	c	b	a	ab
250 – 500	b	a	b	ab	b	c	a	b	---	---	---	---
500 – 750	---	---	---	---	b	b	a	a	---	a	c	b
750 – 1,000	---	---	---	---	a	a	b	a	---	---	---	---
1,000 – 1,250	a	c	b	b	b	a	a	a	---	---	---	---
1,250 – 1,500	a	c	a	b	---	---	---	---	---	---	---	---
1,500 – 1,750	a	c	b	b	---	---	---	---	b	a	a	a
3,750 – 4,000	---	---	---	---	---	---	---	---	c	a	ab	b

Notes: Years with different letters (within transect) depict significantly different estimates with “a” representing the lowest estimate among distance bins, “b” representing the next highest estimate, and “c” representing the highest estimate (e.g., significant increasing trends in percent cover are evidenced by a change from “a” to “b” or from “b” to “c”); grey shading depicts decreasing trends (e.g., lower percent cover than previous year). Multiple letters (e.g., “ab”) represent data which is not significantly different than “a” or “b”.

The overall trends of percent macroflora coverage with distance within each transect differed between years (Figure 28). On the West Transect, mean coverage estimated in 2017 changed little with distance. On the other hand, 2015 data had a sharp increase in macroflora coverage, with higher mean estimates (25-40%) at distances of ≥1,000 m. On the East Transect, mean 2017 estimates of macroflora coverage increased steadily with distance, from ~5% close to the origin of the transect to ~20% at 1,250-1,500 m from transect origin. Macroflora coverage close to the East Transect origin had little variability and was generally similar across all four years of sampling. Within-year variability of estimated coverage was high in 2015 at 250-750 m distances and in 2017 at distances of ≥1,250 m.

On the Coastal Transect, a pattern of increased macroflora coverage with increased distance from transect origin was observed in 2017. While data for all distance bins were not available for previous sampling years, the 2015-2016 estimates appear in agreement with the overall 2017 trend. In 2014, however, estimated coverage was high close to the transect origin, and estimates at increasing distances were overall similar to the values close to the transect origin, suggesting that the 2014 pattern of macroflora coverage on the Coastal Transect as a function of distance may have differed from the pattern in later years. However, the lack of continuous spatial coverage in 2014 to 2016 sampling does not allow reliable conclusions about whether the overall spatial trends differed between years.

The use of distance from transect origin as a continuous variable (rather than distance bins as in the main ANOVA) allows better incorporation of distance data in the analysis, resulting in better understanding of the spatial trends of macroflora coverage within transects. Using the 2017 dataset, a GAM was constructed to evaluate the overall trends (Figure 29). The results reflect the binned data trends but at a higher resolution. The model explained 62% of the overall variability, and estimated an overall lack of distance effect on macroflora coverage on the West Transect, a gradual increase in coverage with distance on the East Transect, a parabolic trend in coverage on the Coastal Transect at distances up to 2,000 m from the transect origin, followed by a stable coverage at distances of 3,500-4,500 m. The model estimates in the 2,000-3,500 m distance on the Coastal Transect are in essence an interpolation between data at <2,000 m and data at 3,500 m, leading to increased uncertainty. If future data are collected in a manner similar to 2017, the GAM approach can be extended to estimate differences between years at the full distance gradient. This would provide more in-depth understanding of annual changes in macroflora coverage in the study area.



Notes: Distance was grouped into 250 m bins for the purpose of statistical analysis. Individual points represent recorded macroflora percent cover (%), squares represent mean percent cover across 250 m distance bin with 95% confidence interval (error bars).

Figure 28: Percent Macroflora Coverage Relative to Distance from Transect Origin, 2014-2017

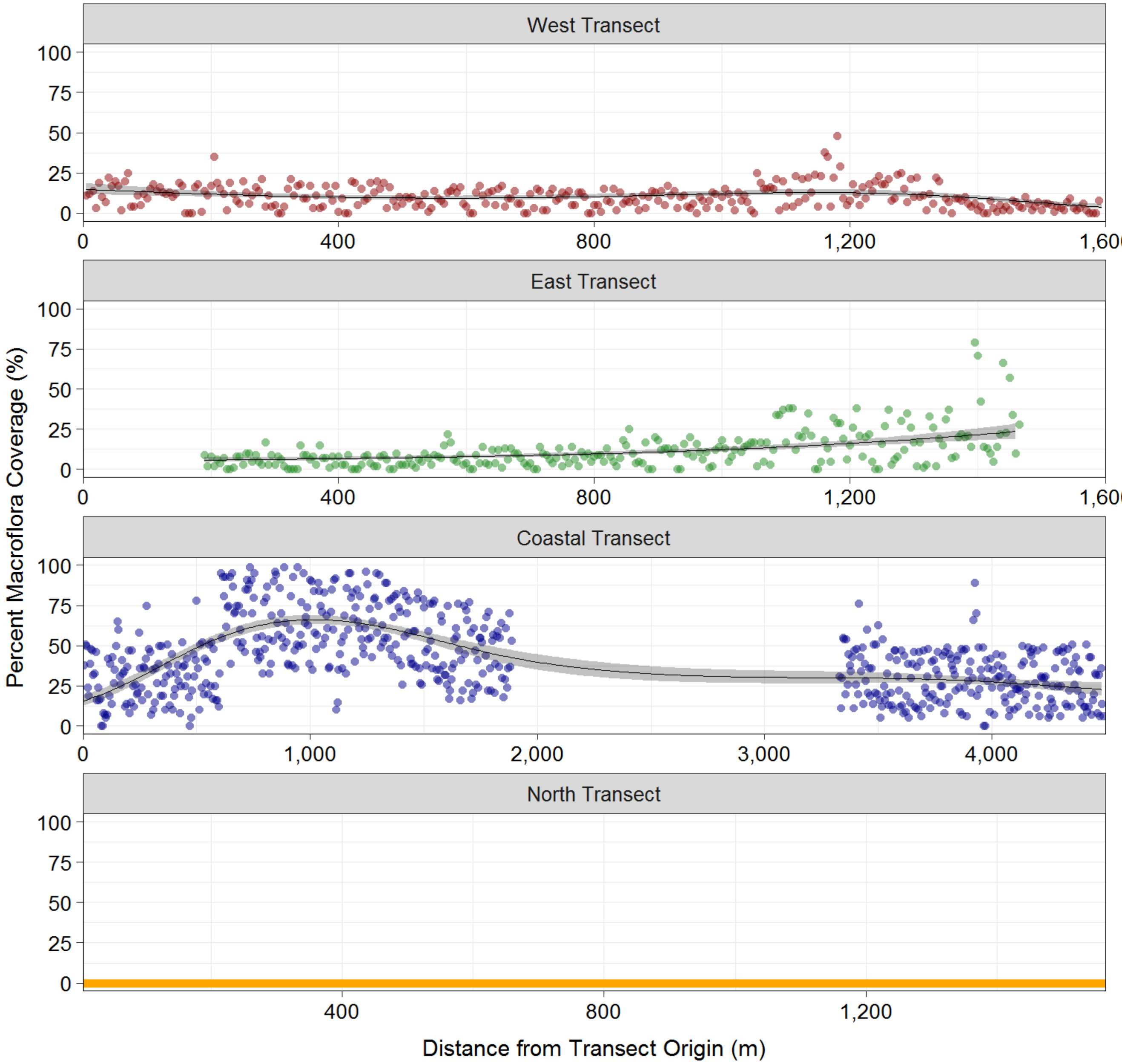


Figure 29: Generalized Additive Model of Percent Macroflora Relative to Distance from Transect Origin, 2017

3.1.3.6 EEM Analysis – Benthic Epifauna

In the analysis of epifauna abundance, the interaction between year and binned distance from transect origin was significant in all transects (Table 32), suggesting differences in epifauna abundances between years in some distance classes. The models explained only 35% of the variability in epifauna abundance on the East Transect, but 60 and 72% of the variability in epifauna abundance on the West and the Coastal Transects, respectively.

On the West Transect, epifauna abundance significantly decreased between 2016 and 2017 in the 0-250 m and 250-500 m distance bins, but not in any of the other distances or years (Table 33). On the East Transect, epifauna abundance significantly decreased between 2016 and 2017 at distances from 0 m to 750 m from transect origin, and at 1,000-1,250 m from transect origin. In addition, a significant decrease was estimated between 2014 and 2015 at the 250-500 m distance. On the Coastal Transect, significant decreases in epifauna abundance were estimated between 2015 and 2016 at all four distances used for multiple comparisons. In addition, a significant decrease between 2014 and 2015 was estimated at the 1,500-1,750 m distance bin. Further discussion relating significant effects to Project activities is provided in Section 4.2.

Table 32: ANOVA Summary of Epifauna Abundance by Year and Transect

Transect	Adj. R^2	Parameter	Df	F value	P value
West Transect	0.60	Binned distance	6	126.6	<0.001
		Year	3	27.5	<0.001
		Distance × Year	11	27.0	<0.001
East Transect	0.35	Binned distance	5	19.4	<0.001
		Year	3	34.9	<0.001
		Distance × Year	12	7.4	<0.001
Coastal Transect	0.72	Binned distance	12	45.7	<0.001
		Year	3	342.8	<0.001
		Distance × Year	14	51.3	<0.001
North Transect	–	Not analyzed			

Notes: Adj. R^2= Adjusted R square value; Df= degress of freedom

Table 33: Comparison of Statistical Trends in Epifauna Abundance by Distance, Transect and Year.

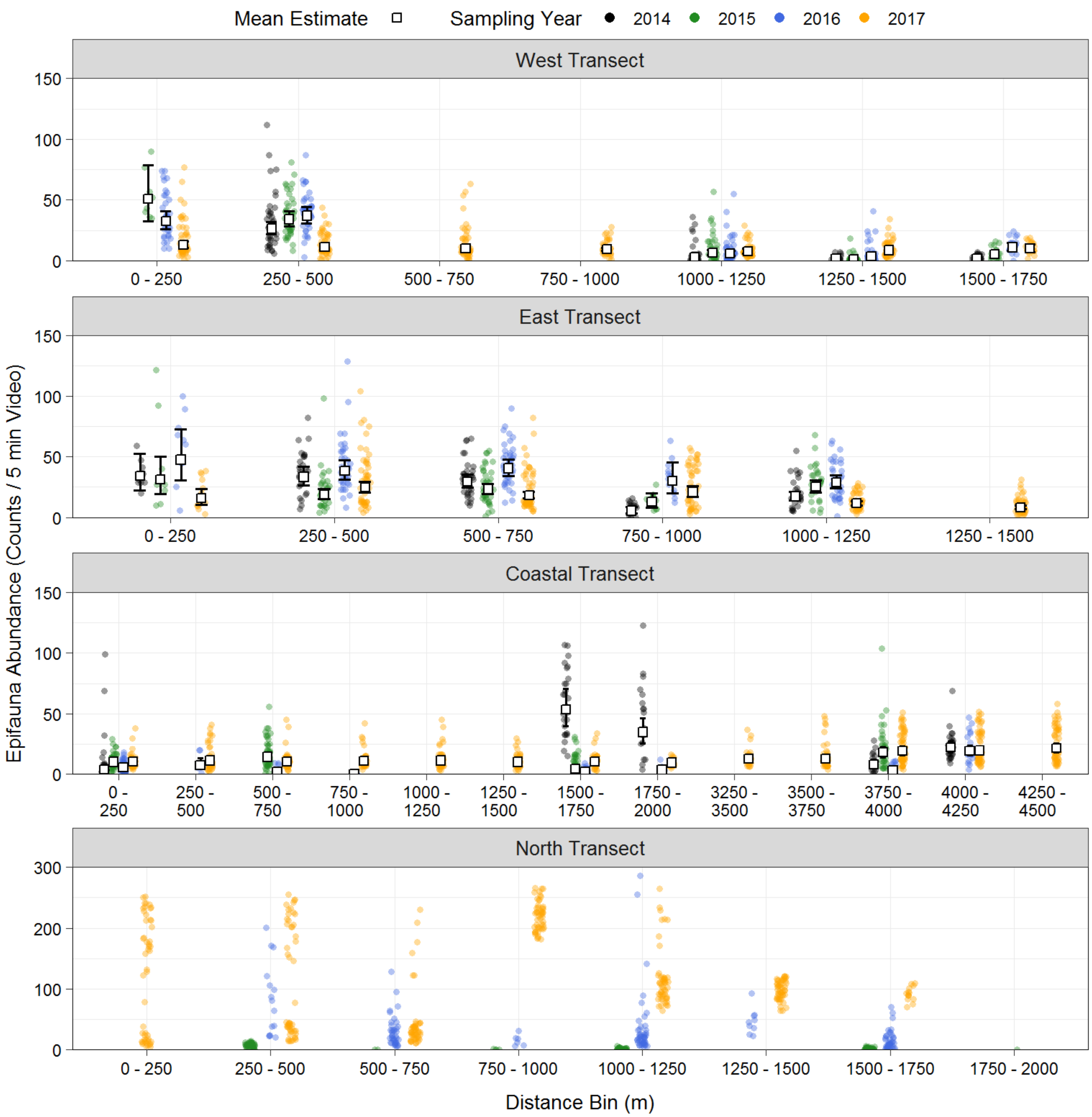
Distance (m)	West Transect				East Transect				Coastal Transect			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
0 - 250	---	b	b	a	ab	ab	b	a	a	b	a	b
250 – 500	b	b	b	a	bc	a	c	ab	---	---	---	---
500 – 750	---	---	---	---	bc	ab	c	a	---	b	a	b
750 – 1,000	---	---	---	---	a	b	c	bc	---	---	---	---
1,000 – 1,250	a	b	b	b	b	bc	c	a	---	---	---	---
1,250 – 1,500	a	a	b	c	---	---	---	---	---	---	---	---
1,500 – 1750	a	b	c	c	---	---	---	---	d	b	a	c
3,750 – 4,000	---	---	---	---	---	---	---	---	b	c	a	c

Notes: Years with different letters (within transect) depict significantly different estimates with "a" representing the lowest estimate among distance bins, "b" representing the next highest estimate, and "c" representing the highest estimate (e.g., significant increasing trends in percent cover are evidenced by a change from "a" to "b" or from "b" to "c"); grey shading depicts decreasing trends (e.g., lower percent cover than previous year). Multiple letters (e.g., "ab") represent data which is not significantly different than "a" or "b".

The overall trends of epifauna abundance with distance within each transect differed between years (Figure 30). On the West Transect, mean abundance in 2014-2016 was generally higher at distances <500 m from the transect origin and generally low at higher distances (≥1,000 m). In 2017, epifauna abundances were generally similar across the distance bins, with higher variability closer to the transect origin. Overall, the 2017 estimated abundances were lower than in previous years closer to the transect origin, but higher or similar to previous years at increasing distances.

On the East Transect, epifauna abundance estimates from 2017 were lower than previous years at 0-250 m and at 1,000-1,250 m from the transect origin, but similar to or higher than previous years' estimates in the remaining distance bins (Figure 30). The general trend across years was higher epifauna abundance up to 750 m from the transect origin and decreased estimates at higher distances. On the Coastal Transect, 2014 abundance estimates were considerably higher than all other years at the 1,500-2,000 m distances. Apart from this, abundance was overall similar across distance bins in all years, with a slight increase in estimates at distances >3,750 m.

Similar to the macroflora coverage results, the use of distance from transect origin as a continuous variable in a GAM to explain epifauna abundance provided a higher resolution estimate of trends with distance (Figure 31). The model estimated an overall lack of distance effect on epifauna abundance on the West and Coastal Transects, and a slight increase in abundance at 400-600 m from transect origin on the East Transect. Since epifauna abundance differed little with distance on both the West and Coastal Transects, the model explained only 22% of the overall variability. If future data are collected in a manner similar to 2017, the GAM approach can be extended to estimate differences between years at the full distance gradient. In addition, the inclusion of other explanatory variables, such as substrate composition, can be examined.



Notes: Distance was grouped into 250 m bins for the purpose of statistical analysis. Individual points represent recorded epifauna abundance (counts), squares represent mean abundance across 250 m distance bin with 95% confidence interval (error bars).

Figure 30: Epifauna Abundance Relative to Distance from Transect Origin, 2014 to 2017

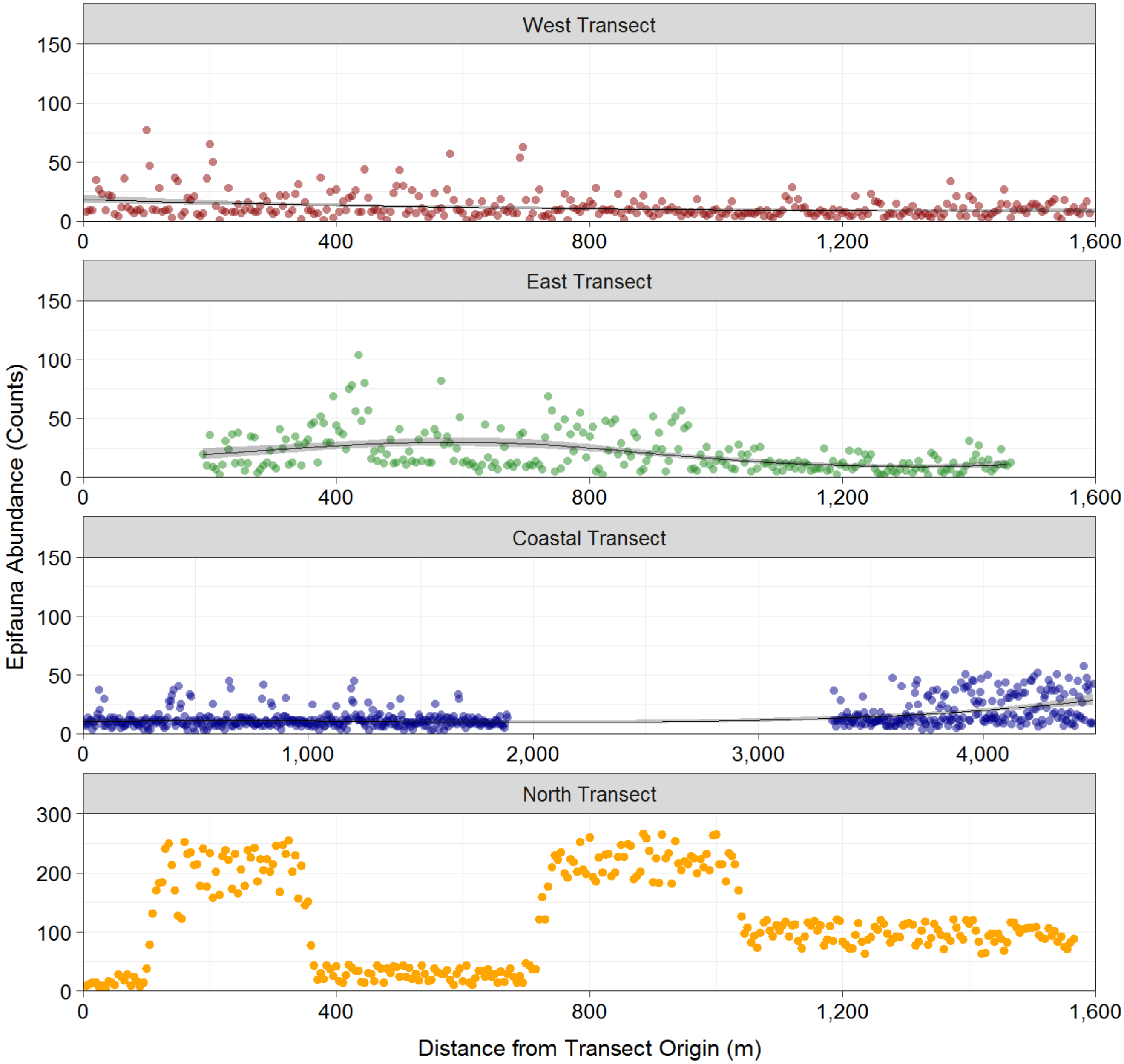


Figure 31: Generalized Additive Model of Epifauna Abundance Relative to Distance from Transect Origin, 2017

3.1.4 Fish Surveys

Tabulated fish survey results are provided in APPENDIX E-7 and photographs are provided in APPENDIX A.

For the 2017 fish survey, overall effort for the four fishing methods are shown in Table 34 and Table 35. Total fishing effort was 1,049 hours and 25 minutes. Angling effort, including trolling and jigging, ranged from 40 minutes to one hour with a mean of 53 minutes (Table 34). Although angling took place at a total of eight stations, three of the angling surveys were considered targeted surveys (AN03, AN04, and AN06) and were removed from the summary statistics to compare only those survey stations that were randomly chosen. The targeted surveys focused on areas where the field team caught larger than average numbers of sculpin. The objective of the targeted sampling was twofold: 1) to increase the length-weight dataset; and, 2) to increase the probability of capturing additional fish species. Shorthorn sculpin (*Myoxocephalus scorpius*) was the most abundant fish species caught during the angling survey followed by Arctic sculpin (*Myoxocephalus scorpioides*) and fourhorn sculpin (*Myoxocephalus quadricorni*) (Table 35). All of the species caught during the angling survey were captured during the previous monitoring surveys in the Milne Port area. The relative abundance, as indicated by CPUE, was highest for shorthorn sculpin, the most abundant fish species captured, with 2.4 fish/h (± 4.83 SD), followed by Arctic sculpin with 1.20 fish/h (± 2.68 SD).

Fukui traps were deployed at 17 stations with each deployment consisting of five traps per set. Trap effort was calculated from the amount of time the traps were left to soak at each station and ranged from 18 hours and 20 minutes to 48 hours and 40 minutes, with a mean of 35 hours and 6 minutes (Table 34). Fourhorn sculpin (n=5) was the most abundance fish species caught during the Fukui trap survey followed by sand lance (*Ammodytes spp.*) and shorthorn sculpin (n=1) (Table 35). Sand lance were not captured during any of the previous monitoring surveys in the Milne Port area. This fish was an incidental mortality and was sent to Biologica for identification to species; however, given the similarity of meristic characteristics between multiple sand lance species, this specimen could not be positively identified. Given the high fishing effort for the Fukui traps, the relative abundance, as indicated by CPUE, was low for those fish species caught. The highest CPUE was fourhorn sculpin, the most abundant fish species captured, with 0.01 fish/h (± 0.02 SD), followed by sand lance and shorthorn sculpin, each with 0.001 fish/h (± 0.005 SD).

Gill net effort was calculated from the amount of time the gill net was left to soak at each station. At each station, the gill net was checked by the field staff up to four times and the fish capture results were pooled for that station. One gill net was deployed per station at a total of 16 stations in the Milne Port area. Effort ranged from 1 hour and 15 minutes to six hours and 55 minutes with a mean of five hours and 15 minutes (Table 34). Arctic char (*Salvelinus alpinus;* n=23) was the most abundant fish species caught during the gill net survey followed by fourhorn sculpin (n=12) and shorthorn sculpin (n=2) (Table 35). All of the species caught during the gill net survey have been captured during the previous monitoring surveys in the Milne Port area. The highest CPUE was for Arctic char, the most abundant fish species captured, with 0.37 fish/h (± 0.70 SD), followed by fourhorn sculpin with 0.19 fish/h (± 0.44 SD) and shorthorn sculpin with 0.04 fish/h (± 0.14 SD).

Minnow traps were deployed at two stations with each deployment including 2 traps per set. Trap effort was calculated from the amount of time the traps were left to soak at each station and ranged from 74 hours and 20 minutes to 74 hours and 55 minutes with a mean of 74 hours and 34 minutes (Table 34). Minnow traps were not an effective method for fish capture during the survey with no fish catch reported.

Table 34: Summary Statistics of Fishing Efforts by Fishing Method

Method	Number of stations	Effort Statistic (hour:minute)				
		Min	Max	Mean	SD	Total
Angling[1]	5	0:40	1:00	0:53	0.2	4:25
Fukui traps[2]	17	18:20	48:40	35:06	12.0	598:58
Gill net	16	1:15	6:55	5:15	1.5	73:12
Minnow traps[3]	2	74:20	74:55	74:34	0.2	372:50
					Total Effort	**1,049:25**

Notes: [1] Three angling surveys were considered targeted surveys and were removed from the summary statistics (AN03, AN04, and AN06). [2] Fukui traps: at each station, five traps were deployed. [3] Minnow traps: at each station, two traps were deployed.

Table 35: Summary Statistics of Fishing Efforts, by Fishing Method and Fish Species

Method[3]	Variable	Arctic Char	Arctic Sculpin	Fourhorn Sculpin	Sand lance	Shorthorn Sculpin
Angling[1]	N range (fish counts)	-	0 - 6	0 - 1	-	0 - 11
	N mean ± SD (fish counts)	-	1.20 ± 2.68	0.20 ± 0.45	-	2.4 ± 4.83
	Total N (fish counts)	-	6	1	-	12
	CPUE range (fish/h)	-	0 - 6	0 - 1	-	0 - 11
	CPUE mean ± SD (fish/h)	-	1.20 ± 2.68	0.20 ± 0.45	-	2.4 ± 4.83
Fukui traps[2]	N range (fish counts)	-	-	0 - 3	0 - 1	0 - 1
	N mean ± SD (fish counts)	-	-	0.29 ± 0.77	0.06 ± 0.24	0.06 ± 0.24
	Total N (fish counts)	-	-	5	1	1
	CPUE range (fish/h)	-	-	0 - 0.07	0 - 0.02	0 - 0.02
	CPUE mean ± SD (fish/h)	-	-	0.01 ± 0.02	0.001 ± 0.005	0.001 ± 0.005
Gill net	N range (fish counts)	0 - 10	0 - 1	0 - 6	-	0 - 2
	N mean ± SD (fish counts)	1.44 ± 2.56	0.06 ± 0.25	0.75 ± 1.57	-	0.13 ± 0.50
	Total N (fish counts)	23	1	12	-	2
	CPUE range (fish/h)	0 - 2.73	0 - 0.15	0 - 1.714	-	0 - 0.57
	CPUE mean ± SD (fish/h)	0.37 ± 0.70	0.01 ± 0.04	0.19 ± 0.44	-	0.04 ± 0.14

Notes: [1] Three angling surveys were considered targeted surveys and were removed from the summary statistics (AN03, AN04, and AN06). [2] Fukui traps: at each station, five traps were deployed. [3] Minnow traps are not included as no fish were caught. (-) indicates no data available.

Five Arctic fish species were captured during the fish survey. The relative abundance of fish species captured in the Milne Port area for all fishing methods are shown in Figure 32. Overall, fourhorn sculpin and Arctic char were the dominant species captured with a relative abundance of 36% and 29% of the total catch, respectively. In addition to these species, shorthorn sculpin, Arctic sculpin and sand lance were also captured during the fish survey with relative abundance of 26%, 8% and 1% of the total catch.

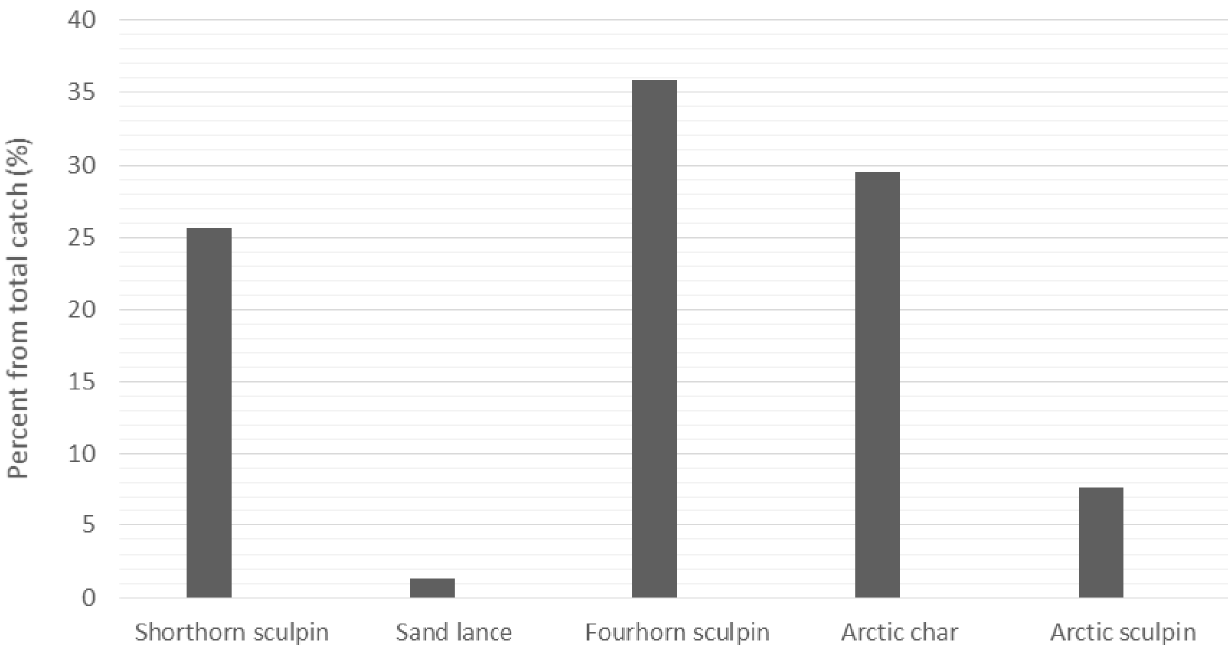


Figure 32: Relative Abundance of Fish Species Captured in Milne Port Area

A summary of the total number of fish caught in Milne Port from 2010 to 2017 is provided in Table 36, with a total of 12 different fish species identified to date. Arctic char was the most common species identified in 2015 and 2016, representing 60% and 80% of the total fish catch in these respective years. Higher catches of Arctic char in certain years are likely influenced by timing of sampling and potential overlap with local migratory movements of this species. Sculpin were the second most abundant non-char fish caught in Milne Port, with shorthorn sculpin and fourhorn sculpin being the most common species recorded in all survey years. Shorthorn sculpin represented 67% of the total fish catch in 2010 and 38% of the total fish catch in 2017. Fourhorn sculpin constituted 58% of the total fish catch in 2014 and 34% of the total fish catch in 2017. Other fish species caught in two or more survey years included Arctic sculpin (*Myoxocephalus scorpioides*), Arctic staghorn sculpin (*Gymnocanthus tricuspis*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), and Atlantic hookear sculpin (*Artediellus atlanticus*), Greenland cod (*Gadus ogac*), fishdoctor (*Gymnelis viridis*), and fourline snakeblenny (*Eumesogrammus parecisus*). Arctic cod were never captured during field sampling, but were observed in large schools around Milne Port in 2016 (SEM 2017b) and were also identified in Arctic char stomach contents in 2016 (SEM 2017a).

The observed decrease in total fish catch in 2017 compared to 2016 may be attributable to timing of sampling, as 2017 sampling began two weeks later than in 2016. Arctic char, an anadramous species with a narrow migratory window in the marine environment, were the dominant species captured in captured in 2016 representing 80% of the total catch. Arctic char were less common in 2017, representing only 19% of the total catch.

Table 36: Total Fish Catch per Year in the Milne Port Area - 2010 to 2017

Common Name	Taxonomic ID	2010	2013	2014	2015	2016	2017
Arctic char	*Salvelinus alpinus*	11	6	3	67	157	23
Arctic sculpin	*Myoxocephalus scorpioides*	0	0	4	1	-	9
Shorthorn sculpin	*Myoxocephalus scorpius*	50	4	9	8	18	45
Fourhorn sculpin	*Myoxocephalus quadricorni*	7	3	39	13	18	40
Arctic staghorn sculpin	*Gymnocanthus tricuspis*	3	0	0	2	0	0
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	0	2	4	2	2	0
Arctic hookear sculpin	*Artediellus atlanticus*	0	0	5	1	0	0
Unidentified sculpin	Cottidae	0	0	0	12	0	0
Greenland cod	*Gadus ogac*	4	0	1	0	0	0
Common lumpfish	*Cyclopterus lumpus*	0	0	1	0	0	0
Fishdoctor	*Gymnelis viridis*	0	1	0	3	0	0
Fourline snakeblenny	*Eumesogrammus parecisus*	0	0	1	2	2	0
Sand lance	*Ammodytes spp.*	0	0	0	0	0	1
Total		**75**	**16**	**67**	**111**	**197**	**118**

The length and weight statistics of fish species sampled in the Milne Port area are provided in Table 37. Arctic char were the largest fish captured with length ranging from 255 to 825 mm and a mean of 595 mm (± 182 mm SD). Arctic char weight ranged from 115 to 7,750 g with a mean of 2,889 g (± 2,170 g SD). The remaining species captured were sculpins (excluding the single sand lance), and were similar in size range. The length of fourhorn sculpin ranged between a minimum length of 86 mm and a maximum length of 308 mm with a mean of 224 mm (± 64 mm SD). Although the lengths of fourhorn sculpin were smaller compared to the other sculpin species, they were a denser species ranging from 50 to 550 g and mean of 171 g (± 102 g SD). Arctic sculpin and shorthorn sculpin were similar in length range with 172 to 225 mm (204 ± 23 mm SD) and 175 to 335 mm (260 ± 50 mm SD), respectively. Arctic sculpin and shorthorn sculpin weight range were not as comparable with shorthorn sculpin a heavier species ranging from 41 to 440 g (249 ± 123 g SD). Only one sand lance was captured with a length of 170 mm and a weight of 19 g.

Length frequencies for fish species sampled in the Milne Port area are provided in Figure 33. Arctic char and fourhorn sculpin showed two size range distributions. For Arctic char, a smaller (younger) size distribution ranged from 255 to 428 mm and a second larger (older) size distribution ranged from 610 to 825 mm. Both groups of fish were captured during gill net sets, with smaller individuals captured at GN02, GN04, and GN11 and larger individuals captured at GN01, GN05, GN08, GN12, and GN15. These results indicate that there is likely segregation of these size/age groups of Arctic char and the different groups likely utilize different areas of the Milne Port area and are specific in their foraging and migrating patterns. For fourhorn sculpin, the smaller (younger) size distribution ranged from 86 to 118 mm and the larger (older) size distribution ranged from 201 to 308 mm. Larger fourhorn sculpin were primarily captured by gill net and angling, with the smaller group primarily caught in Fukui traps. Only two individuals overlapped with these generalizations, with a larger individual captured in a Fukui trap (FT03; length = 308 mm) and a smaller individual captured by angling (AN06; length = 118 mm). These results indicate that these groups show some degree of habitat separation and may occupy a different subtidal niche. It should be noted, however, that the two size distributions are likely multiple age-classes for these both Arctic char and fourhorn sculpin.

Table 37: Length and Weight Statistics for Fish Species Captured in Milne Port Area

Species	N Fish	Variable	Statistic			
			Min	Max	Mean	SD
Arctic char	23	Length (mm)	255	825	595	182
Arctic sculpin	6		172	225	204	23
Fourhorn sculpin	28		86	308	224	64
Sand lance	1		170	170	170	-
Shorthorn sculpin	20		175	335	260	50
Arctic char	23	Weight (g)	115	7,750	2,889	2,170
Arctic sculpin	6		74	127	99	23
Fourhorn sculpin	28		50	550	171	102
Sand lance	1		19	19	19	-
Shorthorn sculpin	20		41	440	249	123

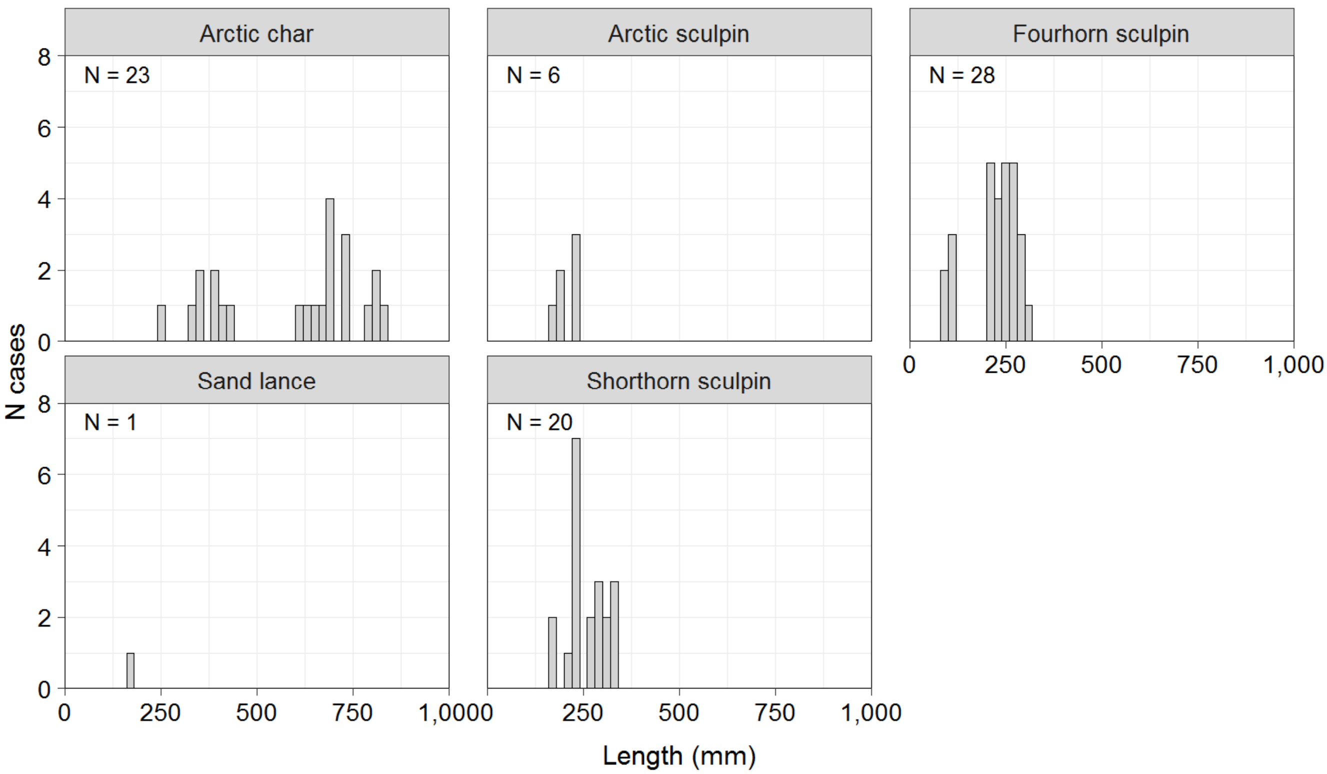


Figure 33: Length Frequencies of Fish Species Captured in Milne Port Area

Weight-length plots and regressions for all fish species (excluding northern sand lance, N = 1) captured in Milne Port area are shown in Figure 34. The R^2 values ranged from 0.658 for fourhorn sculpin to 0.977 for Arctic char. The high R^2 for Arctic char indicates a good fit for the length-weight regression. Lower R^2 values for fourhorn sculpin, shorthorn sculpin, and Arctic sculpin reflect the higher variability in the length-weight values and poorer fit for these species. One fourhorn sculpin had a high body weight for the length and did not fit the curve for the length-weight regression, thus the weight measurement was likely spurious.

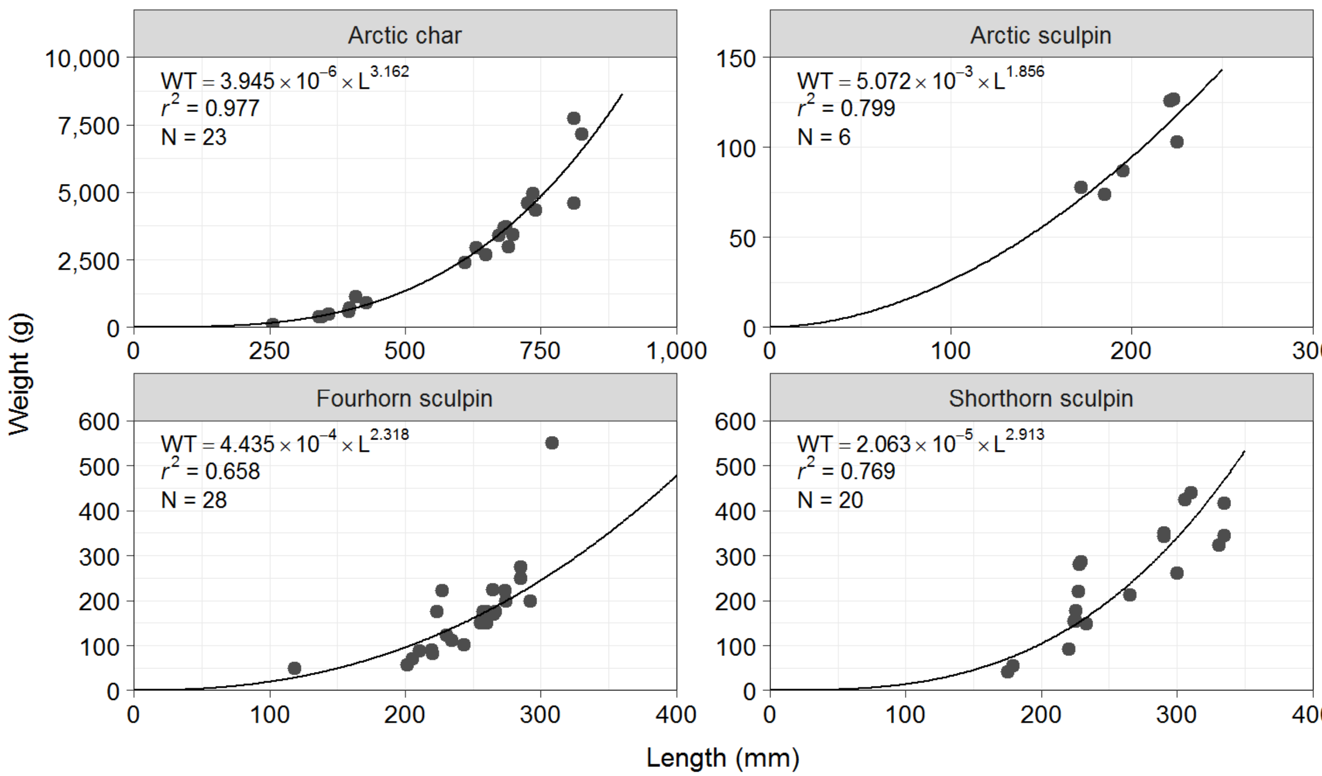


Figure 34: Weight-Length Plots and Regressions for Fish Species Captured in Milne Port Area

Two incidental Arctic char mortalities were retained for aging, body burden analysis, and stomach content analysis. Both fish were damaged during gill net retrieval on 27 and 29 August 2017. A summary of the Arctic char stomach characteristics and estimated age are provided in Table 38. Incidental mortality (IM) -1 was the larger of the two Arctic char, measuring 630 mm in length and 2,950 g in weight and was estimated to be 11 years old based on the number of annuli (growth rings). IM-2 was the smaller of the two Arctic char, measuring 266 mm in length and 175 g in weight and was estimated to be 5 years old. Both incidental mortalities fit the length frequency presented in Figure 33 and are likely two separate age classes.

Table 38: Summary of Arctic Char Incidental Mortality (IM-1, IM-2) Stomach Characteristics and Estimated Age

Fish ID	Date Sampled	Length (mm)	Weight (g)	Age (# of annuli)	Full stomach weight (g)	Stomach fullness (%)	Material digested (%)
IM-1	27 Aug 2017	630	2950	11	73.2	75	75
IM-2	29 Aug 2017	266	175	n/a[1]	10.5	50	75

Notes:
[1] Otolith was damaged and could not be analyzed. This fish was estimated to be 5 years old based on length and biomass (Aymes et al. 2016).

A summary of the stomach contents for each Arctic char are provided in Table 39. For IM-1, the dominant taxon was an unidentified epibenthic Mysida with an abundance of 182 and a total wet weight of 1.39 g. Two fish taxon were identified in the stomach contents, these were larval unidentified Pisces and larval unidentified Gadidae, family name for cod. Unidentified Gadidae were the second most abundant taxon identified with a wet weight of 1.26 g. Gadidae species whose range overlaps with the Milne Port area include polar cod (*Boreogadus saida*), Arctic cod (*Arctogadus glacialis*), and Greenland cod (*Gadus ogac*).

For IM-2, the dominant taxon was planktonic amphipods (Hyperiidae) with an abundance of 370 and a total wet weight of 23.74 g. Two fish taxon were identified in the stomach contents, these were larval unidentified Pisces and larval unidentified Cottidae, family name for sculpins.

Zooplankton samples collected in 2017 from seven stations in Milne Port and four stations at Ragged Island identified four larvae fish taxa in Milne Port including sand lance (*Ammodytes* spp.), gunnel (*Apodichthys* spp.), sculpin (family Cottidae) and cod (family Gadidae). Results are further described in Section 3.2.1. In addition, during sediment collection with a grab sampler in the Milne Port area, an adult fishdoctor was captured, identified and released unharmed.

Table 39: Summary of Stomach Contents for Arctic Char Incidental Mortalities (IM-1, IM-2)

Fish ID	Source	Taxonomic group	Taxon[1]	Stage	Abundance[2]	Total number of taxa	Total WW (g)[3]	WW per individual (g)[3]
IM-1	Fish	Pisces	Pisces indet.	Larvae	1	1	0.07	0.07001
	Fish	Pisces	Gadidae indet.	Larvae	18	1	1.26	0.07001
	Planktonic	Crustacea Amphipoda	Hyperiidea indet.	Adult	26	1	0.86	0.03317
	Epibenthic	Crustacea Mysidacea	Mysida indet.	Adult	182	1	1.39	0.00765
IM-2	Planktonic	Crustacea Amphipoda	Hyperiidea indet.	Adult	370	1	23.74	0.06415
	Fish	Pisces	Pisces indet.	Larvae	1	1	0.08	0.07698
	Fish	Pisces	Cottidae indet.	Larvae	1	1	0.08	0.07698
	Planktonic	Crustacea Amphipoda	Lysianassoidea indet.	Larvae	1	1	0.01	0.07698

Notes:
[1] Taxon, indet = indeterminate
[2] Abundance is the total number of individuals
[3] WW = wet weight (g)

Tissue samples were analyzed to detect changes in fish body burden before Project operation (2010 and 2013) and during Project operation (2015 onwards; Table 40). Numbers of fish used for tissue sampling varied between surveys, depending on the number of incidental mortalities during fish capture, however samples were taken almost entirely from Arctic char, as it was the most abundant species caught in gill nets. Apart from Arctic char, two fourhorn sculpin and one Arctic staghorn sculpin were used for tissue sample collection in 2013. No tissue samples were collected in 2014 since incidental fish mortality did not occur during the survey.

Metals in Arctic char tissue samples were primarily below detectable limits, except for arsenic, cadmium, chromium, copper, iron, mercury, and zinc, whose concentrations exceeded detection limits during at least one sampling event. Concentrations of these metals in fish tissue were generally consistent throughout 2010 to 2017. None of the samples exceeded Health Canada's guideline for mercury in fish tissue for human consumption of 0.5 mg/kg. Complete 2017 metal concentrations for the two Arctic char (IM-1 and IM-2) are provided in APPENDIX E-6.

Table 40: Summary of Detected Metal Concentrations (mg/kg) in Arctic Char Incidental Mortality Tissue Samples in the Milne Port Area (2010 to 2017)

Metals	Health Canada Guideline	2010 (n = 11)		2013 (n = 6)		2015 (n = 5)		2016 (n = 13)		2017 (n = 2)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Arsenic	-	0.82	0.17	0.61	0.12	1.38	0.91	0.97	0.21	0.81	0.4
Cadmium	-	0.01	0.003	<0.05	0	<0.05	0	<0.05	0	0.01	0
Chromium	-	0.59	0.9	<0.5	0	<0.5	0	<0.5	0	<0.01	0
Copper	-	0.85	0.27	1.06	0.26	0.55	0.2	1.63	1.18	0.56	0.12
Iron	-	9.9	5.03	<15	0	<15	0	8.38	3.19	6.00	0.14
Mercury	0.5	0.05	0.03	0.03	0.01	0.04	0.01	0.04	0.02	0.06	0.04
Zinc	-	6.2	0.8	9.2	1.96	6.92	1.71	7.18	1.27	5.84	0.54

Notes: No tissue samples were collected in 2014 since incidental fish mortality did not occur during the surveys.

3.2 Aquatic Invasive Species (AIS)

3.2.1 Zooplankton

Taxonomic data of zooplankton collected from seven stations in Milne Port and four stations at Ragged Island are presented in APPENDIX F-2. Zooplankton taxa presence/absence in 2017 is presented along with presence/absence in 2014, 2015 and 2016 in Table 41. A list of newly observed taxa in Milne Port, defined as taxa identified during the 2017 survey but not during previous monitoring surveys in 2014 through 2016, is provided in Table 42, along with a brief description of the known geographic distribution of each taxa.

A total of fourty-four (44) zooplankton taxa were identified in samples collected during the 2017 AIS monitoring survey. Of the 44 taxa identified, two taxa, the mysid shrimp species *Mysis litoralis* and unidentified ribbon worms of the phylum Nemertea, were identified only in samples collected at Ragged Island. Of the 42 taxa identified in Milne Port, a total of eleven taxa were not observed during previous AIS monitoring or baseline surveys (Table 41). An additional seven of the taxa identified in Milne Port in 2017 were not identified in the AIS monitoring surveys in 2014 through 2016, but were identified during baseline studies in 2008 or 2010.

Table 41: Zooplankton Taxa Presence and Absence in Milne Inlet during AIS Monitoring (2014-2017)

Taxa	2014	2015	2016	2017
Acarti hudsonica			x	
Acartia longiremis	x	x	x	x
*Aeginopsis laurentii***				x
Aglantha digitale	x			x
Ammodytes sp.				x
Anthomedusae indet.		x		
Apodichthys sp.				x
Balanomorpha indet.**				x
Beroe gracilis		x		
Beroe cucumis			x	
Bivalvia indet.	x	x	x	x
Bosmina longicornis		x	x	
Bosminidae indet.	x			x
Calanoida indet.	x	x	x	x
Calanus finmarchicus	x	x	x	x
Calanus glacialis	x	x	x	x
Calanus hyperboreus	x	x	x	x
*Catablema vesicarium***				x
Centropages sp.		x		
Chydorus sphaericus			x	
Clione limacina	x			x
Clytemnestra sp.	x		x	x
Cnidaria indet.			x	x
Corycaeus sp.		x		
Cottidae indet.				x
Ctenocalanus vanus				x
Daphnia sp.		x		
Echinoidea indet.	x	x	x	x
Eukrohnia hamata	x			
Euphysa sp.		x		
Eurytemora herdmani		x		
Euterpina acutifrons		x	x	x
Fritillaria sp.		x	x	
Gadidae indet.				x
Gymnosomata	x			
Hydracarina sp.		x		
Hyperia medusarum				x
Hyperoche medusarum				x
Isopoda indet.**				x
Limacina helicina		x		x
Limacina sp.	x	x	x	x

Taxa	2014	2015	2016	2017
Lucicutia sp	x		x	
Metridia sp.		x		x
Microcalanus sp.				x
Microsetella norvegica	x	x	x	x
*Mysis litoralis**				x
Nemertea indet.*				x
Oikopleura sp.		x		x
Oithona atlantica	x	x	x	x
Oithona similis	x	x	x	x
Oncaea minuta	x	x		
Oncaeidae indet.	x	x	x	x
Parasagitta elegans	x			x
Polychaeta indet.	x	x	x	x
Pseudocalanus sp.	x	x	x	x
Rathkea sp.**				x
Sabellariidae indet.				x
*Sabinea septemcarinata***				x
Sagittidae indet.	x	x	x	
Sapphirina opalina		x		
Sapphirina sp.			x	x
Scolecithricella sp.				x
Synchaeta sp.			x	x
*Themisto abyssorum***				x
Themisto libellula				x
Themisto sp.	x			x
Triconia borealis			x	x

Notes: taxa identifed to the lowest practical taxonomic level; presence/absence for previous years taken from SEM 2015, 2016, 2017a. *=taxa identified only at Ragged Island; **=taxa not identified in 2014, 2015 or 2016 but identified during baseline studies in 2008 or 2010 (Baffinland 2012; SEM 2017a); indet.= indeterminate (taxa which could not be identified beyond the taxonomic level listed); sp.=species. High taxonomic levels presented only for taxa not previously identified to a lower taxonomic level (e.g. Crustacea indet. omitted due to large numbers of crustacean taxa identified to species level, Cottidae indet. presented due to lack of sculpins identified to species level).

Zooplankton samples in 2017 contained a total of thirteen taxa which were not previously identified during previous AIS monitoring or baseline studies, including 11 new taxa collected in Milne Port and two new taxa collected at Ragged Island (Table 41). Five of the 13 new taxa were identified to species level, four were identified to genus level and the remaining four new taxa represented the first recorded occurrence of a family or larger taxonomic level. Four of the newly observed taxa in Milne Port were fish taxa including sand lance (*Ammodytes* sp.), gunnel (*Apodichthys* sp.), sculpin (Cottidae) and cod (Gadidae). Other new taxa identified in the samples included three distinct species of marine amphipods, three genera of calanoid copepods and one family of tube-dwelling polychaete worms (Sabellariidae). Taxa identified at Ragged Island, which have not been identified in Milne Port included mysid shrimp (*Mysis litoralis*) and ribbon worms of the phylum Nemertea. The presence of newly observed fish taxa in the 2017 samples was likely a result of the modified sampling methodology utilized in 2017 in which oblique tows were conducted at a higher speed to target faster moving larval taxa (see Section 2.2.2.1). A total of 22 of the 23 fish larvae collected were caught in the oblique tows.

Each newly observed taxa was cross-checked against a global database of marine invasive species and none of the taxa were identified as a globally-recognized invasive species (Molnar et al. 2008) or an invasive species in Canada according to the National Risk Assessment for Introduction of Aquatic Nonindigenous Species to Canada by Ballast Water (Casas-Monroy et al. 2014). In addition to these databases, each new taxa was researched independently in the literature for their known habitats and distributions for signs of taxa that may be considered non-native to the Arctic region. None of the newly observed zooplankton taxa in 2017 could be identified as non-native to the Arctic, despite not being previously identified in Milne Port. Several of the taxa identified to species level are commonly found in the Arctic Ocean (e.g., *Mysis litoralis, Themisto libellula*), while taxa identified to genus or high taxonomic levels contained at least one species known to occur in the Arctic (e.g., *Apodichthys* sp., *Ammodytes* sp.). Several other taxa, including the majority of the amphipod and copepod taxa, have global distributions, including the amphipod species *Themisto libellula,* which is an important food source for local Arctic cod populations (Dalpadado 2001). Three of the four fish taxa identified are larvae of adult fish observed during the marine surveys in 2017, including cod, sculpin and sand lance, while one additional taxa, gunnel, was also identified.

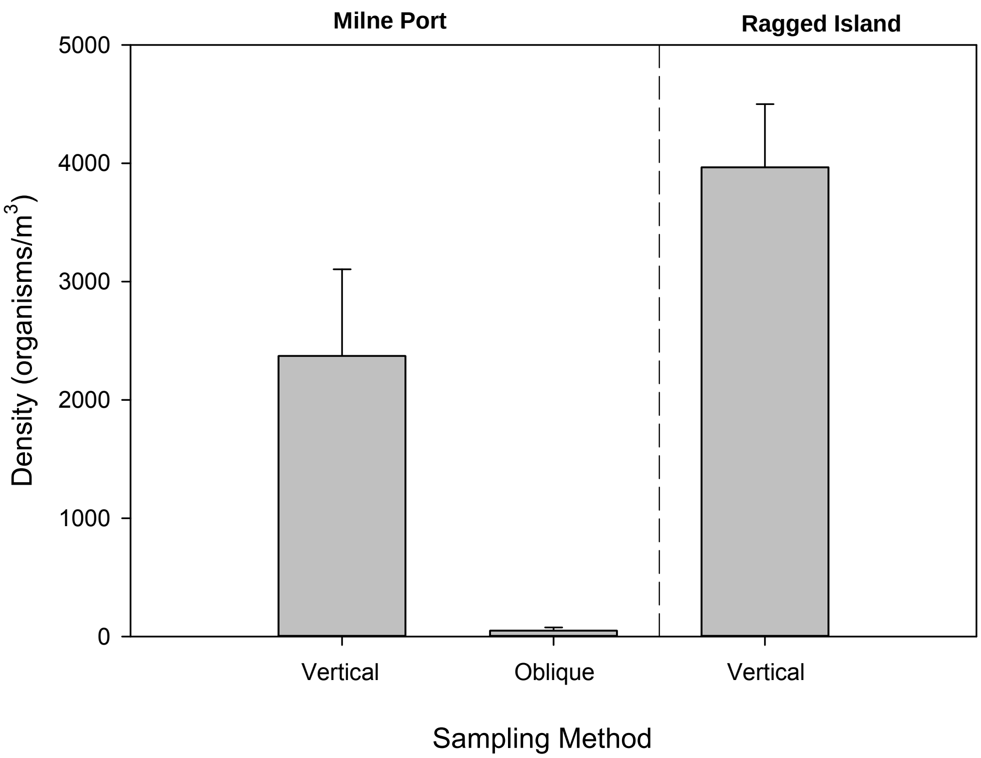
Table 42: Newly Observed Zooplankton Taxa Identified in Milne Port in 2017

Taxa	Common Name	Description
Ammodytes spp.	Unidentified sand lance	Some species of sand lance are known to inhabit the Arctic region. An adult sand lance was also captured during fish surveys in the Milne Port area in 2017(see Section 3.2.5).
Apodichthys sp.	Unidentified gunnel	One species of gunnel is known to inhabit the Arctic Ocean, the banded gunnel (*Pholis fasciata*).
Cottidae indet.	Unidentified sculpin	Several species of sculpin are known to inhabit Milne Port (SEM 2017a).
Ctenocalanus vanus	Calanoid copepod	A small copepod similar to Pseudocalanus, global distribution.
Gadidae indet.	Unidentified cod	Two species of cod are known to occur in Milne Port, arctic cod (*Arctogadus glacialis*) and Greenland cod (*Gadus ogac*).
Hyperia medusarum	Amphipod	Wide geographic distribution at high latitudes, literature not sufficient to characterize species as non-native.
Hyperoche medusarum	Parasitic amphipod	Parasite of certain species of comb jelly (Ctenophora) and common in the North Atlantic Ocean (Raymont 1983). Literature not sufficient to characterize species as non-native.
Microcalanus sp.	Calanoid copepod	A genus of calanoid copepods closely related to *Pseudocalanus*. Wide geographic distribution including in the Arctic and Antarctic Ocean.
*Mysis litoralis**	Mysid shrimp	Distributed throughout the coastal zone of the Arctic and high boreal seas
Nemertea indet.*	Ribbon worms	Unsegmented worms, mostly marine, global distribution
Sabellariidae indet.**	Polychaete worms	A family of marine polychaete tube-dwelling worms, global distribution
Scolecithricella sp.	Calanoid copepod	Distributed throughout the Antarctic and Arctic regions
Themisto lbellula	Marine amphipod	Distributed throughout most of the world, abundant in the Arctic region and an important food source for Arctic cod populations.

*indicates taxa identified at Ragged Island but not in Milne Port.

**Polychaete worms in each of the previous monitoring studies were present but were only identified to class (Polychaeta).

A total of 232,933 organisms were counted from samples collected at Milne Port and Ragged Island in 2017. Adjusted for the total volume of water sampled during each vertical haul and oblique tow, the mean density[16] of organisms for each area and sampling method was 2,372 ± 733 organisms/m^3 in vertical hauls at Milne Port, 306 ± 27 organisms/m^3 in oblique tows at Milne Port, and 3,967 ± 533 organisms/m^3 in vertical hauls at Ragged Island (Figure 35). Higher zooplankton density in vertical hauls compared to the oblique tows was consistent with previous sampling years and likely a result of differences in the depth strata targeted by each sampling method. In general, zooplankton density and taxa richness were higher in 2017 than in previous AIS monitoring years but overall community composition was similar.



Notes: Error bars represent one standard deviation

Figure 35: Mean Density of Zooplankton Collected in Oblique Tows and Vertical Hauls, Milne Inlet, 2017

A taxa accumulation curve was calculated for samples collected in 2017 to compare sampling effort with previous AIS monitoring surveys in Milne Port and to provide an estimate of the effort required to fully characterize the zooplankton community (Figure 36). The taxa accumulation curve for the 2017 AIS sampling effort reached an asymptote at approximately thirteen samples, after which no new taxa were identified in any additional samples up to a total of seventeen. Compared to AIS sampling in 2014 through 2016, for which an asymptote was not reached during a single year's sampling effort, 2017 results showed that AIS sampling captured a much larger proportion of the overall zooplankton community and was sufficient to describe the general zooplankton community structure.

[16] Calculated as the average density per sampling method ± one standard deviation of the mean

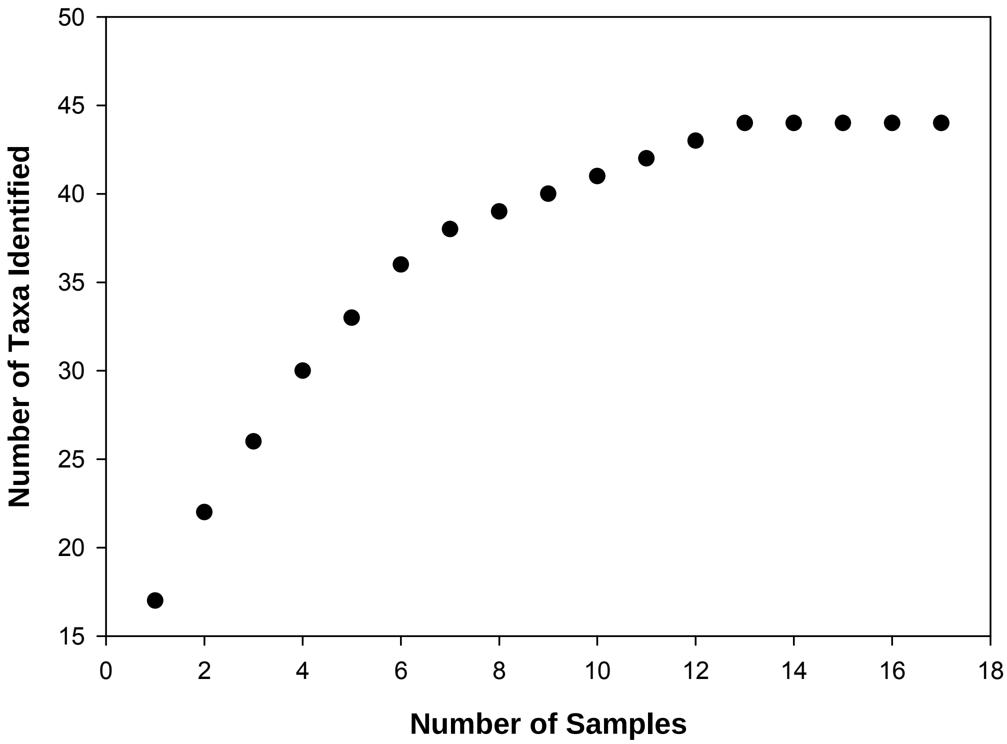


Figure 36: Taxa Accumulation Curve for Zooplankton, Milne Inlet, 2017

The non-parametric species estimator Chao 2[17] was calculated for 2017 following the methods used in SEM 2017a. For samples collected in 2017, the Chao 2 calculation provided an estimate of 47.6 taxa observed, which exceeded the actual observed number of taxa (44) by 8% (Table 43). The discrepancy between the observed and expected number of zooplankton taxa was lower in 2017 than in previous AIS monitoring years. The relatively low discrepancy between the observed and expected number of taxa suggests that the zooplankton sampling effort in 2017 was sufficient to characterize the overall zooplankton community.

Table 43: Chao 2 Species Estimates for Zooplankton Samples Collected in Milne Inlet (2014-2017)

Year	S_{obs}	Q_1	Q_2	S_2	% S_2 exceeds S_{obs}
2014	34	7	6	38.1	12
2015	40	10	6	48.3	21
2016	37	8	5	43.4	17
2017	44	8	9	47.6	8

Notes: Values for 2014 through 2016 taken from SEM 2017a. S_{obs}= # of taxa observed; Q_1= # of species occurring in only one sample; Q_2= # of species occurring in two samples; S_{obs}= # of taxa expected to be observed based on Chao 2 estimate

[17] Chao 2 calculation: $S^1=S_{obs}+(F_1^2/2F_2)$

3.2.2 Benthic Invertebrate Infauna

Benthic invertebrate samples were collected from 15 stations in Milne Port and from four stations at Ragged Island. Benthic infauna taxa presence/absence in 2017 is presented along with presence/absence in 2010, 2013, 2015, and 2016 in APPENDIX G-1 and taxonomic data from laboratory analyses are presented in APPENDIX G-3. The taxa list was updated for new accepted species names for species that had been previously listed under a former unaccepted name. Newly observed taxa in Milne Port and at Ragged Island, defined as taxa identified during the 2017 survey but not during previous monitoring surveys in 2010 through 2016, are listed in Table 44.

A total of 235 benthic infauna taxa were identified in 2017. Of the 235 taxa, a total of 112 newly observed taxa were identified including 90 taxa from samples collected in Milne Port and 22 taxa from samples collected at Ragged Island (Table 44). 53% of the new taxa were identified to species level, 32% were identified to genus level and the remaining 15% new taxa represented the first recorded occurrence of a family or larger taxonomic level.

Table 44: Newly Observed Benthic Invertebrate Infauna Taxa Identified at Milne Port and Ragged Island in 2017

Phylum	Class/Order	Family	Taxa
Annelida	Hirudinea	Piscicolidae	*Mysidobdella* sp.
Annelida	Polychaeta	Ampharetidae	*Ampharete vega*
Annelida	Polychaeta	Apistobranchidae	*Apistobranchus* sp.
Annelida	Polychaeta	Capitellidae	*Notomastus latericeus*
Annelida	Polychaeta	Cirratulidae	*Aphelochaeta* sp.
Annelida	Polychaeta	Cirratulidae	*Chaetozone bathyala*
Annelida	Polychaeta	Cirratulidae	*Chaetozone careyi*
Annelida	Polychaeta	Cirratulidae	*Chaetozone pigmentata*
Annelida	Polychaeta	Cirratulidae	*Tharyx* sp.
Annelida	Polychaeta	Fabriciidae	Fabriciidae indet.
Annelida	Polychaeta	Glyceridae	*Glycera capitata*
Annelida	Polychaeta	Maldanidae	*Clymenura* sp.
Annelida	Polychaeta	Maldanidae	*Euclymene* sp.
Annelida	Polychaeta	Maldanidae	*Microclymene* sp.*
Annelida	Polychaeta	Maldanidae	*Praxillella praetermissa*
Annelida	Polychaeta	Maldanidae	*Rhodine loveni*
Annelida	Polychaeta	Nephtyidae	*Bipalponephtys cornuta**
Annelida	Polychaeta	Oweniidae	*Myriochele danielsseni*
Annelida	Polychaeta	Oweniidae	*Myriochele heeri*
Annelida	Polychaeta	Paraonidae	*Aricidea hartmanae*
Annelida	Polychaeta	Paraonidae	*Aricidea minuta*
Annelida	Polychaeta	Phyllodocidae	*Eteone flava*
Annelida	Polychaeta	Phyllodocidae	*Hypereteone* sp. *
Annelida	Polychaeta	Polynoidae	*Hartmania moorei*
Annelida	Polychaeta	Sabellidae	*Branchiomma* sp.
Annelida	Polychaeta	Sabellidae	*Chone duneri*

Phylum	Class/Order	Family	Taxa
Annelida	Polychaeta	Sabellidae	*Dialychone* sp. A
Annelida	Polychaeta	Sabellidae	*Dialychone* sp. B
Annelida	Polychaeta	Sabellidae	*Euchone rubrocincta*
Annelida	Polychaeta	Sabellidae	*Hypsicomus* sp.
Annelida	Polychaeta	Sabellidae	Sabellidae sp. H
Annelida	Polychaeta	Sabellidae	Sabellidae sp. I
Annelida	Polychaeta	Sabellidae	Sabellidae sp. J
Annelida	Polychaeta	Scalibregmatidae	*Polyphysia crassa*
Annelida	Polychaeta	Serpulidae	*Bushiella (Jugaria) quadrangularis*
Annelida	Polychaeta	Serpulidae	*Pileolaria* sp.
Annelida	Polychaeta	Serpulidae	Spirorbinae indet.*
Annelida	Polychaeta	Spionidae	*Dipolydora caulleryi*
Annelida	Polychaeta	Spionidae	*Dipolydora quadrilobata*
Annelida	Polychaeta	Spionidae	*Prionospio cirrifera*
Annelida	Polychaeta	Syllidae	*Syllides* sp.
Annelida	Polychaeta	Terebellidae	*Lanassa venusta*
Annelida	Polychaeta	Terebellidae	*Leaena abranchiata*
Annelida	Polychaeta	Terebellidae	*Neoamphitrite affinis*
Annelida	Polychaeta	Trichobranchidae	*Terebellides reishi*
Annelida	Polychaeta	Trochochaetidae	*Trochochaeta watsoni*
Arthropoda	Amphipoda	Amphilochidae	*Amphilochopsis hamatus*
Arthropoda	Amphipoda	Calliopiidae	Calliopiidae indet.
Arthropoda	Amphipoda	Dexaminidae	*Dexamine* sp.
Arthropoda	Amphipoda	Eusiridae	*Rhachotropis helleri*
Arthropoda	Amphipoda	Isaeidae	*Protomedeia* sp.*
Arthropoda	Amphipoda	Oedicerotidae	*Rostroculodes longirostris*
Arthropoda	Amphipoda	Podoceridae	*Dyopedos* sp.
Arthropoda	Amphipoda	Stenothoidae	*Hardametopa nasuta*
Arthropoda	Amphipoda	Tryphosidae	*Orchomene* sp.
Arthropoda	Amphipoda	Uristidae	*Menigrates obtusifrons*
Arthropoda	Amphipoda	Uristidae	*Onisimus barentsi* Group
Arthropoda	Cirripedia		Balanomorpha indet.*
Arthropoda	Cumacea	Diastylidae	*Diastylis alaskensis*
Arthropoda	Cumacea	Diastylidae	*Diastylis bradyi*
Arthropoda	Cumacea	Diastylidae	*Diastyloides biplicatus*
Arthropoda	Cumacea	Lampropidae	*Hemilamprops cristatus*
Arthropoda	Cumacea	Nannastacidae	*Campylaspis rubicunda*
Arthropoda	Cyclopoida		Cyclopoida indet.*
Arthropoda	Isopoda	Desmosomatidae	Desmosomatidae indet.
Arthropoda	Isopoda	Paramunnidae	*Pleurogonium rubicundum*

Phylum	Class/Order	Family	Taxa
Arthropoda	Ostracoda	Philomedidae	*Philomedes* sp.*
Arthropoda	Ostracoda	Trachyleberididae	*Robertsonites tuberculatus**
Arthropoda	Pycnogonida	Ammotheidae	*Achelia* sp.
Arthropoda	Pycnogonida	Numphonidae	*Nymphon* sp.
Arthropoda	Tanaidacea	Akanthophoreidae	*Akanthophoreus gracilis*
Arthropoda	Tanaidacea	Pseudotanaidae	*Pseudotanais* sp.*
Arthropoda	Tanaidacea	Typhlotanaidae	*Typhlotanais* sp.*
Arthropoda	Trombidiformes	Halacaridae	Halacaridae indet.*
Bryozoa	Ctenostomata		Ctenostomata indet.
Bryozoa	Ctenostomata	Vesiculariidae	*Bowerbankia* sp.
Bryozoa		Crisiidae	*Crisia* sp.
Bryozoa		Epistomiidae	*Synnotum* sp.
Bryozoa		Hippothoidae	*Celleporella hyalina**
Chordata	Ascidiacea	Styelidae	*Polycarpa fibrosa*
Chordata			Pisces indet.
Cnidaria	Anthozoa	Actiniidae	*Urticina* sp.*
Cnidaria	Anthozoa	Hormathiidae	*Hormathia digitata**
Cnidaria	Anthozoa	Parazoanthidae	*Parazoanthus* sp.
Cnidaria	Hydrozoa	Bougainvilliidae	Bougainvilliidae indet.
Cnidaria	Hydrozoa	Olindiidae	*Monobrachium parasitum*
Echinodermata	Holothuroidea	Myriotrochidae	*Myriotrochus rinkii*
Echinodermata	Holothuroidea	Psolidae	*Psolus phantapus*
Echinodermata	Molpadida		Molpadida indet.
Mollusca	Aplacophora		Aplacophora indet.
Mollusca	Bivaliva	Lyonsiidae	*Lyonsia arenosa*
Mollusca	Bivaliva	Margaritidae	*Margarites helicinus*
Mollusca	Bivaliva	Mytilidae	*Mytilus* sp.
Mollusca	Bivaliva	Propeamussiidae	*Similipecten greenlandicus*
Mollusca	Bivaliva	Tellinidae	*Macoma moesta*
Mollusca	Bivaliva	Thyasiridae	*Axinopsida serricata**
Mollusca	Bivaliva	Thyasiridae	*Thyasira* sp.*
Mollusca	Gastropoda	Buccinidae	*Colus* sp.
Mollusca	Gastropoda	Buccinidae	*Volutopsius norwegicus*
Mollusca	Gastropoda	Colloniidae	*Moelleria costulata**
Mollusca	Gastropoda	Cylichnidae	*Acteocina* sp.
Mollusca	Gastropoda	Cylichnidae	*Cylichna* sp.
Mollusca	Gastropoda	Lottiidae	Lottiidae indet.*
Mollusca	Gastropoda	Mangeliidae	*Propebela* sp.
Mollusca	Gastropoda	Rissoidae	Rissoidae indet.*
Mollusca	Gastropoda	Velutinidae	Velutinidae indet.

Phylum	Class/Order	Family	Taxa
Nemertea	Enopla	Tetrastemmatidae	*Tetrastemma* sp. *
Nemertea	Palaeonemertea	Cephalothricidae	*Cephalothrix* sp.
Platyhelminthes			Platyhelminthes indet.
Porifera	Calcarea		Calcarea indet.*
Sipuncula	Sipunculidea	Golfingiidae	*Golfingia* sp.
Sipuncula	Sipunculidea	Golfingiidae	*Nephasoma* sp.

Notes: taxa identified to the lowest practical taxonomic level; presence/absence for previous years taken from SEM 2017. *=taxa identified only at Ragged Island; indet.= indeterminate (taxa which could not be identified beyond the taxonomic level listed); sp.=species. High taxonomic levels presented only for taxa not previously identified to a lower taxonomic level (e.g., Crustacea indet. omitted due to large numbers of crustacean taxa identified to species level, Porifera indet. presented due to lack of sponges identified to a lower level).

Each newly observed taxa was cross-checked against a global database of marine invasive species (Molnar et al. 2008), as well as a known invasive species list within the National Risk Assessment for Introduction of Aquatic Nonindigenous Species to Canada By Ballast Water (Casas-Monroy et al. 2014). In addition to the global database, each new taxa was researched independently in the literature for their known habitats and distributions for signs of taxa that may be considered invasive or non-native to the Arctic region (Jirkov 2001; Roy et al. 2014; Palomares and Pauly 2017; Eol 2018; Read and Fauchald 2018; Sirenko et al. 2018; Worms 2018).

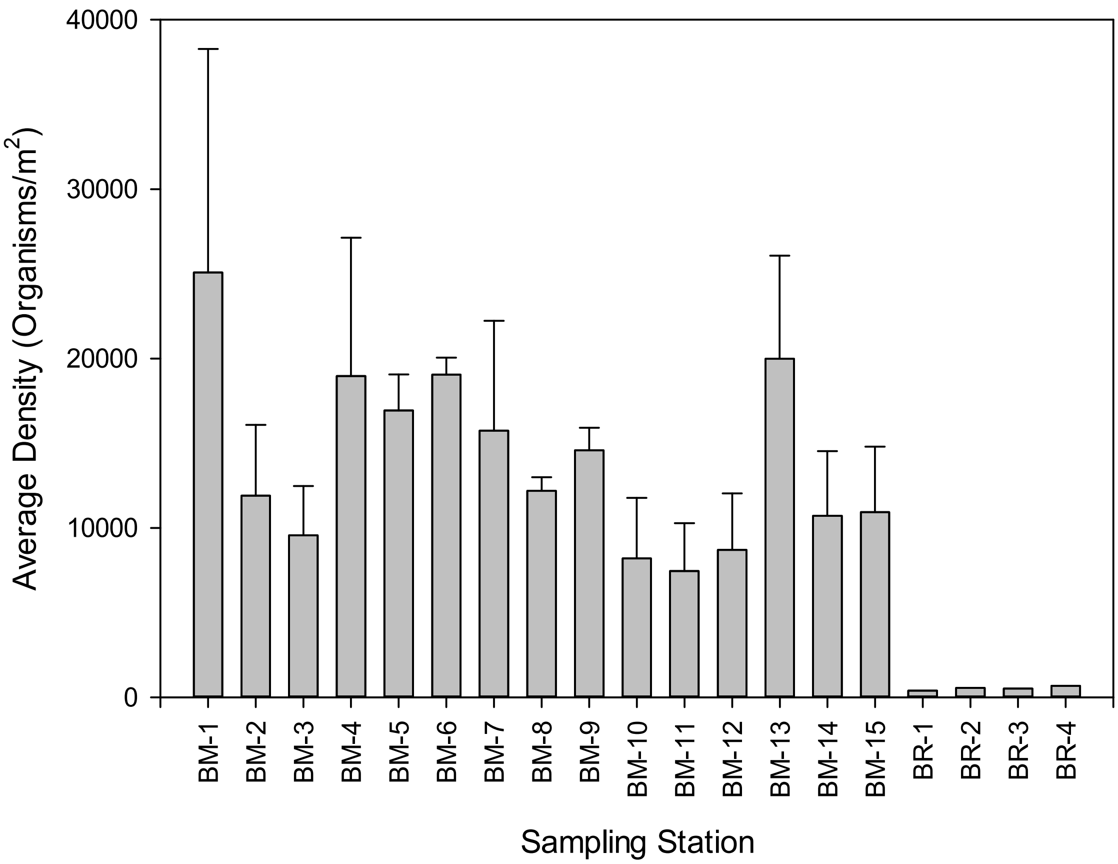
Most of the new taxa observed in 2017 are found in the Arctic; however, a few taxa have unknown northern limits, but are found as far north as Nova Scotia, the Norwegian Sea (Iceland, Norway), or southern Greenland.

One species, *Monocorophium insidiosum,* is listed as an invasive species in the global database of marine invasive species, and it was also noted that this species had been previously observed under a former unaccepted species name (*Corophium insidiosum*) during surveys in Milne Inlet in 2013 (SEM 2017a). *M. insidiosum* is an epifaunal tube-dwelling amphipod with a native distribution from the northern Atlantic Ocean (Palomares and Pauly 2017; NIMPIS 2018). It is widely dispersed by shipping (e.g., ballast water, hull biofouling) and can be entrained in ballast water as they swim into the water column to feed, and can survive living within sediment accumulated at the bottom of ballast water tanks (Fofonoff et al. 2018; NIMPIS 2018). *M. insidiosum* is now found along coastal areas in the southern Atlantic and in the Pacific Ocean. Its history is complex due to taxonomic uncertainties and confusion with similar species, and it is unclear if it is native to the northwestern Atlantic Ocean or if it was introduced from Europe. It is considered crypotogenic in the east coast of North America because dispersal by shipping could have happened before taxonomic recognition (Fofonoff et al. 2018; Fofonoff et al. 2003); however, it is not listed as an invasive species with potential to arrive by vessels to the Arctic (Casas-Monroy et al. 2014). A literature review did not yield any records of it occurring in the Arctic Ocean, but its northernmost Atlantic range is not clear. The species is documented as far north as the Bay of Fundy, New Brunswick, in the northwestern Atlantic Ocean, and Sweden and the UK in the northeastern Atlantic Ocean (Worms 2018; Trott 2004). In 2017, an estimated 60 specimens[18] were found in one replicate consisting of 6 composite grabs from station BM-7. Further analysis of the occurrence of *M. insidosium* within Milne Port and its relation to Project activities is provided in Section 4.2.

[18] 4 adults and 6 intermediate (has adult features but not of typical reproductive size) were counted in a 1/6th subsample and extrapolated to an estimate of 60 in the replicate.

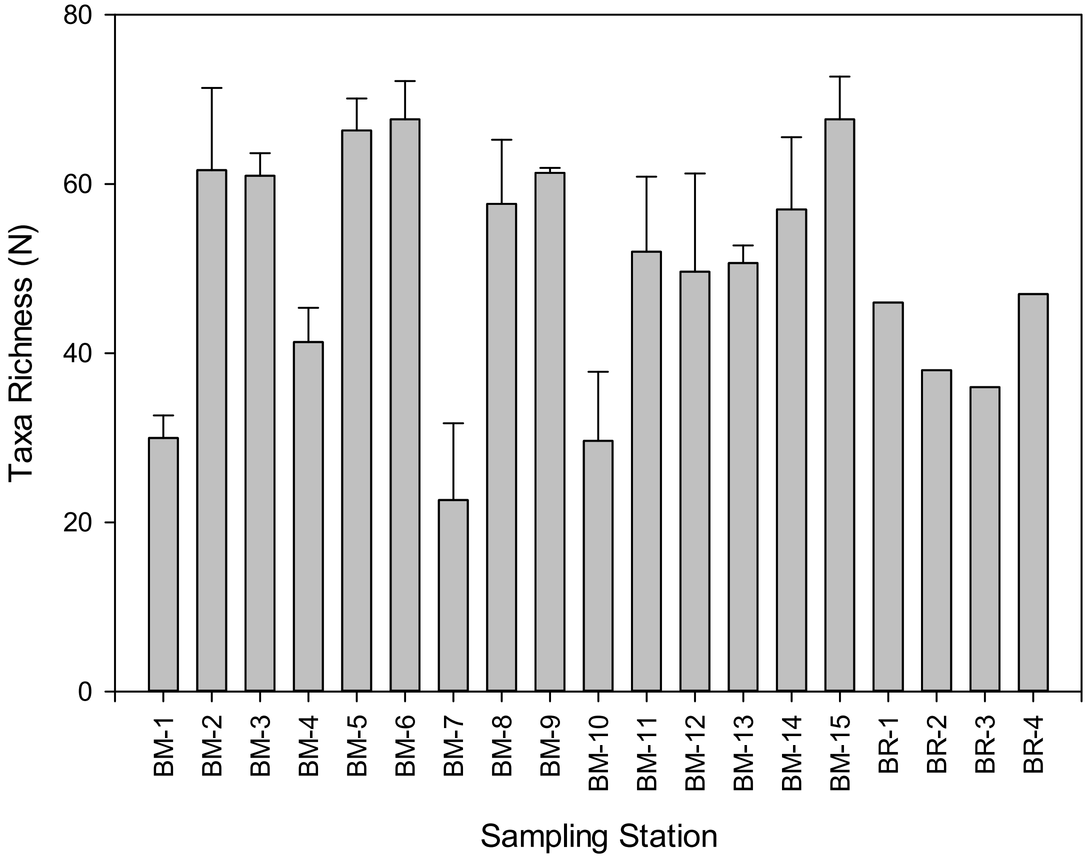
Since the occurrence of *M. insidiosum* in 2013 has not been discussed in previous SEM reports, the full taxa list for benthic invertebrates was checked against the global database of marine invasive species (Molnar et al. 2008) and to the list of AIS species that have the potential to arrive by vessels into Canada (Casas-Monroy et al. 2014). Another species in the cumulative taxa list for species previously observed at Milne Port is also listed as an invasive species in the global marine invasive database (Molnar et al. 2008); a bivalve, *Mya arenaria*. However, *M. arenaria* is a native clam from the northwestern Atlantic occurring between Labrador and Virginia, and it appears to also be native to the Arctic Ocean. Occurrences have been documented on southern Baffin Island, Hudson Strait, Newfoundland, east Greenland, Iceland, and the Beaufort Sea (Eol 2018; GBIF 2018). The clam is a broadcast spawner of planktonic larvae and can disperse by currents or be taken further afield by ballast water (Molnar et al. 2008). It currently has a widespread invasive distribution in the North Sea and European waters, and the northwest Pacific Ocean (Palomares and Pauly 2017; Cohen 2011). *M. arenaria* was observed in 2015 and 2016; a total of five individuals were found at 4 different benthic stations (SEM 2016; 2017a).

A total of 68,622 organisms were counted from samples collected at Milne Port and Ragged Island in 2017 (APPENDIX G-3). Summary statistics calculated for each sample, including total benthic infauna density, taxonomic richness, Shannon-Weiner Diversity (H’) and relative abundance of major taxonomic groups, are presented in Figure 37 to Figure 40. Density is lower at Ragged Island compared to Milne Inlet. Taxa richness is within the range reported from previous years 2013, 2015, and 2016, but Shannon-Weiner Diversity is higher due to a higher number of taxa found in 2017. The presence of numerous newly observed benthic infauna taxa in the 2017 samples was likely a result of the increased detection of smaller and rarer individuals. Shannon-Weiner diversity is within the range reported from Frobisher Bay on southern Baffin Island (approximately 2.6 ± 0.1 SE), but slightly higher at some stations compared to what has been reported from other areas within the Canadian Arctic. (Cusson et al. 2007). Polychaetes, crustaceans, and bivalves dominate the taxa composition at all stations, which is similar to baseline studies in 2010 and 2013 (SEM 2014).



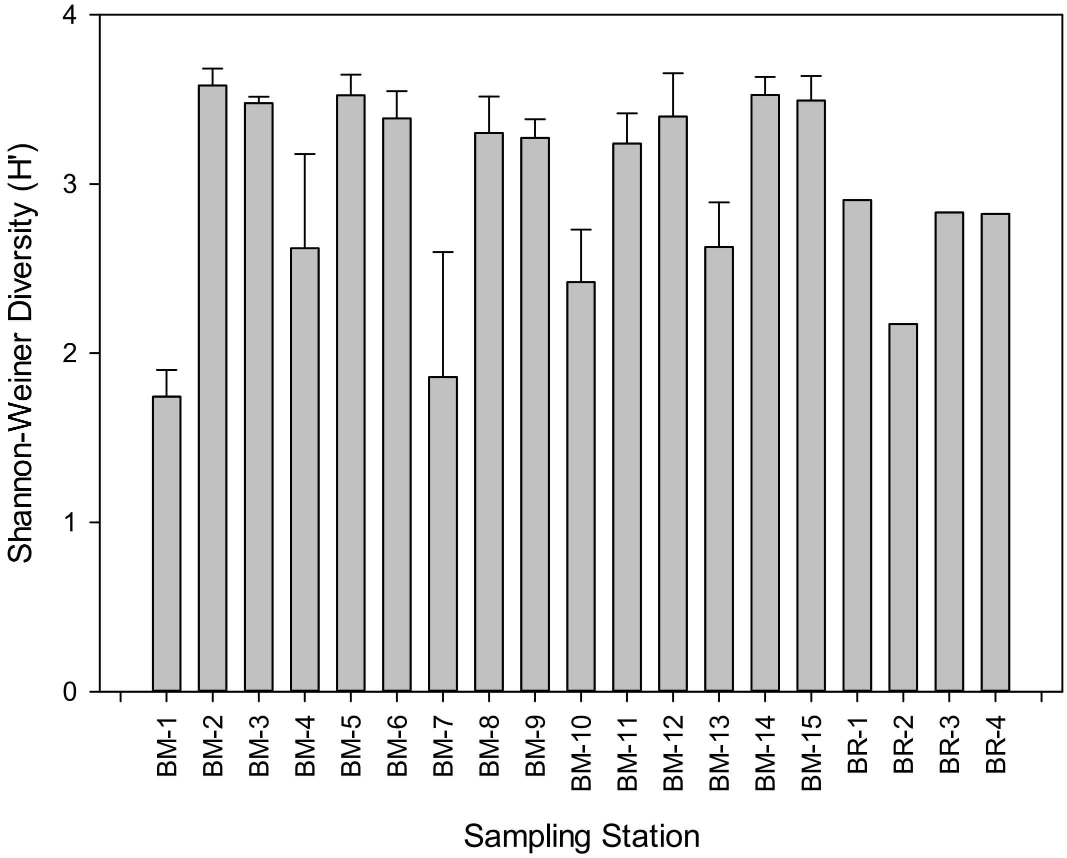
Note: Error bars represent one standard deviation

Figure 37: Average Benthic Infauna Density for Each Sampling Station in Milne Inlet, 2017



Note: Error bars represent one standard deviation

Figure 38: Benthic Infauna Taxa Richness for Each Sampling Station in Milne Inlet and Ragged Island, 2017



Note: Error bars represent one standard deviation

Figure 39: Benthic Infauna Diversity (H') for Each Sampling Station in Milne Inlet and Ragged Island, 2017

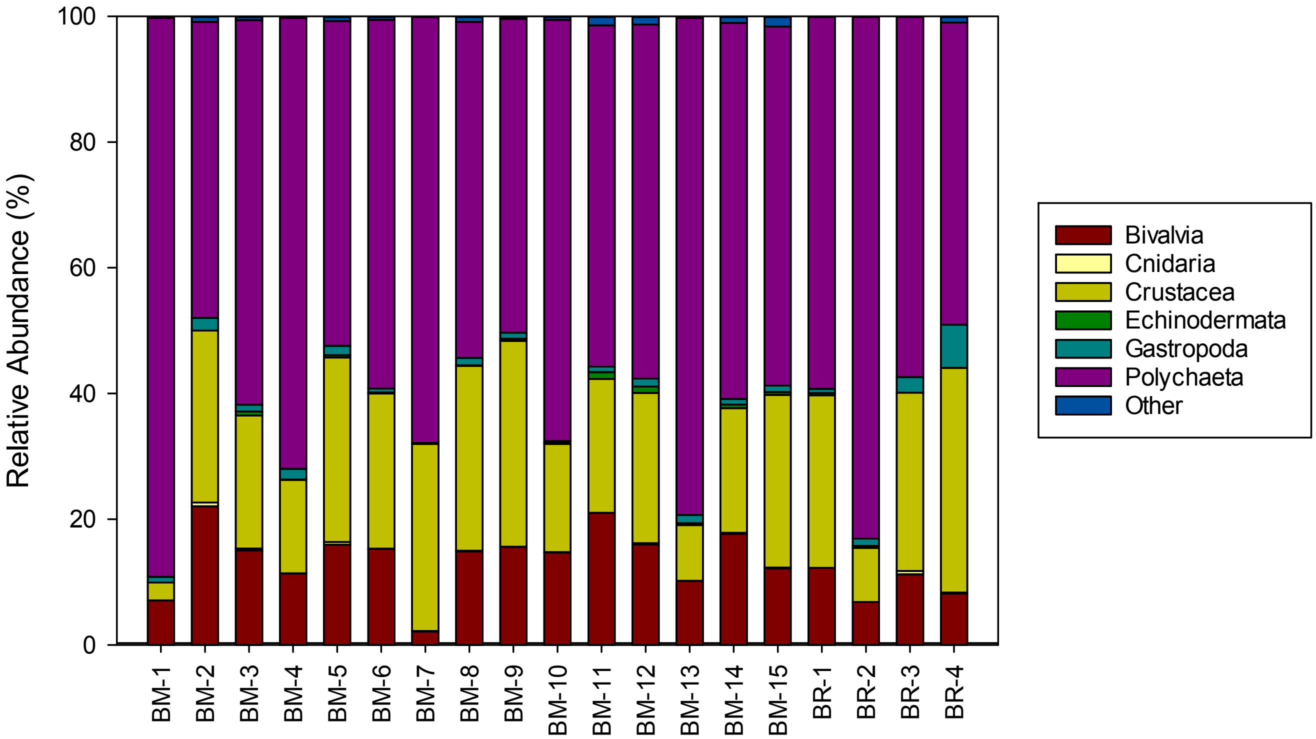


Figure 40: Relative Abundance of Major Benthic Infauna Groups in Milne Inlet and Ragged Island, 2017

A taxa accumulation curve (Figure 41) was calculated for samples collected in 2017 in Milne Inlet and at Ragged Island to compare sampling effort with previous AIS monitoring surveys and to provide an estimate of the effort required to fully characterize the benthic infauna community. The taxa accumulation curve for the 2017 AIS sampling effort reached an asymptote at 46 samples, after which no new taxa were identified in any additional samples up to a total of 49 samples. AIS sampling effort in 2017 was sufficient to fully characterize the benthic infauna community. The asymptote was reached at 234 taxa for 2017, which is higher than any previous sampling years (approximately 180 taxa in 2013, 170 in 2015, and 210 taxa in 2016) (Figure 3.41 in SEM 2017a). This is due to an increased number of new taxa observed this year compared to previous years as a result of a greater detection probability of small and rare taxa through the sorting methods applied by Biologica.

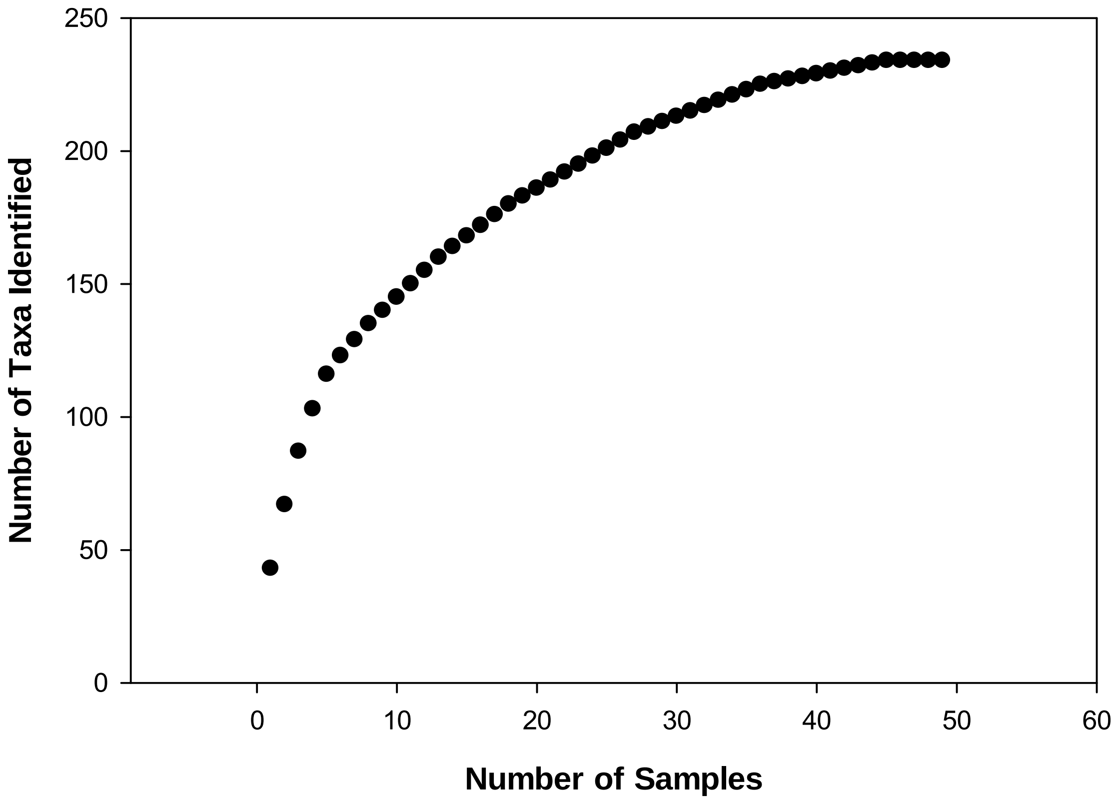


Figure 41: Taxa Accumulation Curve for Benthic Infauna, Milne Inlet and Ragged Island, 2017

The non-parametric species estimator Chao 2 was calculated for 2017 following the methods used in SEM 2017a. For samples collected in 2017, the Chao 2 calculation provided an estimate of 324 taxa expected which exceeded the observed number of taxa (235) by 38% (Table 45). The discrepancy between the observed and expected number of benthic infauna taxa in 2017 is within the range in previous AIS monitoring years.

Table 45: Chao 2 Species Estimates for Benthic Infauna Samples Collected in Milne Inlet (2013-2017)

Year	S_{obs}	Q_1	Q_2	S_2	% S_2 exceeds S_{obs}
2013	188	70	27	278.7	48
2015	181	56	25	246.3	36
2016	218	59	38	263.8	21
2017	236	92	47	324.0	38

Notes: Values for 2014 through 2016 taken from SEM 2017a. S_{obs}= # of taxa observed; Q_1= # of species occurring in only one sample; Q_2= # of species occurring in two samples; S_{obs}= # of taxa expected to be observed based on Chao 2 estimate

3.2.3 Macroflora and Benthic Epifauna

A total of six distinct macroflora taxa were observed during AIS underwater video surveys in Milne Port in 2017 (Table 46). Each of the six observed taxa was observed during at least one previous AIS monitoring survey (SEM 2017a).

Table 46: Macroflora from AIS Video Surveys in Milne Port (2014 to 2017)

Taxa	Common Name	Sampling Year			
		2014	2015	2016	2017
Agarum cribrosum	Sea colander	x	x	x	x
Chlorophyta indet.	Green algae	x	x		x
Chondrus crispus	Irish moss	x	x	x	x
Desmarestia sp.	Sour weed	x	x	x	x
Fucus sp.	Wrack	x		x	x
Laminaria sp.	Brown bladed kelp	x	x	x	x

Notes: taxa identifed to the lowest practical taxonomic level; presence/absence for previous years taken from SEM 2015, 2016, 2017a.

A total of twenty seven distinct epifauna taxa were recorded from AIS underwater video surveys and Fukui trap samples in Milne Port in 2017 (Table 47). Five of the twenty-seven taxa had not been previously recorded during AIS surveys in 2014 through 2016 (SEM 2017a). Each newly observed taxa was cross-checked against a global database of marine invasive species and none of the taxa were identified as a globally-recognized invasive species (Molnar et al. 2008). The five new taxa in 2017 included sand lance of the genus *Ammodytes,* which was also caught in zooplankton samples (see Section 3.2.1), Iceland scallop (*Chlamys islandica*), an unidentified sea spider (*Nymphon* sp.), a species of tunicate (*Polycarpa pomaria*), and an unidentified marine amphipod (*Anonyx* sp.) (Table 48).

Table 47: Benthic Epifauna from Fukui Traps and AIS Video Surveys in Milne Port (2010-2017)

Taxa	Sampling Year					
	2010	2013	2014	2015	2016	2017
Actiniaria indet.	x	x	x	x	x	x
Cerianthidae indet.	x					
Ammodytes sp.						x
Anonyx sp.						x
Arctica islandia					x	x
Asteroidea indet.		x	x	x	x	x
Bourgueticrininia sp.					x	
Ophiura sarsi		x			x	x
Chlamys islandica						x
Crossaster pappuosus			x	x	x	x
Ctenodiscus crispatus			x		x	x
Bivalvia indet.	x		x	x	x	x
Hiatella arctica		x				x
Macoma calcarea		x				
Buccinum undatum		x	x	x	x	x
Clione limnacina		x	x		x	x
Cnidaria indet.		x		x	x	x
Ctenophora indet.			x	x	x	x
Cyrtodaria siliqua					x	
Echinocardium cordatum				x	x	x
Echinoidea indet.			x	x	x	x
Holothuroidea indet.	x	x	x		x	x
Limacina helicina		x	x	x	x	x
Mytilidae indet.	x	x		x	x	x
Musculus laevigatus		x				
Nymphon sp.						x
Ophiuridea indet.	x	x	x	x	x	x
Ennucula tenuis		x				
Pandalus sp.		x		x	x	x
Panalus montagui		x				
Pecten albicans	x			x	x	
Mya truncate		x				
Polychaetea indet.		x		x	x	x
Polycarpa pomaria						x
Strongylocentrotus droebachiensis	x	x	x	x	x	x

Taxa	Sampling Year					
	2010	2013	2014	2015	2016	2017
Sabellidae indet.					x	x
Siliqua sp.					x	
Weyprechtia pinguis		x	x	x		
Bryozoa indet.	x					

Notes: taxa identifed to the lowest practical taxonomic level; presence/absence for previous years taken from SEM 2015, 2016, 2017a. indet.= indeterminate (taxa which could not be identified beyond the taxonomic level listed); sp.=species. High taxonomic levels presented only for taxa not previously identified to a lower taxonomic level.

Table 48: Newly Observed Benthic Epifauna Taxa Identified in Milne Port in 2017

Taxa	Common Name	Description
Ammodytes sp.	unidentified sand lance	Some species of sand lance are known to inhabit the Arctic region (*Ammodytes spp.*), with one adult captured during fish surveys in Milne Port in 2017 (see Section 3.1.4).
Anonyx sp.	marine amphipod	Marine amphipod species distributed throughout the North Pacific and North Atlantic Oceans.
Chlamys islandica	Iceland scallop	Species of bivalve mollusc native to the North Atlantic, distributed in the northwest Atlantic between Greenland and Massachusetts.
Nymphon sp.	sea spider	Genus of sea spiders with >50 species, global distribution.
Polycarpa pomaria	tunicate	Species of tunicate native to the North Atlantic Ocean.

3.2.4 Fish and Mobile Epifauna

No aquatic invasive fish or mobile epifauna taxa were observed during the AIS surveys. Fish and mobile epifauna collected during the AIS surveys and sent for taxonomic analysis are provided in Table 49. All taxa listed have been previously identified and described in Sections 3.2.1, 3.2.2 and 3.2.3 or in previous AIS surveys in Milne Inlet.

Table 49: Fish and Mobile Epifauna Identified in Milne Port in 2017

Taxa	Common Name
Pista maculata	marine polychaete worm species
Ophiura sarsii	brittle star
Hiatella arctica	wrinkled rock-borer
Ammodytes sp.	unidentified sand lance
Anonyx sp.	marine amphipod
Buccinidae indet.	sea snail
Chlamys islandica	Iceland scallop
Nymphon sp.	sea spider
Polycarpa pomaria	tunicate

3.2.5 Encrusting Epifauna

Settlement baskets deployed in 2016 by SEM were retrieved by Golder in September 2017 and examined for signs of colonization by encrusting epifauna. The cobble substrate in the settlement baskets exhibited limited evidence of colonization. No organisms were available for processing or taxonomic analysis. Although the majority of the rocks were bare, several rocks showed limited colonization by a white encrusting epifauna that could not be taxonomically identified (Photo 1). Previous surveys conducted by SEM indicated that the process of biological colonization was expected to be slow (occurring over several years) (SEM 2017a). As such, the baskets were redeployed for recovery in 2018. Similar observations were reported by SEM in 2015 for settlement baskets deployed in 2014, in which inadequate epifaunal growth was available on the settlement substrate to allow for taxonomic analysis. The baskets were retrieved again in 2016 at which point colonization was sufficient for sample collection.

Photo 1: Settlement basket retrieved from west side of ore dock in 2017.

4.0 DISCUSSION

4.1 MEEMP

4.1.1 Water Quality

4.1.1.1 Water Samples

Monitoring of water quality at Milne Port was added to the MEEMP in 2015. Since 2015, samples have been collected near the site drainage discharge location and at three other nearby locations over five separate sampling events in August and September. Due to the shallow water depths at the sampling locations, only water samples near the surface were collected. During the 2017 sampling program, observations were made by the field team that site drainage may not have been discharging directly into the ocean, but instead could have been permeating into the ground upland.

All water quality parameters measured were within ranges typical of background conditions, except for one sample collected at the Source sampling location on 10 September 2017. In this sample, TSS and turbidity exceeded the clear flow long term CCME WQG and aluminum and iron concentrations exceeded concentrations in any other sample at least by factors of two and five, respectively. During the 10 September sampling event, waves were stirring up sediment along the shore including near the Source sampling location. Higher TSS and turbidity levels and associated total metals observed as the Source sampling location during this event were likely due to sediment being suspended in the water column, and not from the site discharge itself.

Nitrates, total arsenic, cadmium, chromium, mercury, and silver in 2017 were below CCME WQG. PAHs were below the detection limit for all samples during all sampling events in 2017, 2016 and 2015. Naphthalene was also below the CCME WQG for all samples in 2017. Naphthalene was not tested for in 2016 and 2015.

Fecal coliform bacteria measurements were added to the testing in one sampling event in 2017. Levels ranged from 1 to 2 CFU/100 mL. There are no CCME WQG for fecal coliform in marine environments.

4.1.2 Sediment Quality

Percent fines and iron concentrations in sediments were used as indicators for potential Project-related environmental effects. Analysis of sediment quality showed significant differences in composition over time, particularly along the West and East transects; however, these differences could not always be conclusively interpreted as indicators of Project-related effects. For example, along the West Transect, no differences were observed in percent fines or iron concentrations near the dock, but differences were observed at further distances (500 m, 1,000 m, and 1,500 m). Percent fines at the 500, 1,000 and 1,500 m distances on the West Transect significantly increased from 2014 to 2017, although measurements in 2015 and 2016 were not significantly different from either 2014 or 2017. Iron concentrations at the 500, 1,000 and 1,500 m distances on the West Transect significantly increased from 2015 to 2017, although measurements in 2017 were not significantly different from baseline iron concentrations recorded in 2014.

On the East Transect, for sampling stations near the ore dock and at the 500 m distance, percent fines and iron concentrations in 2014 and 2015 decreased in 2016 and significantly increased in 2017. No significant changes were observed at the 1,000 or 1,500 m distances on the East transect.

There were no significant differences in sediment composition along the other two transects, except at the 500-m distance along the North Transect where iron concentrations increased from 2015 to 2017.

Along the West Transect, an increase in the content of fines could be due to propeller scour and re-deposition of sediment further away due to vessel orientation at the dock. Observed changes in sediment composition along the West Transect, however, could also be caused by alluvial deposition from Philips Creek. Along the East Transect, changes in sediment composition near the dock may be a result of ore dust deposition or from changes in local hydrodynamics caused by the presence of the dock.

4.1.3 Macroflora and Benthic Epifauna

Changes in macroflora percent cover and epifauna abundance along the radial transects were used as indicators of potential effects on benthic habitat following the methods outlined in SEM 2017a. Indicators were used to assess potential effects on benthic habitat as a result of sediment deposition or re-distribution (e.g., iron ore dust deposition, sediment redistribution by propeller wash).

Several significant differences were observed between macroflora percent cover in 2017 and that of previous years. However, percent cover was generally variable between years and no identifiable trend is currently present along the radial transects. Both significant decreases and increases in percent cover were observed between 2016 and 2017 in a comparison of binned 250 m segments of the radial transects. Each of the significant decreases observed between 2016 and 2017 followed a significant increase in percent cover between 2015 and 2016 along the same 250 m segment. The largest change in percent cover was observed between 2015 and 2016 where many of the segments along the East and West Transects showed a significant decrease in percent cover. Percent cover in each of these segments in 2017 showed either an increase from 2016 or a non-significant result, suggesting that a potential trend of decreasing macroflora cover from 2015 did not continue in 2017. Overall, fewer significant decreases were observed between 2016 and 2017 than between 2015 and 2016 and percent cover of macroflora, while variable between years, shows no identifiable trend of decreasing as a result of potential sediment deposition or redistribution.

As with macroflora, several significant differences were observed between epifauna abundance in 2017 and that of previous years but with one observable trend. Significant decreases in epifauna abundance occurred between 2016 and 2017 within the first 500 m of the West Transect and within portions of the first 1,250 m of the East Transect. Changes in abundance along the East Transect were not reflective of an overall trend, as abundance had significantly increased between 2015 and 2016 and abundance in 2017 was generally comparable with that of 2015. On the West Transect, epifauna abundance was significantly lower in 2017 closer to the ore dock than in all previous years, and higher along the westernmost portion adjacent to the outflow of Phillips Creek. Overall abundance was similar in 2017 to previous years but a change in epifauna distribution may have occurred between 2016 and 2017. Changes in sediment composition showed a potential redistribution of fine sediments from areas near the ore dock to further along the transect, potentially as a result of propeller scour or from deposition of sediments from Phillips Creek. Given that the epifaunal community in this area was dominated by brittle stars and sea urchins, both mobile taxa, it is possible that epifauna have simply re-distributed further along the West Transect in 2017 in response to changes in sediment composition. In general, the relative abundance of epifauna was similar in all areas between 2017 and 2016, suggesting that while changes in distribution may have occurred along the West Transect, the overall community composition has remained unchanged from previous years.

Overall, the results of statistical analyses of macroflora percent cover and epifauna abundance must be interpreted cautiously as data within some of the 250 m distance bins is limited by the replicate segment analysis approach utilized in 2014 to 2016. Far fewer data points from previous years were available for comparison in many segments of the transects. For example, analysis of video from the West Transect began at the 260 m mark in 2014, at the 205 m mark in 2015, at the 75 m mark in 2016, and at the 0 m mark in 2017. Lower epifauna abundance recorded in the 0 to 250 m range in 2017 could be attributable to a change in distribution or to a lack of comparable data collected in previous years. Further, replicate transects conducted in previous years were in some cases far enough apart that confounding effects from differences in depth between replicate transects may have created additional variability in the dataset. Additional studies conducted in future monitoring years should help to remove the influence of potentially confounding effects from these data gaps and potentially non-representative replicate transects.

4.1.4 Fish Surveys

The fish survey was expanded from previous efforts of gill netting and Fukui traps to include two additional fishing methods; angling (trolling and jigging) and minnow traps. The objective of including additional sampling methods was to: 1) capture additional fish species that were not otherwise known to occur in the Milne Port area, and 2) identify additional non-lethal methods that may be more efficient at capturing fish. Trolling was not a suitable means for collecting fish as only one individual was captured. However, the one individual was an adult male shorthorn sculpin with spawning colouration, which is important to note as the area may be utilized as a mating and spawning area for this species. Jigging was successful with 32 fish captured and comprised 27% of the total fish caught during the survey. None of the fish captured during jigging were injured and all were released in good condition. Minnow traps were set at the ore dock and positioned on the subtidal constructed riprap toe of the dock structure. No fish were captured in the minnow traps regardless of the high fishing effort (i.e., total soak time). Similar to previous surveys, the gill net continued to be an effective means of fish collection with three fish species captured comprising 32% of total fish caught. In addition to traditional fishing stations surveyed in 2016, gill net stations were added to the east side of the ore dock in 2017, which were successful in fish capture.

Total fish counts were lower in 2017 compared to 2016, which may be due to seasonality. The 2017 fishing efforts started approximately two weeks later in the summer season in an effort to overlap with peak Arctic char occurrence in the Milne Port area. Seagoing Arctic char are anadromous, undertaking migrations to forage in the marine environment prior to returning to freshwater to spawn. Since Arctic char are a migratory fish, conducting surveys throughout the summer season may be more conducive for collection of this species. In 2016, Arctic char were the dominant species captured encompassing 80% of the total catch, compared to 2017 with 19% of the total catch. In comparison, sculpin species comprised 19% of the total fish catch in 2016 and 80% of the total fish catch in 2017. This difference in relative abundance of Arctic char and sculpin capture may also be attributed to the introduction of jigging as a fishing method in 2017 that was successful with sculpin capture but not with Arctic char.

It was determined in 2016 that the population size of the local sculpin species could not be determined and therefore targeted lethal collection for body burden analysis was not recommended (SEM 2017b). Thus tissue collection was reliant on incidental mortalities, which were almost entirely Arctic char. Since Arctic char is a migratory species, exposure to environmental contaminants associated with the Project are likely lower than expected for resident species, resulting in lower body burdens. However, this approach was the preferred method given the unknown size of the resident sculpin population.

Stomach content analysis of Arctic char revealed prey items including larval fish, planktonic Amphipoda, and epibenthic Mysidacea, all taxa identified during the 2017 zooplankton sampling program.

Sandlance were recorded in the LSA during the 2017 sampling program (never previously identified as part of the MEEMP). Sand lance are a schooling benthic demersal fish that occur in coastal inshore waters. When not schooling, they burrow into sandy bottoms several inches deep (Gilman 1994). Sand lance are an important forage fish for marine birds, mammals and fish. Only one individual of sand lance was captured in the Fukui trap and was sent for positive identification to a laboratory. Six species of sand lance are known to occur in Pacific, Atlantic and Arctic waters with some species such as the *Ammodytes Americanus* and *A. dubius* species overlapping in distribution. The meristic characteristics, such as number of fin, anal and dorsal rays, have broad ranges and are difficult to discern without genetics/ DNA testing. In addition to the adult specimen captured, larval sand lance (*Ammodytes* sp.) were also collected in the zooplankton samples in the Milne Port area, indicating successful spawning is likely occurring in Milne Inlet.

4.2 Aquatic Invasive Species (AIS)

AIS surveys were completed for the fourth year since program inception in 2014, and the third year since commencement of shipping activities. The 2017 survey results added to the previously established AIS taxa list for zooplankton, benthic infauna, epifauna, macroflora, and fish in Milne Port. Additional AIS surveys for zooplankton and benthic infauna were conducted at Ragged Island to screen for potential AIS in existing vessel anchorage areas.

In general, field methods were similar or identical to those utilized in the 2014 to 2016 monitoring surveys conducted by SEM (SEM 2017a). However, the oblique zooplankton sampling was modified by conducting faster tows to target faster moving zooplankton taxa (e.g., fish larvae, larger crustaceans). The number of zooplankton samples collected and the number of benthic infauna sample locations were also increased to expand the volume and spatial distribution of sample collection. The net result was an increase in total number of identified taxa compared to previous years.

No new zooplankton taxa were identified as invasive to the Arctic region. A literature review of known geographic distributions for each taxa confirmed that each new taxa was either known to occur in the Arctic or identified at a higher taxonomic level (e.g., genus, family, class), which contained species known to occur in the Arctic. It is possible that some specimens, which could not be identified to species level from the samples collected in 2017 or those with poorly defined species ranges, could in fact be invasive or non-native to the Arctic region. However, the literature for these species in the Arctic is limited and not adequate at this time to establish accurate species ranges. Taxa collected during the AIS monitoring surveys should continue be compared on an annual basis to the best available literature (i.e., check for additions to the Canadian and global invasive species databases) to confirm the geographic ranges of known invasive species.

No new benthic infauna taxa were identified as invasive to the Arctic region, however, one species observed in previous years is listed as invasive in the global database of invasive species (Molnar et al. 2008). A tube-dwelling amphipod, *Monocorophium insidosium*, was observed in 2013 during baseline surveys and in 2017 in low abundance. The best available literature is inconclusive as to whether this species is invasive to the northeastern Atlantic or if its occurrence in Milne Port falls within the northern range of its natural geographic distribution. This species is considered crypotogenic in the east coast of North America because dispersal by shipping may have happened before taxonomic recognition (Fofonoff et al. 2018, Fofonoff et al. 2003). *M. insidosium* is not currently listed as an invasive species with potential to arrive by vessels to the Arctic according to the National Risk Assessment for Introduction of Aquatic Nonindigenous Species to Canada by Ballast Water (Casas-Monroy et al. 2014)). Further, this species was identified during surveys in 2013, meaning it is unlikely that Project shipping activities were the initial vector of its arrival in Milne Port. As a result, no additional mitigation measures are recommended in response to the identification of *M. insidosium* within Milne Port at this time. Future monitoring studies should continue to consult the best available literature to confirm the geographic ranges of *M. insidosium* and other identified invasive species.

None of the macroflora, benthic epifauna, or fish taxa observed during the AIS surveys were identified to be invasive. Encrusting epifauna samples were not possible to collect from settlement baskets deployed in 2016 by SEM in 2017 due to limited colonization and growth by epifauna. The baskets were redeployed for recovery in 2018. SEM had previously reported that biological colonization is slow in the area with taxonomic sampling only possible after the baskets have been deployed for at least two years.

5.0 CONCLUSIONS AND RECOMMENDATIONS

MEEMP:

- Water quality:
  - All water quality samples collected in 2017 were below the applicable water quality guidelines for all tested parameters. Concentrations of iron and aluminum were above detection limits; however, these parameters do not have established limits in the CCME guidelines. Temporal and spatial variability were generally low among water samples collected throughout the water quality program. Water sampling should be repeated in 2018 following the same procedures outlined in this report.
- Sediment Quality:
  - There is evidence of a possible accumulation of fines and iron concentrations in sediments near the Project facilities. On the East Transect, percent fines and iron concentrations were shown to increase significantly in the proximity of the dock and at the 500 m sampling station. These 'nearshore' changes in sediment composition in proximity to the ore dock may represent ore dust deposition or may reflect substrate shifts due changes in local hydrodynamic conditions caused by the presence of the dock. On the West Transect, no differences were observed in percent fines or iron concentrations near the dock, but significant increases were observed at the far-field sampling locations (500 m, 1,000 m, and 1,500 m sampling stations). Percent fines at these stations increased significantly from 2014 to 2017, although measurements in 2015 and 2016 were not significantly different from either 2014 or 2017. Iron concentrations at these stations also increased significantly from 2015 to 2017, although measurements in 2017 were not significantly different from 2014 baseline conditions. Changes in sediment composition on the West Transect may be related to alluvial depositions from Philips Creek.
  - Sediment sampling should continue in 2018 to evaluate if the temporal trends found in sediment composition (2014 to 2017) will continue in the same direction and to assess whether these changes are caused by Project-related effects or natural variability of the marine environment.
- Macroflora and Epifauna:
  - Previous surveys have reiterated the difficulty in accurately replicating the position of underwater video transects between replicate transects and between subsequent survey years. The same challenges were encountered in 2017; however, analysis of the full transect length in 2017 (rather than analyzing replicate segments of each transect as done in previous years) removed some of the variability reported in previous years. Despite this, a large amount of variability still remains in each yearly dataset – which makes it difficult to interpret inter-annual changes and assess potential linkages to Project activities. As a result, it is recommended that future EEM biological sampling focus on benthic infauna rather than epifauna and macroflora, Benthic infaunal sampling should be conducted in conjunction with sediment sampling along the radial transects following established methods outlined in Environment Canada's Metal Mining EEM Guidance Document (Environment Canada 2012). As with epifauna, community composition and distribution of benthic infauna can be used as an indicator of potential effects from increased sedimentation or contamination from Project activities, should any be present within sediments in Milne Port. Sampling for benthic infauna along the radial transects would provide a more reliable dataset using a more repeatable sampling method than underwater video surveys with less variability created by the inherent difficulty in replicating surveys between years.

- Samples collected from benthic infauna samples could also be submitted for monitoring of the health and condition of specific taxa, and/or analysis of toxicity to determine whether contaminants, if present, result in epifaunal uptake in the Milne Port area.

- Fish:
  - Less fish were caught during the 2017 field season despite a greater sampling effort. This may have been due to timing of sampling, as the fish collection program in 2017 started two weeks later than the 2016 sampling program. For 2018, it is recommended that fish sampling be conducted earlier and sampling be spread throughout the duration of the MEEMP Program.
  - Body burden analysis is recommended to continue pending incidental fish mortalities. Sculpin and Arctic char are the recommended species for body burden analysis.
  - In 2018, it is recommended that unidentified fish and larval fish captured during zooplankton hauls be sent for DNA barcoding for positive species identification.
  - In 2018, monitoring should continue to be conducted to provide general characterization of the fish community, including Arctic char, in the Milne Port area. Fish community monitoring should include monitoring for the relative abundance and distribution of species, catch per unit of effort, measurements of length/weight distribution of each fish species, and analysis of age distribution, body burden and diet of incidental fish mortalities.
  - Angling was an effective means for catching sculpin in the Milne Port area and is recommended to be continued for subsequent surveys.
  - Additional gill net surveys were conducted on the west side of the ore dock in 2017 and are recommended for future surveys as fish capture was successful in this area.

AIS Monitoring Program:

- Due to unmanageable safety concerns and administrative restrictions, no dive program was conducted in 2017 and no dive program is proposed for 2018. Instead, an alternative monitoring tool for hull biofouling, such as underwater video mounted on a remotely operated underwater vehicle (ROV), is being considered for the 2018 summer program. This option will be further discussed with the MEWG during the spring 2018 meeting.
- Sampling at Ragged Island was limited by weather conditions (high winds and heavy chop) during 2017, which impeded regular sampling at this location. The AIS monitoring program should be shifted forward by a few weeks (earlier in the season) to allow for increased sampling at Ragged Island, including more stations and replicates per station, to obtain a more representative dataset for AIS presence in this area.
- Future studies should continue to monitor for the presence of *Monocorophium insidiosum* in Milne Port. Effort should be made to review relevant literature on an annual basis to confirm whether new information is available with respect to the distribution and range of this species.

6.0 CLOSURE

We trust this report meets your current needs. Should you have any questions, please contact the undersigned at 1-250-881-7372.

GOLDER ASSOCIATES LTD.

Arman Ospan, MSc, RPBio
Marine Biologist

John Sherrin, MSc
Marine Biologist

Erika Grebeldinger, MSc, RPBio
Fisheries Biologist

Sima Usvyatsov, PhD
Biological Scientist

Virginia Lawrence, BSc, RPBio
Biologist Senior

Derek Nishimura, MSc, RPBio
Biologist

Shawn Redden, RPBio
Associate, Senior Biologist

AO/EG/KW/JS/VL/DN/SR/lih

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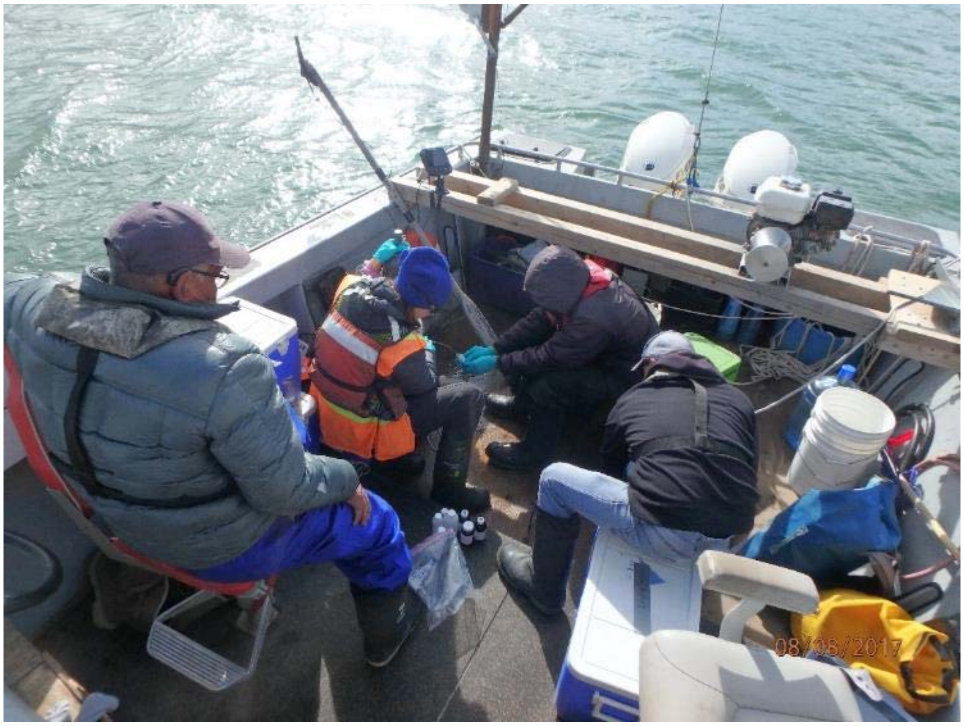
APPENDIX A

Photographs

Photograph 1: Milne Port ore dock, photograph taken on 7 August 2017, looking northeast.

Photograph 2: West beach, west of Milne Port ore dock (field vessel anchorage location), looking northwest. Photograph taken on 14 August 2017.



Photograph 3: Field team processing water samples on 8 August 2017.

Photograph 4: Collecting water samples using Niskin bottle for water quality analysis on 22 August 2017.

Photograph 5: Open grab sampler, petite ponar, after sediment collection on 11 August 2017.

Photograph 6: Collecting terra core sediment sample from station SC-3 on 12 August 2017.

Photograph 7: Collecting sediment sample from station SN-1 on 26 August 2017.

Photograph 8: Stirring sediment to homogenize sample from station SN-4 on 12 August 2017.

Photograph 9: Fukui trap deployment in Milne Port, 26 August 2017.

Photograph 10: Gill net sampling at the west beach, 27 August 2017.

Photograph 11: Arctic char caught in gill net set (GN01) on 26 August 2017.

Photograph 12: Arctic sculpin caught by jigging (AN04) on 1 September 2017.

Photograph 13: Sand lance caught in Fukui trap (FT15) on 1 September 2017.

Photograph 14: Fourhorn sculpin caught in gill net (GN02) on 26 August 2017.

Photograph 15: Incidental invertebrate catch in Fukui trap at station FT-18 on 3 September 2017.

Photograph 16: Removing invertebrates with forceps from sieve stand at station BM-3 on 18 August 2017.

Photograph 17: A sea spider (Nymphon sp.) collected during benthic grab sample at station BM-11 on 18 August 2017.

Photograph 18: Fish Doctor (Gymnelis viridis) collected during benthic grab sample at station BM-4 on 21 August 2017.

Photograph 19: Benthic sample from BM-4 placed in Rubbermaid tote prior to sieving on 21 August 2017.

Photograph 20: Benthic sample in sieving tray from BM-11 with urchins (Strongylocentrotus droebachiensis) on 16 August 2017.

Photograph 21: Benthic sample in sieving tray from BM-1 with peanut worm (Priapulus caudatus), 18 August 2017.

Photograph 22: Processing benthic sample in sieving tray from station BM-7 on 21 August 2017.

Photograph 23: Zooplankton net set-up prior to deployment on 7 August 2017.

Photograph 24: Processing zooplankton samples collected in the Milne Port area on 7 August 2017.

Photograph 25: Fish larvae (yellow arrow) collected during zooplankton haul on 28 August 2017.

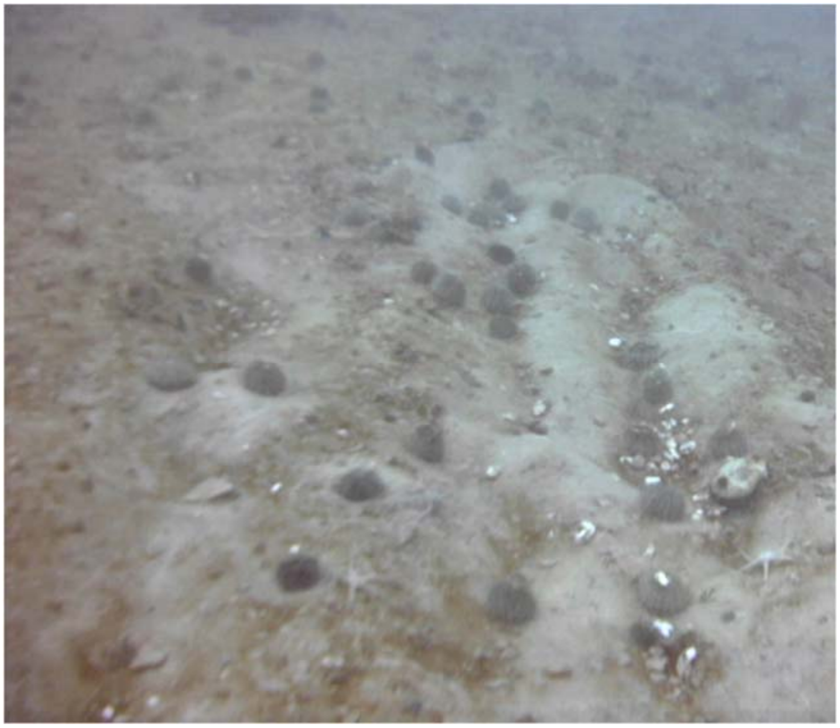
Photograph 26: Field team constructing settlement plates for deployment at Milne Port ore dock, 23 August 2017.

Photograph 27: Seabird CTD deployment, Milne Inlet, 30 August 2017.

Photograph 28: Pod of orca observed west of Stephens Island, 30 August 2017.

Photograph 29: Pod of orca observed south of Bruce Head, 11 September 2017.

Photograph 30: Sea colander and bivalves from underwater video along West Transect, 3 September 2017.



Photograph 31: Sea urchins and brittle stars from underwater video along West Transect, 3 September 2017.

Photograph 32: Brittle star and deep sea scallop from underwater video along East Transect, 2 September 2017.

Photograph 33: Underwater video along North Transect, 3 September 2017.

Photograph 34: Brittle stars from underwater video along North Transect, 3 September 2017.

APPENDIX B

Water Quality Laboratory Data

GOLDER ASSOCIATES LTD.
ATTN: John Sherrin
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8

Date Received: 14-AUG-17
Report Date: 06-SEP-17 15:25 (MT)
Version: FINAL

Client Phone: 250-881-7372

Certificate of Analysis

Lab Work Order #: L1974199

Project P.O. #: NOT SUBMITTED

Job Reference: 1663724/10000/1003

C of C Numbers:

Legal Site Desc:

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1974199-1	L1974199-2	L1974199-3	L1974199-4	
	Description	Sea Water	Sea Water	Sea Water	Sea Water	
	Sampled Date	08-AUG-17	08-AUG-17	08-AUG-17	08-AUG-17	
	Sampled Time	11:59	11:10	11:35	11:00	
	Client ID	SOURCE	WNW	NORTH	ENE	
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Conductivity (uS/cm)	13400	16600	19400	18300	
	Hardness (as CaCO3) (mg/L)	1390	1720	2060	1920	
	pH (pH)	7.14	7.01	7.14	7.12	
	Turbidity (NTU)	0.72	0.47	0.38	0.45	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	59.6	44.5	53.9	54.8	
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Total Kjeldahl Nitrogen (mg/L)	0.098	0.100	0.101	0.124	
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	31.8	26.3	28.7	8.36	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0282	0.0174	0.0200	0.0222	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Barium (Ba)-Total (mg/L)	0.0055	0.0056	0.0059	0.0060	
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Total (mg/L)	1.06	1.27	1.47	1.40	
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Calcium (Ca)-Total (mg/L)	101	125	146	137	
	Cesium (Cs)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Cobalt (Co)-Total (mg/L)	0.000050	<0.000050	<0.000050	<0.000050	
	Copper (Cu)-Total (mg/L)	0.00082	0.00065	<0.00050	0.00054	
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	0.035	0.042	0.026	0.028	
	Lead (Pb)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	
	Lithium (Li)-Total (mg/L)	0.046	0.058	0.070	0.065	
	Magnesium (Mg)-Total (mg/L)	285	357	422	403	
	Manganese (Mn)-Total (mg/L)	0.00127	0.00116	0.00116	0.00124	
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Total (mg/L)	0.0028	0.0034	0.0038	0.0035	
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Phosphorus (P)-Total (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Potassium (K)-Total (mg/L)	86	110	130	123	
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Rubidium (Rb)-Total (mg/L)	0.0301	0.0376	0.0446	0.0428	
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Silicon (Si)-Total (mg/L)	<0.50	<0.50	<0.50	<0.50	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1974199-1	L1974199-2	L1974199-3	L1974199-4
	Description	Sea Water	Sea Water	Sea Water	Sea Water
	Sampled Date	08-AUG-17	08-AUG-17	08-AUG-17	08-AUG-17
	Sampled Time	11:59	11:10	11:35	11:00
	Client ID	SOURCE	WNW	NORTH	ENE
SEAWATER					
Total Metals	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)	2320	2990	3570	3330
	Strontium (Sr)-Total (mg/L)	1.69	2.19	2.61	2.44
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Total (mg/L)	0.00127	0.00171	0.00148	0.00149
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	0.0091	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Dissolved (mg/L)	0.0050	0.0057	0.0062	0.0059
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	1.06	1.30	1.60	1.56
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Dissolved (mg/L)	98.1	120	141	133
	Cesium (Cs)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Dissolved (mg/L)	0.00091	0.00079	<0.00050	<0.00050
	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Dissolved (mg/L)	0.049	0.056	0.067	0.073
	Magnesium (Mg)-Dissolved (mg/L)	277	344	416	387
	Manganese (Mn)-Dissolved (mg/L)	0.00089	0.00123	0.00077	0.00057
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.0026	0.0030	0.0036	0.0042

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1974199-1	L1974199-2	L1974199-3	L1974199-4
	Description	Sea Water	Sea Water	Sea Water	Sea Water
	Sampled Date	08-AUG-17	08-AUG-17	08-AUG-17	08-AUG-17
	Sampled Time	11:59	11:10	11:35	11:00
	Client ID	SOURCE	WNW	NORTH	ENE
Grouping	**Analyte**				
SEAWATER					
Dissolved Metals	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<1.0	<1.0	<1.0	<1.0
	Potassium (K)-Dissolved (mg/L)	83	106	126	119
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Dissolved (mg/L)	0.0265	0.0343	0.0442	0.0414
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Dissolved (mg/L)	<0.50	<0.50	<0.50	<0.50
	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Dissolved (mg/L)	2250	2860	3430	3230
	Strontium (Sr)-Dissolved (mg/L)	1.65	2.10	2.50	2.35
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Dissolved (mg/L)	0.00150	0.00185	0.00152	0.00176
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00050
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Dissolved (mg/L)	0.00131	<0.00050	<0.00050	<0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1974199-1	L1974199-2	L1974199-3	L1974199-4
	Description	Sea Water	Sea Water	Sea Water	Sea Water
	Sampled Date	08-AUG-17	08-AUG-17	08-AUG-17	08-AUG-17
	Sampled Time	11:59	11:10	11:35	11:00
	Client ID	SOURCE	WNW	NORTH	ENE
WATER					
Hydrocarbons	EPH10-19 (mg/L)	<0.050	<0.050	<0.050	<0.050
	EPH19-32 (mg/L)	<0.050	<0.050	<0.050	<0.050
	LEPH (mg/L)	<0.050	<0.050	<0.050	<0.050
	HEPH (mg/L)	<0.050	<0.050	<0.050	<0.050
	Surrogate: 2-Bromobenzotrifluoride (%)	80.0	71.8	86.5	SURR-ND 54.4
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Acenaphthylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Acridine (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benz(a)anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(a)pyrene (mg/L)	DLCI <0.000070	DLCI <0.000060	<0.0000050	<0.0000050
	Benzo(b&j)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(g,h,i)perylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(k)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Chrysene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Dibenz(a,h)anthracene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Fluorene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Phenanthrene (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Surrogate: Acridine d9 (%)	100.1	96.6	99.1	98.0
	Surrogate: Chrysene d12 (%)	109.4	105.6	105.8	104.3
	Surrogate: Naphthalene d8 (%)	75.0	79.5	79.6	85.0
	Surrogate: Phenanthrene d10 (%)	94.7	100.2	94.8	100.5

* 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.
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**
ALK-TITR-VA	Seawater	Alkalinity Spec by Titration (Seawater)	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CARBONS-C-TOC-VA	Seawater	TOC by combustion (seawater)	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-C-PCT-VA	Seawater	Conductivity (Automated) (seawater)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EPH-L-ME-FID-VA	Water	EPH in Water (Low Level)	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.

HARDNESS-CALC-VA	Seawater	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-C-CVAFS-VA	Seawater	Diss. Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-C-CVAFS-VA	Seawater	Total Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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).

MET-D-L-HRMS-VA	Seawater	Diss. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-DIS-C-ICP-VA	Seawater	Diss. Metals in Seawater by ICPOES	PUGET SOUND PROTOCOLS, EPA 6010B

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by acid digestion or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-L-HRMS-VA	Seawater	Tot. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

MET-TOT-C-ICP-VA	Seawater	Total Metals in Seawater by ICPOES	PUGET SOUND PROTOCOLS, EPA 6010B

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by acid digestion or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Seawater	Ammonia in Seawater by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

Reference Information

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

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.

PH-C-PCT-VA	Seawater	pH by Meter (Automated) (seawater)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

It is recommended that this analysis be conducted in the field.

TKN-C-F-VA	Seawater	TKN in Seawater by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TURBIDITY-C-VA	Seawater	Turbidity by Meter in Seawater	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1974199 Report Date: 06-SEP-17

Client: GOLDER ASSOCIATES LTD.
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8
Contact: John Sherrin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EPH-L-ME-FID-VA	**Water**							
Batch R3798705								
WG2593989-2 LCS								
EPH10-19			106.1		%		50-150	17-AUG-17
EPH19-32			92.9		%		50-150	17-AUG-17
WG2596224-2 LCS								
EPH10-19			76.9		%		50-150	19-AUG-17
EPH19-32			67.5		%		50-150	19-AUG-17
WG2593989-1 MB								
EPH10-19			<0.050		mg/L		0.05	17-AUG-17
EPH19-32			<0.050		mg/L		0.05	17-AUG-17
Surrogate: 2-Bromobenzotrifluoride			71.7		%		60-140	17-AUG-17
WG2596224-1 MB								
EPH10-19			<0.050		mg/L		0.05	19-AUG-17
EPH19-32			<0.050		mg/L		0.05	19-AUG-17
Surrogate: 2-Bromobenzotrifluoride			56.4	RRQC	%		60-140	19-AUG-17
PAH-ME-MS-VA	**Water**							
Batch R3793979								
WG2593989-2 LCS								
Acenaphthene			104.9		%		60-130	18-AUG-17
Acenaphthylene			108.9		%		60-130	18-AUG-17
Acridine			128.0		%		60-130	18-AUG-17
Anthracene			112.9		%		60-130	18-AUG-17
Benz(a)anthracene			115.3		%		60-130	18-AUG-17
Benzo(a)pyrene			115.7		%		60-130	18-AUG-17
Benzo(b&j)fluoranthene			97.8		%		50-150	18-AUG-17
Benzo(g,h,i)perylene			101.7		%		60-130	18-AUG-17
Benzo(k)fluoranthene			121.8		%		60-130	18-AUG-17
Chrysene			129.1		%		60-130	18-AUG-17
Dibenz(a,h)anthracene			111.0		%		60-130	18-AUG-17
Fluoranthene			114.9		%		60-130	18-AUG-17
Fluorene			108.5		%		60-130	18-AUG-17
Indeno(1,2,3-c,d)pyrene			101.2		%		60-130	18-AUG-17
Naphthalene			96.7		%		50-130	18-AUG-17
Phenanthrene			119.4		%		60-130	18-AUG-17
Pyrene			115.0		%		60-130	18-AUG-17
Quinoline			122.9		%		60-130	18-AUG-17
WG2593989-1 MB								

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ME-MS-VA	**Water**							
Batch R3793979								
WG2593989-1 MB								
Acenaphthene			<0.000010		mg/L		0.00001	18-AUG-17
Acenaphthylene			<0.000010		mg/L		0.00001	18-AUG-17
Acridine			<0.000010		mg/L		0.00001	18-AUG-17
Anthracene			<0.000010		mg/L		0.00001	18-AUG-17
Benz(a)anthracene			<0.000010		mg/L		0.00001	18-AUG-17
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	18-AUG-17
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	18-AUG-17
Benzo(g,h,i)perylene			<0.000010		mg/L		0.00001	18-AUG-17
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	18-AUG-17
Chrysene			<0.000010		mg/L		0.00001	18-AUG-17
Dibenz(a,h)anthracene			<0.0000050		mg/L		0.000005	18-AUG-17
Fluoranthene			<0.000010		mg/L		0.00001	18-AUG-17
Fluorene			<0.000010		mg/L		0.00001	18-AUG-17
Indeno(1,2,3-c,d)pyrene			<0.000010		mg/L		0.00001	18-AUG-17
Naphthalene			<0.000050		mg/L		0.00005	18-AUG-17
Phenanthrene			<0.000020		mg/L		0.00002	18-AUG-17
Pyrene			<0.000010		mg/L		0.00001	18-AUG-17
Quinoline			<0.000050		mg/L		0.00005	18-AUG-17
Surrogate: Acridine d9			128.0		%		60-130	18-AUG-17
Surrogate: Chrysene d12			102.4		%		60-130	18-AUG-17
Surrogate: Naphthalene d8			99.3		%		50-130	18-AUG-17
Surrogate: Phenanthrene d10			128.6		%		60-130	18-AUG-17
Batch R3802720								
WG2596224-2 LCS								
Acenaphthene			89.3		%		60-130	21-AUG-17
Acenaphthylene			106.2		%		60-130	21-AUG-17
Acridine			117.8		%		60-130	21-AUG-17
Anthracene			112.0		%		60-130	21-AUG-17
Benz(a)anthracene			109.0		%		60-130	21-AUG-17
Benzo(a)pyrene			111.0		%		60-130	21-AUG-17
Benzo(b&j)fluoranthene			117.4		%		50-150	21-AUG-17
Benzo(g,h,i)perylene			101.6		%		60-130	21-AUG-17
Benzo(k)fluoranthene			118.2		%		60-130	21-AUG-17
Chrysene			111.1		%		60-130	21-AUG-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ME-MS-VA	**Water**							
Batch R3802720								
WG2596224-2 LCS								
Dibenz(a,h)anthracene			106.2		%		60-130	21-AUG-17
Fluoranthene			110.6		%		60-130	21-AUG-17
Fluorene			103.0		%		60-130	21-AUG-17
Indeno(1,2,3-c,d)pyrene			105.4		%		60-130	21-AUG-17
Naphthalene			92.7		%		50-130	21-AUG-17
Phenanthrene			110.3		%		60-130	21-AUG-17
Pyrene			111.5		%		60-130	21-AUG-17
Quinoline			105.6		%		60-130	21-AUG-17
WG2596224-1 MB								
Acenaphthene			<0.000010		mg/L		0.00001	21-AUG-17
Acenaphthylene			<0.000010		mg/L		0.00001	21-AUG-17
Acridine			<0.000010		mg/L		0.00001	21-AUG-17
Anthracene			<0.000010		mg/L		0.00001	21-AUG-17
Benz(a)anthracene			<0.000010		mg/L		0.00001	21-AUG-17
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	21-AUG-17
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	21-AUG-17
Benzo(g,h,i)perylene			<0.000010		mg/L		0.00001	21-AUG-17
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	21-AUG-17
Chrysene			<0.000010		mg/L		0.00001	21-AUG-17
Dibenz(a,h)anthracene			<0.0000050		mg/L		0.000005	21-AUG-17
Fluoranthene			<0.000010		mg/L		0.00001	21-AUG-17
Fluorene			<0.000010		mg/L		0.00001	21-AUG-17
Indeno(1,2,3-c,d)pyrene			<0.000010		mg/L		0.00001	21-AUG-17
Naphthalene			<0.000050		mg/L		0.00005	21-AUG-17
Phenanthrene			<0.000020		mg/L		0.00002	21-AUG-17
Pyrene			<0.000010		mg/L		0.00001	21-AUG-17
Quinoline			<0.000050		mg/L		0.00005	21-AUG-17
Surrogate: Acridine d9			113.1		%		60-130	21-AUG-17
Surrogate: Chrysene d12			122.5		%		60-130	21-AUG-17
Surrogate: Naphthalene d8			87.2		%		50-130	21-AUG-17
Surrogate: Phenanthrene d10			105.4		%		60-130	21-AUG-17
ALK-TITR-VA	**Seawater**							

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-TITR-VA	**Seawater**							
Batch R3802202								
WG2592590-3 CRM		**VA-ALK-TITR-CONTROL**						
Alkalinity, Total (as CaCO3)			96.7		%		85-115	16-AUG-17
WG2592590-5 DUP		**L1974199-1**						
Alkalinity, Total (as CaCO3)		59.6	59.6		mg/L	0.0	20	16-AUG-17
WG2592590-1 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	16-AUG-17
CARBONS-C-TOC-VA	**Seawater**							
Batch R3803855								
WG2595258-4 LCS								
Total Organic Carbon			101.3		%		80-120	17-AUG-17
WG2595258-3 MB								
Total Organic Carbon			<0.50		mg/L		0.5	17-AUG-17
EC-C-PCT-VA	**Seawater**							
Batch R3802202								
WG2592590-4 CRM		**VA-EC-PCT-CONTROL**						
Conductivity			95.0		%		90-110	16-AUG-17
WG2592590-5 DUP		**L1974199-1**						
Conductivity		13400	13300		uS/cm	0.1	10	16-AUG-17
WG2592590-1 MB								
Conductivity			<2.0		uS/cm		2	16-AUG-17
HG-DIS-C-CVAFS-VA	**Seawater**							
Batch R3801684								
WG2593973-2 LCS								
Mercury (Hg)-Dissolved			95.7		%		80-120	16-AUG-17
WG2593973-1 MB		**LF**						
Mercury (Hg)-Dissolved			<0.000010		mg/L		0.00001	16-AUG-17
WG2593973-4 MS		**L1974199-4**						
Mercury (Hg)-Dissolved			94.1		%		70-130	16-AUG-17
HG-TOT-C-CVAFS-VA	**Seawater**							
Batch R3800373								
WG2592499-2 LCS								
Mercury (Hg)-Total			97.1		%		80-120	15-AUG-17
WG2592499-1 MB								
Mercury (Hg)-Total			<0.000010		mg/L		0.00001	15-AUG-17
MET-D-L-HRMS-VA	**Seawater**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3814442								
WG2594924-1 MB		**LF**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	27-AUG-17
Antimony (Sb)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	27-AUG-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	27-AUG-17
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Bismuth (Bi)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	27-AUG-17
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	27-AUG-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	27-AUG-17
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	27-AUG-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	27-AUG-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	27-AUG-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	27-AUG-17
Molybdenum (Mo)-Dissolved			<0.0020		mg/L		0.002	27-AUG-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	27-AUG-17
Rhenium (Re)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	27-AUG-17
Selenium (Se)-Dissolved			<0.0020		mg/L		0.002	27-AUG-17
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	27-AUG-17
Tellurium (Te)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	27-AUG-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	27-AUG-17
Titanium (Ti)-Dissolved			<0.0050		mg/L		0.005	27-AUG-17
Tungsten (W)-Dissolved			<0.0010		mg/L		0.001	27-AUG-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	27-AUG-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Yttrium (Y)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	27-AUG-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3814442								
WG2594924-1 MB		**LF**						
Zirconium (Zr)-Dissolved			<0.00050		mg/L		0.0005	27-AUG-17
Batch R3817192								
WG2594924-2 LCS								
Aluminum (Al)-Dissolved			82.4		%		80-120	28-AUG-17
Antimony (Sb)-Dissolved			88.5		%		80-120	28-AUG-17
Arsenic (As)-Dissolved			95.0		%		80-120	28-AUG-17
Barium (Ba)-Dissolved			98.4		%		80-120	28-AUG-17
Beryllium (Be)-Dissolved			90.1		%		80-120	28-AUG-17
Bismuth (Bi)-Dissolved			90.9		%		80-120	28-AUG-17
Boron (B)-Dissolved			109.1		%		80-120	28-AUG-17
Cadmium (Cd)-Dissolved			96.0		%		80-120	28-AUG-17
Cesium (Cs)-Dissolved			94.9		%		80-120	28-AUG-17
Chromium (Cr)-Dissolved			106.4		%		80-120	28-AUG-17
Cobalt (Co)-Dissolved			93.2		%		80-120	28-AUG-17
Copper (Cu)-Dissolved			88.8		%		80-120	28-AUG-17
Gallium (Ga)-Dissolved			97.6		%		80-120	28-AUG-17
Iron (Fe)-Dissolved			100.7		%		80-120	28-AUG-17
Lead (Pb)-Dissolved			102.8		%		80-120	28-AUG-17
Lithium (Li)-Dissolved			100.4		%		80-120	28-AUG-17
Manganese (Mn)-Dissolved			104.0		%		80-120	28-AUG-17
Molybdenum (Mo)-Dissolved			91.6		%		80-120	28-AUG-17
Nickel (Ni)-Dissolved			88.2		%		80-120	28-AUG-17
Phosphorus (P)-Dissolved			93.0		%		80-120	28-AUG-17
Rhenium (Re)-Dissolved			87.9		%		80-120	28-AUG-17
Rubidium (Rb)-Dissolved			97.5		%		80-120	28-AUG-17
Selenium (Se)-Dissolved			111.3		%		80-120	28-AUG-17
Silver (Ag)-Dissolved			95.3		%		80-120	28-AUG-17
Tellurium (Te)-Dissolved			90.5		%		80-120	28-AUG-17
Thallium (Tl)-Dissolved			84.9		%		80-120	28-AUG-17
Thorium (Th)-Dissolved			102.2		%		80-120	28-AUG-17
Tin (Sn)-Dissolved			118.9		%		80-120	28-AUG-17
Titanium (Ti)-Dissolved			94.4		%		80-120	28-AUG-17
Tungsten (W)-Dissolved			90.3		%		80-120	28-AUG-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817192								
WG2594924-2 LCS								
Uranium (U)-Dissolved			102.1		%		80-120	28-AUG-17
Vanadium (V)-Dissolved			97.0		%		80-120	28-AUG-17
Yttrium (Y)-Dissolved			105.1		%		80-120	28-AUG-17
Zinc (Zn)-Dissolved			81.6		%		80-120	28-AUG-17
Zirconium (Zr)-Dissolved			100.0		%		80-120	28-AUG-17
Batch R3817205								
WG2605819-1 MB		**LF**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Antimony (Sb)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	31-AUG-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Bismuth (Bi)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	31-AUG-17
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	31-AUG-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	31-AUG-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	31-AUG-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Molybdenum (Mo)-Dissolved			<0.0020		mg/L		0.002	31-AUG-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	31-AUG-17
Rhenium (Re)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Selenium (Se)-Dissolved			<0.0020		mg/L		0.002	31-AUG-17
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	31-AUG-17
Tellurium (Te)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817205								
WG2605819-1 MB		**LF**						
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Titanium (Ti)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Tungsten (W)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Yttrium (Y)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	31-AUG-17
Zirconium (Zr)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Batch R3819809								
WG2605819-2 LCS								
Aluminum (Al)-Dissolved			94.2		%		80-120	01-SEP-17
Antimony (Sb)-Dissolved			80.7		%		80-120	01-SEP-17
Arsenic (As)-Dissolved			97.8		%		80-120	01-SEP-17
Barium (Ba)-Dissolved			106.8		%		80-120	01-SEP-17
Beryllium (Be)-Dissolved			89.9		%		80-120	01-SEP-17
Bismuth (Bi)-Dissolved			92.5		%		80-120	01-SEP-17
Boron (B)-Dissolved			116.1		%		80-120	01-SEP-17
Cadmium (Cd)-Dissolved			95.5		%		80-120	01-SEP-17
Cesium (Cs)-Dissolved			105.2		%		80-120	01-SEP-17
Chromium (Cr)-Dissolved			101.2		%		80-120	01-SEP-17
Cobalt (Co)-Dissolved			96.4		%		80-120	01-SEP-17
Copper (Cu)-Dissolved			102.4		%		80-120	01-SEP-17
Gallium (Ga)-Dissolved			98.8		%		80-120	01-SEP-17
Iron (Fe)-Dissolved			99.4		%		80-120	01-SEP-17
Lead (Pb)-Dissolved			89.4		%		80-120	01-SEP-17
Lithium (Li)-Dissolved			105.0		%		80-120	01-SEP-17
Manganese (Mn)-Dissolved			114.1		%		80-120	01-SEP-17
Molybdenum (Mo)-Dissolved			93.1		%		80-120	01-SEP-17
Nickel (Ni)-Dissolved			95.7		%		80-120	01-SEP-17
Rhenium (Re)-Dissolved			86.5		%		80-120	01-SEP-17
Rubidium (Rb)-Dissolved			106.8		%		80-120	01-SEP-17
Selenium (Se)-Dissolved			102.5		%		80-120	01-SEP-17
Silver (Ag)-Dissolved			96.7		%		80-120	01-SEP-17
Tellurium (Te)-Dissolved			89.2		%		80-120	01-SEP-17

Quality Control Report

Workorder: L1974199 Report Date: 06-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3819809								
WG2605819-2 LCS								
Thallium (Tl)-Dissolved			82.1		%		80-120	01-SEP-17
Thorium (Th)-Dissolved			107.0		%		80-120	01-SEP-17
Tin (Sn)-Dissolved			111.7		%		80-120	01-SEP-17
Titanium (Ti)-Dissolved			99.6		%		80-120	01-SEP-17
Tungsten (W)-Dissolved			91.4		%		80-120	01-SEP-17
Uranium (U)-Dissolved			81.5		%		80-120	01-SEP-17
Vanadium (V)-Dissolved			99.6		%		80-120	01-SEP-17
Yttrium (Y)-Dissolved			110.0		%		80-120	01-SEP-17
Zinc (Zn)-Dissolved			91.5		%		80-120	01-SEP-17
Zirconium (Zr)-Dissolved			109.3		%		80-120	01-SEP-17
MET-DIS-C-ICP-VA	**Seawater**							
Batch R3803800								
WG2594924-2 LCS								
Calcium (Ca)-Dissolved			101.8		%		80-120	18-AUG-17
Magnesium (Mg)-Dissolved			102.4		%		80-120	18-AUG-17
Potassium (K)-Dissolved			97.8		%		80-120	18-AUG-17
Silicon (Si)-Dissolved			102.9		%		80-120	18-AUG-17
Sodium (Na)-Dissolved			96.7		%		80-120	18-AUG-17
Strontium (Sr)-Dissolved			99.1		%		80-120	18-AUG-17
WG2594924-1 MB		**LF**						
Calcium (Ca)-Dissolved			<0.50		mg/L		0.5	18-AUG-17
Magnesium (Mg)-Dissolved			<1.0		mg/L		1	18-AUG-17
Potassium (K)-Dissolved			<20		mg/L		20	18-AUG-17
Silicon (Si)-Dissolved			<0.50		mg/L		0.5	18-AUG-17
Sodium (Na)-Dissolved			<20		mg/L		20	18-AUG-17
Strontium (Sr)-Dissolved			<0.050		mg/L		0.05	18-AUG-17
MET-T-L-HRMS-VA	**Seawater**							
Batch R3819809								
WG2607625-2 LCS								
Aluminum (Al)-Total			94.8		%		80-120	01-SEP-17
Aluminum (Al)-Total			94.8		%		80-120	01-SEP-17
Antimony (Sb)-Total			87.9		%		80-120	01-SEP-17
Antimony (Sb)-Total			87.9		%		80-120	01-SEP-17
Arsenic (As)-Total			100.4		%		80-120	01-SEP-17
Arsenic (As)-Total			100.4		%		80-120	01-SEP-17

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3819809								
WG2607625-2 LCS								
Barium (Ba)-Total			105.2		%		80-120	01-SEP-17
Barium (Ba)-Total			105.2		%		80-120	01-SEP-17
Beryllium (Be)-Total			100.2		%		80-120	01-SEP-17
Beryllium (Be)-Total			100.2		%		80-120	01-SEP-17
Bismuth (Bi)-Total			98.6		%		80-120	01-SEP-17
Bismuth (Bi)-Total			98.6		%		80-120	01-SEP-17
Cadmium (Cd)-Total			99.3		%		80-120	01-SEP-17
Cadmium (Cd)-Total			99.3		%		80-120	01-SEP-17
Cesium (Cs)-Total			112.9		%		80-120	01-SEP-17
Cesium (Cs)-Total			112.9		%		80-120	01-SEP-17
Chromium (Cr)-Total			102.4		%		80-120	01-SEP-17
Chromium (Cr)-Total			102.4		%		80-120	01-SEP-17
Cobalt (Co)-Total			100.0		%		80-120	01-SEP-17
Cobalt (Co)-Total			100.0		%		80-120	01-SEP-17
Copper (Cu)-Total			107.0		%		80-120	01-SEP-17
Copper (Cu)-Total			107.0		%		80-120	01-SEP-17
Gallium (Ga)-Total			102.0		%		80-120	01-SEP-17
Gallium (Ga)-Total			102.0		%		80-120	01-SEP-17
Iron (Fe)-Total			104.3		%		80-120	01-SEP-17
Iron (Fe)-Total			104.3		%		80-120	01-SEP-17
Lead (Pb)-Total			95.7		%		80-120	01-SEP-17
Lead (Pb)-Total			95.7		%		80-120	01-SEP-17
Lithium (Li)-Total			108.9		%		80-120	01-SEP-17
Lithium (Li)-Total			108.9		%		80-120	01-SEP-17
Manganese (Mn)-Total			116.5		%		80-120	01-SEP-17
Manganese (Mn)-Total			116.5		%		80-120	01-SEP-17
Molybdenum (Mo)-Total			107.0		%		80-120	01-SEP-17
Molybdenum (Mo)-Total			107.0		%		80-120	01-SEP-17
Nickel (Ni)-Total			99.99		%		80-120	01-SEP-17
Nickel (Ni)-Total			99.99		%		80-120	01-SEP-17
Rhenium (Re)-Total			101.0		%		80-120	01-SEP-17
Rhenium (Re)-Total			101.0		%		80-120	01-SEP-17
Rubidium (Rb)-Total			111.1		%		80-120	01-SEP-17
Rubidium (Rb)-Total			111.1		%		80-120	01-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3819809								
WG2607625-2 LCS								
Selenium (Se)-Total			103.3		%		80-120	01-SEP-17
Selenium (Se)-Total			103.3		%		80-120	01-SEP-17
Silver (Ag)-Total			99.1		%		80-120	01-SEP-17
Silver (Ag)-Total			99.1		%		80-120	01-SEP-17
Tellurium (Te)-Total			99.7		%		80-120	01-SEP-17
Tellurium (Te)-Total			99.7		%		80-120	01-SEP-17
Thallium (Tl)-Total			90.5		%		80-120	01-SEP-17
Thallium (Tl)-Total			90.5		%		80-120	01-SEP-17
Thorium (Th)-Total			114.3		%		80-120	01-SEP-17
Thorium (Th)-Total			114.3		%		80-120	01-SEP-17
Tin (Sn)-Total			118.1		%		80-120	01-SEP-17
Tin (Sn)-Total			118.1		%		80-120	01-SEP-17
Titanium (Ti)-Total			103.2		%		80-120	01-SEP-17
Titanium (Ti)-Total			103.2		%		80-120	01-SEP-17
Tungsten (W)-Total			105.0		%		80-120	01-SEP-17
Tungsten (W)-Total			105.0		%		80-120	01-SEP-17
Uranium (U)-Total			88.1		%		80-120	01-SEP-17
Uranium (U)-Total			88.1		%		80-120	01-SEP-17
Vanadium (V)-Total			101.0		%		80-120	01-SEP-17
Vanadium (V)-Total			101.0		%		80-120	01-SEP-17
Yttrium (Y)-Total			119.4		%		80-120	01-SEP-17
Yttrium (Y)-Total			119.4		%		80-120	01-SEP-17
Zinc (Zn)-Total			92.6		%		80-120	01-SEP-17
Zinc (Zn)-Total			92.6		%		80-120	01-SEP-17
Zirconium (Zr)-Total			120.0		%		80-120	01-SEP-17
Zirconium (Zr)-Total			120.0		%		80-120	01-SEP-17
WG2607625-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	01-SEP-17
Aluminum (Al)-Total			<0.0050		mg/L		0.005	01-SEP-17
Antimony (Sb)-Total			<0.000030		mg/L		0.00003	01-SEP-17
Antimony (Sb)-Total			<0.000030		mg/L		0.00003	01-SEP-17
Arsenic (As)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Arsenic (As)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Barium (Ba)-Total			<0.0010		mg/L		0.001	01-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3819809								
WG2607625-1 MB								
Barium (Ba)-Total			<0.0010		mg/L		0.001	01-SEP-17
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Boron (B)-Total			<0.10		mg/L		0.1	01-SEP-17
Boron (B)-Total			<0.10		mg/L		0.1	01-SEP-17
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Cesium (Cs)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Cesium (Cs)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Gallium (Ga)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Gallium (Ga)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Iron (Fe)-Total			<0.010		mg/L		0.01	01-SEP-17
Iron (Fe)-Total			<0.010		mg/L		0.01	01-SEP-17
Lead (Pb)-Total			<0.00030		mg/L		0.0003	01-SEP-17
Lead (Pb)-Total			<0.00030		mg/L		0.0003	01-SEP-17
Lithium (Li)-Total			<0.00040		mg/L		0.0004	01-SEP-17
Lithium (Li)-Total			<0.00040		mg/L		0.0004	01-SEP-17
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Nickel (Ni)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Nickel (Ni)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Phosphorus (P)-Total			<0.030		mg/L		0.03	01-SEP-17
Phosphorus (P)-Total			<0.030		mg/L		0.03	01-SEP-17
Rhenium (Re)-Total			<0.0000050		mg/L		0.000005	01-SEP-17

Quality Control Report

Workorder: L1974199 Report Date: 06-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3819809								
WG2607625-1 MB								
Rhenium (Re)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Rubidium (Rb)-Total			<0.000020		mg/L		0.00002	01-SEP-17
Rubidium (Rb)-Total			<0.000020		mg/L		0.00002	01-SEP-17
Selenium (Se)-Total			<0.0020		mg/L		0.002	01-SEP-17
Selenium (Se)-Total			<0.0020		mg/L		0.002	01-SEP-17
Silver (Ag)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Silver (Ag)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Tellurium (Te)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Tellurium (Te)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Thallium (Tl)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Thallium (Tl)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Thorium (Th)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Thorium (Th)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Tin (Sn)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Tin (Sn)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Titanium (Ti)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Titanium (Ti)-Total			<0.00020		mg/L		0.0002	01-SEP-17
Tungsten (W)-Total			<0.000010		mg/L		0.00001	01-SEP-17
Tungsten (W)-Total			<0.000010		mg/L		0.00001	01-SEP-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	01-SEP-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Yttrium (Y)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Yttrium (Y)-Total			<0.0000050		mg/L		0.000005	01-SEP-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	01-SEP-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	01-SEP-17
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	01-SEP-17
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	01-SEP-17
MET-TOT-C-ICP-VA	**Seawater**							
Batch R3803665								
WG2594485-2 LCS								
Calcium (Ca)-Total			108.9		%		80-120	18-AUG-17
Magnesium (Mg)-Total			111.9		%		80-120	18-AUG-17

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-C-ICP-VA	**Seawater**							
Batch R3803665								
WG2594485-2 LCS								
Potassium (K)-Total			109.6		%		80-120	18-AUG-17
Silicon (Si)-Total			113.8		%		80-120	18-AUG-17
Sodium (Na)-Total			109.0		%		80-120	18-AUG-17
Strontium (Sr)-Total			112.4		%		80-120	18-AUG-17
WG2594485-1 MB								
Calcium (Ca)-Total			<0.50		mg/L		0.5	18-AUG-17
Magnesium (Mg)-Total			<1.0		mg/L		1	18-AUG-17
Potassium (K)-Total			<20		mg/L		20	18-AUG-17
Silicon (Si)-Total			<0.50		mg/L		0.5	18-AUG-17
Sodium (Na)-Total			<20		mg/L		20	18-AUG-17
Strontium (Sr)-Total			<0.050		mg/L		0.05	18-AUG-17
NH3-F-VA	**Seawater**							
Batch R3799337								
WG2592026-3 DUP		**L1974199-2**						
Ammonia, Total (as N)		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-AUG-17
WG2592026-2 LCS								
Ammonia, Total (as N)			99.3		%		85-115	14-AUG-17
WG2592026-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	14-AUG-17
WG2592026-4 MS		**L1974199-2**						
Ammonia, Total (as N)			94.9		%		75-125	14-AUG-17
PH-C-PCT-VA	**Seawater**							
Batch R3802202								
WG2592590-2 CRM		**VA-PH7-BUF**						
pH			7.00		pH		6.9-7.1	16-AUG-17
WG2592590-5 DUP		**L1974199-1**						
pH		7.14	7.11	J	pH	0.03	0.3	16-AUG-17
TKN-C-F-VA	**Seawater**							
Batch R3804108								
WG2595223-3 DUP		**L1974199-3**						
Total Kjeldahl Nitrogen		0.101	0.132	J	mg/L	0.031	0.1	19-AUG-17
WG2595223-2 LCS								
Total Kjeldahl Nitrogen			101.6		%		75-125	19-AUG-17
WG2595223-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	19-AUG-17
WG2595223-4 MS		**L1974199-4**						

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-C-F-VA	**Seawater**							
Batch R3804108								
WG2595223-4 MS		**L1974199-4**						
Total Kjeldahl Nitrogen			101.0		%		70-130	19-AUG-17
TURBIDITY-C-VA	**Seawater**							
Batch R3804401								
WG2596671-2 CRM		**VA-FORM-40**						
Turbidity			99.0		%		85-115	20-AUG-17
WG2596671-5 CRM		**VA-FORM-40**						
Turbidity			99.0		%		85-115	20-AUG-17
WG2596671-1 MB								
Turbidity			<0.10		NTU		0.1	20-AUG-17
WG2596671-4 MB								
Turbidity			<0.10		NTU		0.1	20-AUG-17

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
RRQC	Refer to report remarks for information regarding this QC result.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Turbidity by Meter in Seawater							
	1	08-AUG-17 11:59	20-AUG-17 15:53	3	12	days	EHTR
	2	08-AUG-17 11:10	20-AUG-17 15:53	3	12	days	EHTR
	3	08-AUG-17 11:35	20-AUG-17 15:53	3	12	days	EHTR
	4	08-AUG-17 11:00	20-AUG-17 15:53	3	12	days	EHTR
pH by Meter (Automated) (seawater)							
	1	08-AUG-17 11:59	16-AUG-17 08:25	0.25	188	hours	EHTR-FM
	2	08-AUG-17 11:10	16-AUG-17 08:25	0.25	189	hours	EHTR-FM
	3	08-AUG-17 11:35	16-AUG-17 08:25	0.25	189	hours	EHTR-FM
	4	08-AUG-17 11:00	16-AUG-17 08:25	0.25	189	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1974199 were received on 14-AUG-17 09:23.

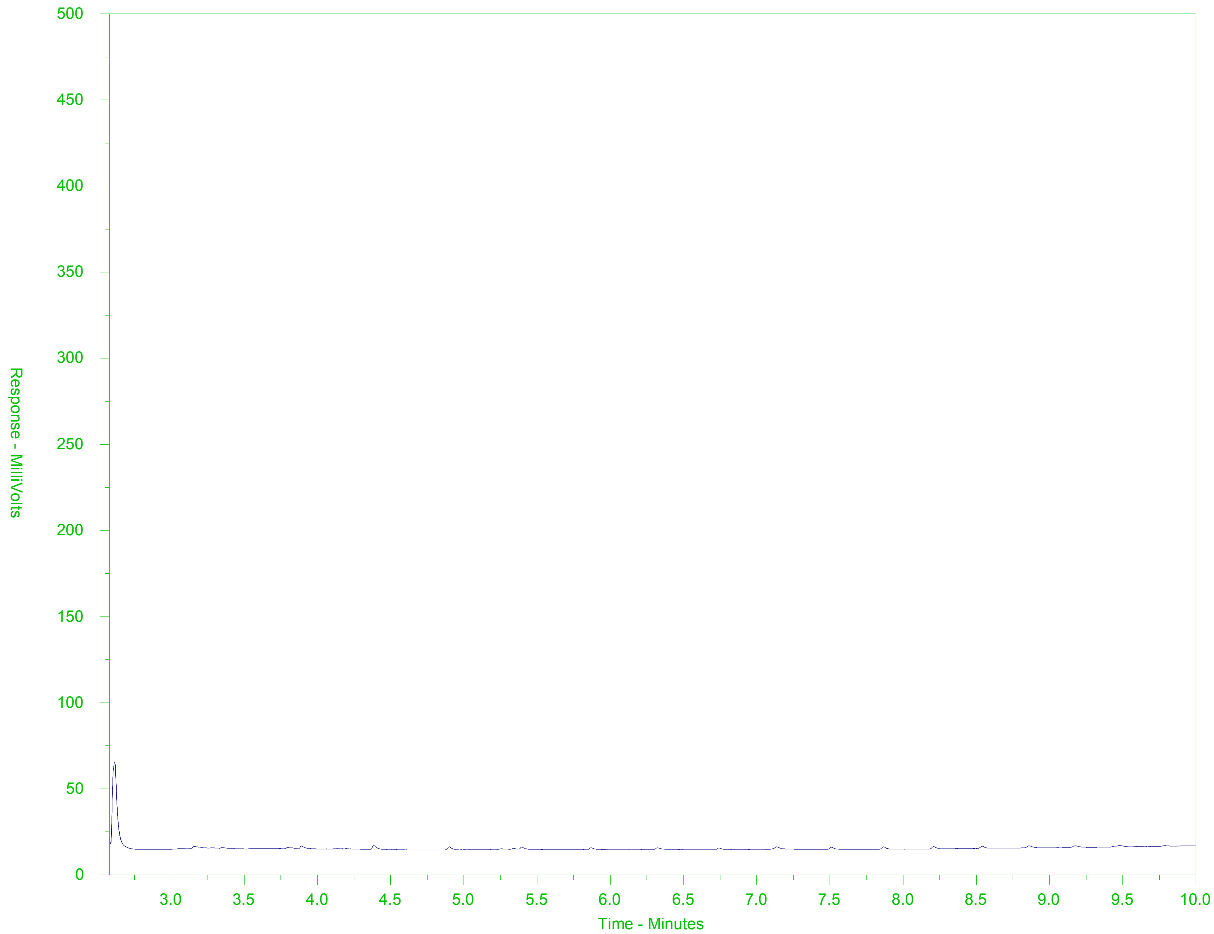
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1974199-L-1
Client Sample ID: SOURCE



← 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.

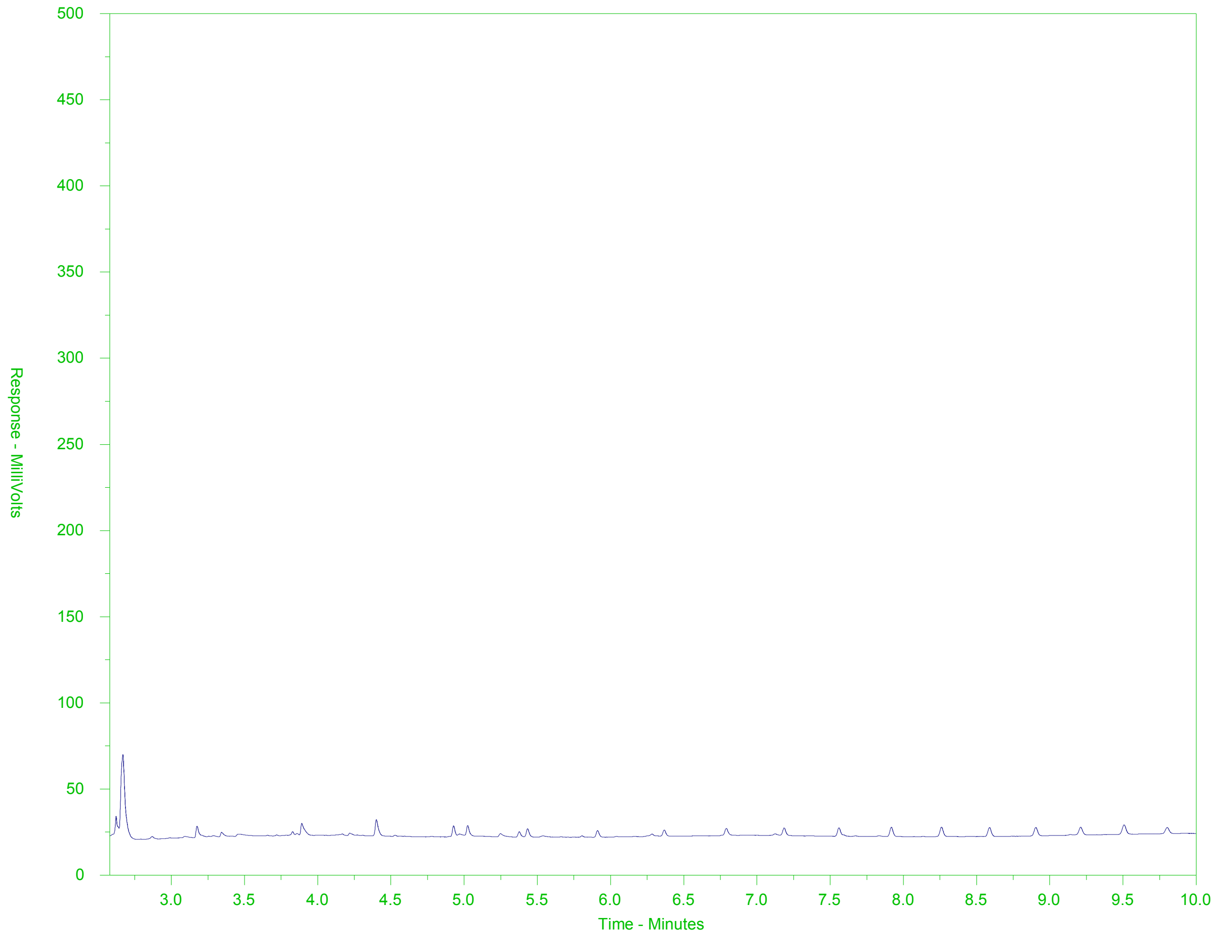
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1974199-L-2
Client Sample ID: WNW



← 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.

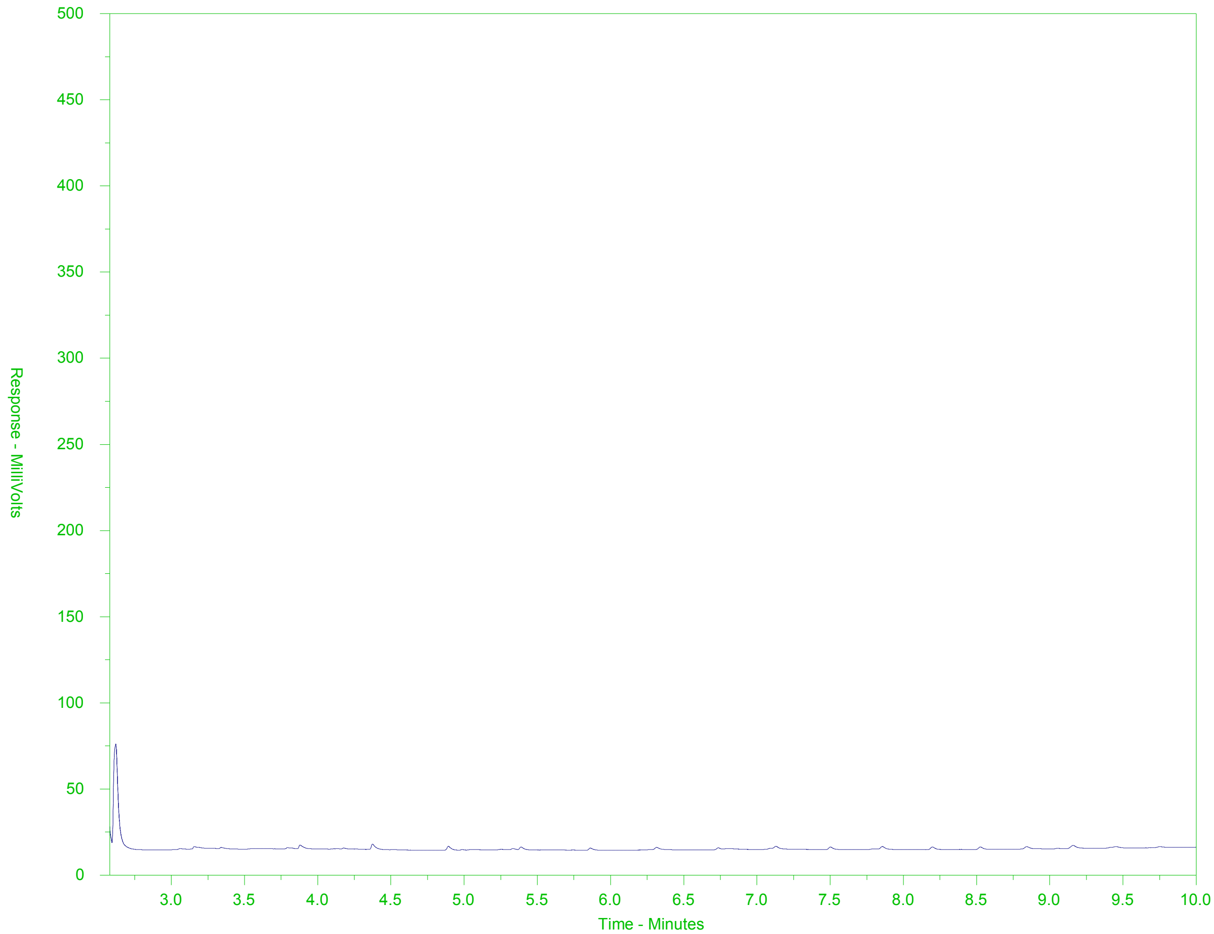
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1974199-L-3
Client Sample ID: NORTH



← 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.

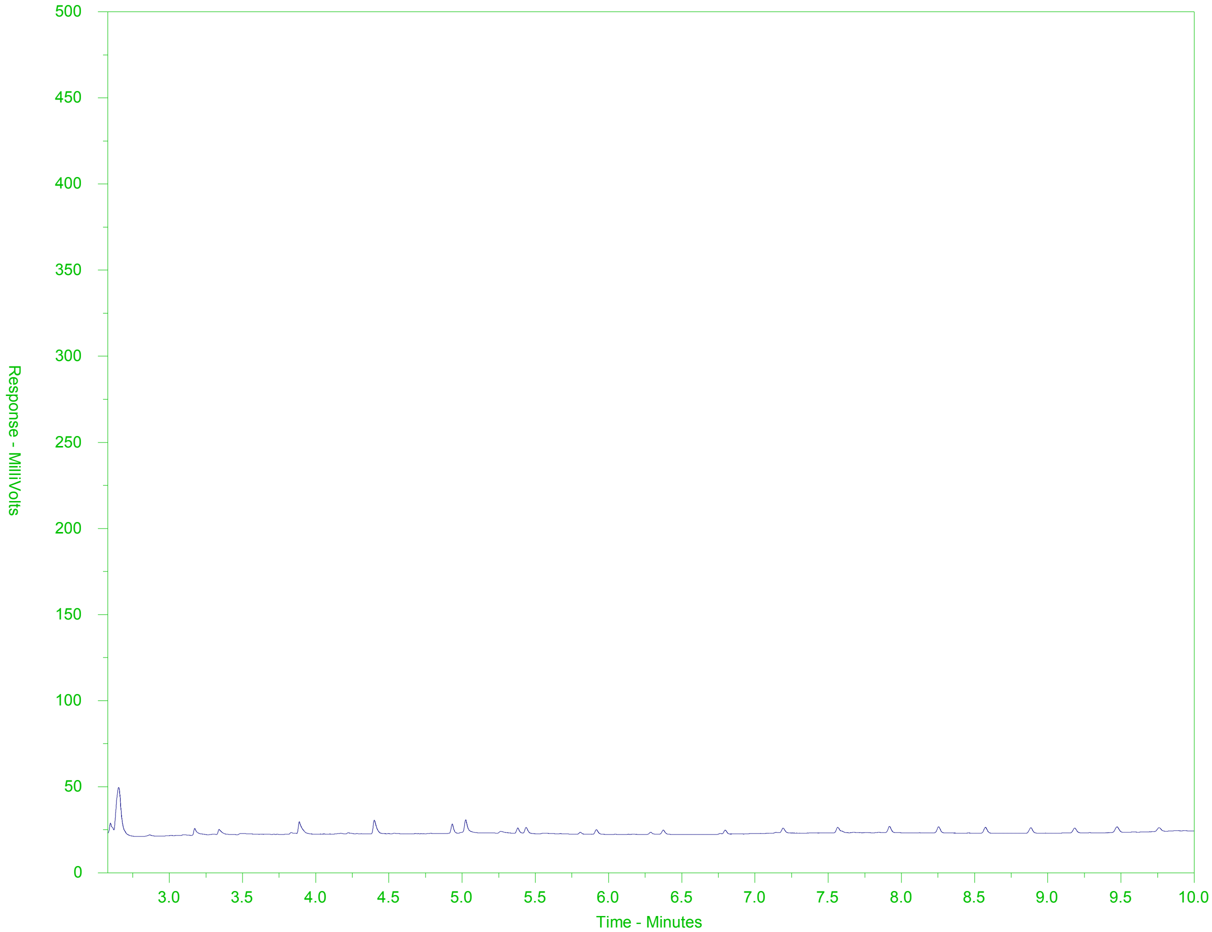
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1974199-L-4
Client Sample ID: ENE



← 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

APPENDIX ... WATER ANALYTICAL DATA

Canada Toll Free: 1 800 668 9878

L1974199-COFC

COC Number: 15 - XXXXXX

Report To	Contact and companyname below will appear on the final report
Company:	Golder Associatex Ltd.
Contact:	John Sherrin / Arman Ospan
Phone:	1 (250) 881 7372
	Company address below will appear on the final report
Street:	2nd floor 3795 Carey Rd.
City/Province:	Victoria BC
Postal Code:	V8Z 6T8
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	
Contact:	

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 jsherrin@golder.com

Email 2 aospan@golder.com

Email 3 mspani@golder.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

...rm 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.

Project Information

ALS Account # / Quote #:	BR191034
Job #:	1663724/10000/1003
PO / AFE:	
LSD:	
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:	Sampler:

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	General (pH, Alkalinity, Turbidity, Conductivity)	TOC, Ammonia, TKN (P)	Dissolved Metals	Total Metals (P)	Dissolved Mercury	Total Mercury (P)	Hydrocarbons (PAH/LEPH/HEPH) (P)	Fecal Coliforms (P)	Number of Containers
	Source	Aug 8 2017	11:59	Sea water	X	X	X	X	X	X	X	X	9
	WNW	↓	11:10	↓	↓	↓	↓	↓	↓	↓	↓	↓	9
	North	↓	11:35	↓	↓	↓	↓	↓	↓	↓	↓	↓	9
	ENE	↓	11:00	↓	↓	↓	↓	↓	↓	↓	↓	↓	9

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)

Rush Analysis - Time Sensitive
Bacteria Samples
* Attn: Amber Springer *

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: 19.8

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Michelle Spani	Date: Aug 8 2017	Received by:	Date:	Time:	Received by: PAUL	Date: AUG 14	Time: 09:23

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**.

GOLDER ASSOCIATES LTD.
ATTN: John Sherrin
3795 Carey Road, Second Floor
Victoria bc V8Z 6T8

Date Received: 24-AUG-17
Report Date: 07-SEP-17 16:17 (MT)
Version: FINAL

Client Phone: 250-881-7372

Certificate of Analysis

Lab Work Order #: L1980315

Project P.O. #: NOT SUBMITTED
Job Reference: 1663724/10000/1003
C of C Numbers:
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1980315-1	L1980315-2	L1980315-3	L1980315-4	L1980315-5
	Description	seawater	seawater	seawater	seawater	seawater
	Sampled Date	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17
	Sampled Time	09:58	09:22	10:40	10:27	10:10
	Client ID	SOURCE	WNW	NORTH	ENE	DUP A
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Conductivity (uS/cm)	9640	7470	11100	11500	9350
	Hardness (as CaCO3) (mg/L)	1100	828	1200	1360	958
	pH (pH)	7.95	7.95	7.95	7.94	7.96
	Total Suspended Solids (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Turbidity (NTU)	0.39	0.42	0.49	0.57	0.50
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	81.9	78.9	83.0	79.2	84.4
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	10.8	7.7	13.9	12.1	11.9
	Chloride (Cl) (mg/L)	3140	2290	3860	3680	3080
	Fluoride (F) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Nitrate (as N) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nitrite (as N) (mg/L)	0.12	<0.10	<0.10	0.18	<0.10
	Total Kjeldahl Nitrogen (mg/L)	0.075	0.070	0.088	0.085	0.101
	Sulfate (SO4) (mg/L)	438	319	547	514	435
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	1.19	1.21	1.12	1.21	1.10
Total Metals	Aluminum (Al)-Total (mg/L)	0.0106	0.0107	0.0178	0.0217	0.0093
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Total (mg/L)	0.0050	0.0046	0.0054	0.0057	0.0048
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	0.80	0.60	0.95	1.13	0.71
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Total (mg/L)	77.7	63.7	88.2	101	73.3
	Cesium (Cs)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.013	0.011	0.024	0.031	0.011
	Lead (Pb)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Total (mg/L)	0.035	0.030	0.043	0.050	0.032
	Magnesium (Mg)-Total (mg/L)	195	150	229	281	180
	Manganese (Mn)-Total (mg/L)	0.00070	0.00064	0.00094	0.00113	0.00076
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.0022	<0.0020	0.0024	0.0031	<0.0020

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1980315-1	L1980315-2	L1980315-3	L1980315-4	L1980315-5
	Description	seawater	seawater	seawater	seawater	seawater
	Sampled Date	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17
	Sampled Time	09:58	09:22	10:40	10:27	10:10
	Client ID	SOURCE	WNW	NORTH	ENE	DUP A
Grouping	**Analyte**					
SEAWATER						
Total Metals	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Potassium (K)-Total (mg/L)	61	46	71	85	56
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Total (mg/L)	0.0241	0.0182	0.0290	0.0332	0.0221
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Total (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)	1710	1300	2010	2410	1560
	Strontium (Sr)-Total (mg/L)	1.17	0.896	1.37	1.65	1.07
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Total (mg/L)	0.00158	0.000929	0.00123	0.00132	0.00152
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	0.00070	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Dissolved (mg/L)	0.0046	0.0042	0.0048	0.0048	0.0046
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	0.78	0.61	0.86	1.00	0.72
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Dissolved (mg/L)	86.2	68.2	91.8	103	77.0
	Cesium (Cs)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1980315-1	L1980315-2	L1980315-3	L1980315-4	L1980315-5
	Description	seawater	seawater	seawater	seawater	seawater
	Sampled Date	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17
	Sampled Time	09:58	09:22	10:40	10:27	10:10
	Client ID	SOURCE	WNW	NORTH	ENE	DUP A
Grouping	**Analyte**					
SEAWATER						
Dissolved Metals	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Dissolved (mg/L)	0.038	0.028	0.042	0.045	0.032
	Magnesium (Mg)-Dissolved (mg/L)	216	160	236	269	186
	Manganese (Mn)-Dissolved (mg/L)	0.00059	0.00049	0.00077	0.00059	0.00058
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.0023	<0.0020	0.0025	0.0028	0.0021
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Potassium (K)-Dissolved (mg/L)	64	47	70	80	55
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Dissolved (mg/L)	0.0226	0.0168	0.0257	0.0289	0.0215
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Dissolved (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Dissolved (mg/L)	1720	1250	1890	2170	1470
	Strontium (Sr)-Dissolved (mg/L)	1.30	0.941	1.41	1.62	1.11
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Dissolved (mg/L)	0.00145	0.000907	0.00112	0.00118	0.00144
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1980315-1	L1980315-2	L1980315-3	L1980315-4	L1980315-5
	Description	seawater	seawater	seawater	seawater	seawater
	Sampled Date	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17	22-AUG-17
	Sampled Time	09:58	09:22	10:40	10:27	10:10
	Client ID	SOURCE	WNW	NORTH	ENE	DUP A
WATER						
Hydrocarbons	EPH10-19 (mg/L)	SURR-ND <0.050	<0.050	<0.050	<0.050	<0.050
	EPH19-32 (mg/L)	SURR-ND <0.050	<0.050	<0.050	<0.050	<0.050
	LEPH (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	HEPH (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: 2-Bromobenzotrifluoride (%)	SURR-ND 58.3	62.8	63.9	62.7	69.2
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Acenaphthylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Acridine (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benz(a)anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(a)pyrene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Benzo(b&j)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(g,h,i)perylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(k)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chrysene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Dibenz(a,h)anthracene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Fluorene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Phenanthrene (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Surrogate: Acridine d9 (%)	100.4	91.6	88.6	91.7	87.9
	Surrogate: Chrysene d12 (%)	123.4	99.2	92.8	102.4	83.5
	Surrogate: Naphthalene d8 (%)	108.9	109.6	101.5	112.0	99.8
	Surrogate: Phenanthrene d10 (%)	101.6	99.6	92.9	101.8	89.9

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Bromide (Br)	MS-B	L1980315-1, -2, -3, -4, -5
Matrix Spike	Chloride (Cl)	MS-B	L1980315-1, -2, -3, -4, -5
Matrix Spike	Sulfate (SO4)	MS-B	L1980315-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L1980315-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1980315-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L1980315-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Total	MS-B	L1980315-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
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**
ALK-TITR-VA	Seawater	Alkalinity Spec by Titration (Seawater)	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-C-BR-IC-VA	Seawater	Bromide by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-CL-IC-VA	Seawater	Chloride by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-F-IC-VA	Seawater	Fluoride by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-NO2-IC-VA	Seawater	Nitrite in Seawater by IC	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-C-NO3-IC-VA	Seawater	Nitrate in Seawater by IC	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-C-SO4-IC-VA	Seawater	Sulfate by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-C-TOC-VA	Seawater	TOC by combustion (seawater)	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-C-PCT-VA	Seawater	Conductivity (Automated) (seawater)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EPH-L-ME-FID-VA	Water	EPH in Water (Low Level)	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.

HARDNESS-CALC-VA	Seawater	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-C-CVAFS-VA	Seawater	Diss. Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-C-CVAFS-VA	Seawater	Total Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

Reference Information

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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).

MET-D-L-HRMS-VA Seawater Diss. Metals in Seawater by HR-ICPMS EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-DIS-C-ICP-VA Seawater Diss. Metals in Seawater by ICPOES PUGET SOUND PROTOCOLS, EPA 6010B

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by acid digestion or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-L-HRMS-VA Seawater Tot. Metals in Seawater by HR-ICPMS EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

MET-TOT-C-ICP-VA Seawater Total Metals in Seawater by ICPOES PUGET SOUND PROTOCOLS, EPA 6010B

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by acid digestion or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA Seawater Ammonia in Seawater by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

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.

PH-C-PCT-VA Seawater pH by Meter (Automated) (seawater) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

It is recommended that this analysis be conducted in the field.

TKN-C-F-VA Seawater TKN in Seawater by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-C-VA Seawater Total Suspended Solids by Gravimetric APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) is determined by filtering a sample through a glass fibre filter. TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-C-VA Seawater Turbidity by Meter in Seawater APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Client: GOLDER ASSOCIATES LTD.
3795 Carey Road, Second Floor
Victoria bc V8Z 6T8

Contact: John Sherrin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EPH-L-ME-FID-VA	**Water**							
Batch R3808760								
WG2603277-2 LCS								
EPH10-19			76.1		%		50-150	29-AUG-17
EPH19-32			75.0		%		50-150	29-AUG-17
WG2603277-1 MB								
EPH10-19			<0.050		mg/L		0.05	29-AUG-17
EPH19-32			<0.050		mg/L		0.05	29-AUG-17
Surrogate: 2-Bromobenzotrifluoride			59.3	RRQC	%		60-140	29-AUG-17
PAH-ME-MS-VA	**Water**							
Batch R3812481								
WG2603277-2 LCS								
Acenaphthene			113.4		%		60-130	30-AUG-17
Acenaphthylene			116.7		%		60-130	30-AUG-17
Acridine			113.7		%		60-130	30-AUG-17
Anthracene			108.4		%		60-130	30-AUG-17
Benz(a)anthracene			114.9		%		60-130	30-AUG-17
Benzo(a)pyrene			111.6		%		60-130	30-AUG-17
Benzo(b&j)fluoranthene			117.4		%		60-130	30-AUG-17
Benzo(g,h,i)perylene			115.1		%		60-130	30-AUG-17
Benzo(k)fluoranthene			128.8		%		60-130	30-AUG-17
Chrysene			124.0		%		60-130	30-AUG-17
Dibenz(a,h)anthracene			111.4		%		60-130	30-AUG-17
Fluoranthene			118.0		%		60-130	30-AUG-17
Fluorene			115.0		%		60-130	30-AUG-17
Indeno(1,2,3-c,d)pyrene			111.2		%		60-130	30-AUG-17
Naphthalene			116.5		%		50-130	30-AUG-17
Phenanthrene			119.0		%		60-130	30-AUG-17
Pyrene			117.8		%		60-130	30-AUG-17
Quinoline			117.7		%		60-130	30-AUG-17
WG2603277-1 MB								
Acenaphthene			<0.000010		mg/L		0.00001	30-AUG-17
Acenaphthylene			<0.000010		mg/L		0.00001	30-AUG-17
Acridine			<0.000010		mg/L		0.00001	30-AUG-17
Anthracene			<0.000010		mg/L		0.00001	30-AUG-17
Benz(a)anthracene			<0.000010		mg/L		0.00001	30-AUG-17
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	30-AUG-17
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	30-AUG-17

ALS Environmental

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ME-MS-VA	**Water**							
Batch R3812481								
WG2603277-1 MB								
Benzo(g,h,i)perylene			<0.000010		mg/L		0.00001	30-AUG-17
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	30-AUG-17
Chrysene			<0.000010		mg/L		0.00001	30-AUG-17
Dibenz(a,h)anthracene			<0.0000050		mg/L		0.000005	30-AUG-17
Fluoranthene			<0.000010		mg/L		0.00001	30-AUG-17
Fluorene			<0.000010		mg/L		0.00001	30-AUG-17
Indeno(1,2,3-c,d)pyrene			<0.000010		mg/L		0.00001	30-AUG-17
Naphthalene			<0.000050		mg/L		0.00005	30-AUG-17
Phenanthrene			<0.000020		mg/L		0.00002	30-AUG-17
Pyrene			<0.000010		mg/L		0.00001	30-AUG-17
Quinoline			<0.000050		mg/L		0.00005	30-AUG-17
Surrogate: Acridine d9			101.1		%		60-130	30-AUG-17
Surrogate: Chrysene d12			127.9		%		60-130	30-AUG-17
Surrogate: Naphthalene d8			108.5		%		50-130	30-AUG-17
Surrogate: Phenanthrene d10			103.9		%		60-130	30-AUG-17
ALK-TITR-VA	**Seawater**							
Batch R3812968								
WG2601360-3 CRM		**VA-ALK-TITR-CONTROL**						
Alkalinity, Total (as CaCO3)			96.2		%		85-115	27-AUG-17
WG2601360-5 DUP		**L1980315-5**						
Alkalinity, Total (as CaCO3)		84.4	84.4		mg/L	0.0	20	27-AUG-17
WG2601360-1 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	27-AUG-17
ANIONS-C-BR-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-3 DUP		**L1980315-5**						
Bromide (Br)		11.9	10.0		mg/L	17	20	06-SEP-17
WG2609955-2 LCS								
Bromide (Br)			99.6		%		85-115	06-SEP-17
WG2609955-1 MB								
Bromide (Br)			<5.0		mg/L		5	06-SEP-17
WG2609955-4 MS		**L1980315-5**						
Bromide (Br)			N/A	MS-B	%		-	06-SEP-17
ANIONS-C-CL-IC-VA	**Seawater**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-CL-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-3 DUP		**L1980315-5**						
Chloride (Cl)		3080	3070		mg/L	0.3	20	06-SEP-17
WG2609955-2 LCS								
Chloride (Cl)			98.9		%		90-110	06-SEP-17
WG2609955-1 MB								
Chloride (Cl)			<50		mg/L		50	06-SEP-17
WG2609955-4 MS		**L1980315-5**						
Chloride (Cl)			N/A	MS-B	%		-	06-SEP-17
ANIONS-C-F-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-3 DUP		**L1980315-5**						
Fluoride (F)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	06-SEP-17
WG2609955-2 LCS								
Fluoride (F)			99.7		%		90-110	06-SEP-17
WG2609955-1 MB								
Fluoride (F)			<1.0		mg/L		1	06-SEP-17
ANIONS-C-NO2-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-3 DUP		**L1980315-5**						
Nitrite (as N)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	06-SEP-17
WG2609955-2 LCS								
Nitrite (as N)			97.4		%		90-110	06-SEP-17
WG2609955-1 MB								
Nitrite (as N)			<0.10		mg/L		0.1	06-SEP-17
ANIONS-C-NO3-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-3 DUP		**L1980315-5**						
Nitrate (as N)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	06-SEP-17
WG2609955-2 LCS								
Nitrate (as N)			99.5		%		90-110	06-SEP-17
WG2609955-1 MB								
Nitrate (as N)			<0.50		mg/L		0.5	06-SEP-17
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-3 DUP		**L1980315-5**						
Sulfate (SO4)		435	432		mg/L	0.7	20	06-SEP-17
WG2609955-2 LCS								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3821521								
WG2609955-2 LCS								
Sulfate (SO4)			100.3		%		90-110	06-SEP-17
WG2609955-1 MB								
Sulfate (SO4)			<30		mg/L		30	06-SEP-17
WG2609955-4 MS		**L1980315-5**						
Sulfate (SO4)			N/A	MS-B	%		-	06-SEP-17
CARBONS-C-TOC-VA	**Seawater**							
Batch R3812234								
WG2601704-4 LCS								
Total Organic Carbon			102.9		%		80-120	25-AUG-17
WG2601704-3 MB								
Total Organic Carbon			<0.50		mg/L		0.5	25-AUG-17
WG2601704-2 MS		**L1980315-1**						
Total Organic Carbon			105.8		%		70-130	25-AUG-17
EC-C-PCT-VA	**Seawater**							
Batch R3812968								
WG2601360-4 CRM		**VA-EC-PCT-CONTROL**						
Conductivity			99.0		%		90-110	27-AUG-17
WG2601360-5 DUP		**L1980315-5**						
Conductivity		9350	9260		uS/cm	1.0	10	27-AUG-17
WG2601360-1 MB								
Conductivity			<2.0		uS/cm		2	27-AUG-17
HG-DIS-C-CVAFS-VA	**Seawater**							
Batch R3816438								
WG2606175-1 MB		**LF**						
Mercury (Hg)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
HG-TOT-C-CVAFS-VA	**Seawater**							
Batch R3810278								
WG2601282-2 LCS								
Mercury (Hg)-Total			99.3		%		80-120	25-AUG-17
WG2601282-1 MB								
Mercury (Hg)-Total			<0.000010		mg/L		0.00001	25-AUG-17
MET-D-L-HRMS-VA	**Seawater**							

ALS Environmental

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3816373								
WG2603544-1 MB		**LF**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	30-AUG-17
Antimony (Sb)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	30-AUG-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	30-AUG-17
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Bismuth (Bi)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	30-AUG-17
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	30-AUG-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	30-AUG-17
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	30-AUG-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	30-AUG-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	30-AUG-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	30-AUG-17
Molybdenum (Mo)-Dissolved			<0.0020		mg/L		0.002	30-AUG-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	30-AUG-17
Rhenium (Re)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	30-AUG-17
Selenium (Se)-Dissolved			<0.0020		mg/L		0.002	30-AUG-17
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	30-AUG-17
Tellurium (Te)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	30-AUG-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	30-AUG-17
Titanium (Ti)-Dissolved			<0.0050		mg/L		0.005	30-AUG-17
Tungsten (W)-Dissolved			<0.0010		mg/L		0.001	30-AUG-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	30-AUG-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Yttrium (Y)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17
Zirconium (Zr)-Dissolved			<0.00050		mg/L		0.0005	30-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817205								
WG2603544-1 MB		**LF**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Antimony (Sb)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
Antimony (Sb)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	31-AUG-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	31-AUG-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Beryllium (Be)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Beryllium (Be)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	31-AUG-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	31-AUG-17
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	31-AUG-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	31-AUG-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	31-AUG-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	31-AUG-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	31-AUG-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	31-AUG-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817205								
WG2603544-1 MB		**LF**						
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	31-AUG-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	31-AUG-17
Rhenium (Re)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Rhenium (Re)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	31-AUG-17
Selenium (Se)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Selenium (Se)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Silver (Ag)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Silver (Ag)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Tellurium (Te)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
Tellurium (Te)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	31-AUG-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Titanium (Ti)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Titanium (Ti)-Dissolved			<0.00020		mg/L		0.0002	31-AUG-17
Tungsten (W)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
Tungsten (W)-Dissolved			<0.000010		mg/L		0.00001	31-AUG-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Vanadium (V)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Vanadium (V)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Yttrium (Y)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Yttrium (Y)-Dissolved			<0.0000050		mg/L		0.000005	31-AUG-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	31-AUG-17

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817205								
WG2603544-1 MB		**LF**						
Zirconium (Zr)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Zirconium (Zr)-Dissolved			<0.000050		mg/L		0.00005	31-AUG-17
Batch R3817440								
WG2603544-2 LCS								
Aluminum (Al)-Dissolved			91.1		%		80-120	01-SEP-17
Aluminum (Al)-Dissolved			91.1		%		80-120	01-SEP-17
Arsenic (As)-Dissolved			95.0		%		80-120	01-SEP-17
Arsenic (As)-Dissolved			95.0		%		80-120	01-SEP-17
Barium (Ba)-Dissolved			93.2		%		80-120	01-SEP-17
Barium (Ba)-Dissolved			93.2		%		80-120	01-SEP-17
Beryllium (Be)-Dissolved			92.0		%		80-120	01-SEP-17
Beryllium (Be)-Dissolved			92.0		%		80-120	01-SEP-17
Bismuth (Bi)-Dissolved			97.3		%		80-120	01-SEP-17
Bismuth (Bi)-Dissolved			97.3		%		80-120	01-SEP-17
Boron (B)-Dissolved			103.4		%		80-120	01-SEP-17
Boron (B)-Dissolved			103.4		%		80-120	01-SEP-17
Cadmium (Cd)-Dissolved			90.9		%		80-120	01-SEP-17
Cadmium (Cd)-Dissolved			90.9		%		80-120	01-SEP-17
Cesium (Cs)-Dissolved			93.0		%		80-120	01-SEP-17
Cesium (Cs)-Dissolved			93.0		%		80-120	01-SEP-17
Chromium (Cr)-Dissolved			96.8		%		80-120	01-SEP-17
Chromium (Cr)-Dissolved			96.8		%		80-120	01-SEP-17
Cobalt (Co)-Dissolved			96.0		%		80-120	01-SEP-17
Cobalt (Co)-Dissolved			96.0		%		80-120	01-SEP-17
Copper (Cu)-Dissolved			88.0		%		80-120	01-SEP-17
Copper (Cu)-Dissolved			88.0		%		80-120	01-SEP-17
Gallium (Ga)-Dissolved			96.0		%		80-120	01-SEP-17
Gallium (Ga)-Dissolved			96.0		%		80-120	01-SEP-17
Iron (Fe)-Dissolved			96.7		%		80-120	01-SEP-17
Iron (Fe)-Dissolved			96.7		%		80-120	01-SEP-17
Lead (Pb)-Dissolved			87.5		%		80-120	01-SEP-17
Lead (Pb)-Dissolved			87.5		%		80-120	01-SEP-17
Lithium (Li)-Dissolved			109.6		%		80-120	01-SEP-17
Lithium (Li)-Dissolved			109.6		%		80-120	01-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817440								
WG2603544-2 LCS								
Manganese (Mn)-Dissolved			103.7		%		80-120	01-SEP-17
Manganese (Mn)-Dissolved			103.7		%		80-120	01-SEP-17
Molybdenum (Mo)-Dissolved			89.2		%		80-120	01-SEP-17
Molybdenum (Mo)-Dissolved			89.2		%		80-120	01-SEP-17
Nickel (Ni)-Dissolved			98.4		%		80-120	01-SEP-17
Nickel (Ni)-Dissolved			98.4		%		80-120	01-SEP-17
Phosphorus (P)-Dissolved			116.4		%		80-120	01-SEP-17
Phosphorus (P)-Dissolved			116.4		%		80-120	01-SEP-17
Rhenium (Re)-Dissolved			96.6		%		80-120	01-SEP-17
Rhenium (Re)-Dissolved			96.6		%		80-120	01-SEP-17
Rubidium (Rb)-Dissolved			109.4		%		80-120	01-SEP-17
Rubidium (Rb)-Dissolved			109.4		%		80-120	01-SEP-17
Selenium (Se)-Dissolved			99.3		%		80-120	01-SEP-17
Selenium (Se)-Dissolved			99.3		%		80-120	01-SEP-17
Silver (Ag)-Dissolved			88.2		%		80-120	01-SEP-17
Silver (Ag)-Dissolved			88.2		%		80-120	01-SEP-17
Tellurium (Te)-Dissolved			86.1		%		80-120	01-SEP-17
Tellurium (Te)-Dissolved			86.1		%		80-120	01-SEP-17
Thallium (Tl)-Dissolved			81.3		%		80-120	01-SEP-17
Thallium (Tl)-Dissolved			81.3		%		80-120	01-SEP-17
Thorium (Th)-Dissolved			118.9		%		80-120	01-SEP-17
Thorium (Th)-Dissolved			118.9		%		80-120	01-SEP-17
Tin (Sn)-Dissolved			104.9		%		80-120	01-SEP-17
Tin (Sn)-Dissolved			104.9		%		80-120	01-SEP-17
Titanium (Ti)-Dissolved			98.8		%		80-120	01-SEP-17
Titanium (Ti)-Dissolved			98.8		%		80-120	01-SEP-17
Tungsten (W)-Dissolved			92.3		%		80-120	01-SEP-17
Tungsten (W)-Dissolved			92.3		%		80-120	01-SEP-17
Uranium (U)-Dissolved			89.0		%		80-120	01-SEP-17
Uranium (U)-Dissolved			89.0		%		80-120	01-SEP-17
Vanadium (V)-Dissolved			95.0		%		80-120	01-SEP-17
Vanadium (V)-Dissolved			95.0		%		80-120	01-SEP-17
Yttrium (Y)-Dissolved			114.8		%		80-120	01-SEP-17
Yttrium (Y)-Dissolved			114.8		%		80-120	01-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3817440								
WG2603544-2 LCS								
Zinc (Zn)-Dissolved			87.0		%		80-120	01-SEP-17
Zinc (Zn)-Dissolved			87.0		%		80-120	01-SEP-17
Zirconium (Zr)-Dissolved			114.0		%		80-120	01-SEP-17
Zirconium (Zr)-Dissolved			114.0		%		80-120	01-SEP-17
Batch R3820092								
WG2603544-3 DUP		**L1980315-5**						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	02-SEP-17
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Arsenic (As)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	02-SEP-17
Barium (Ba)-Dissolved		0.0046	0.0045		mg/L	3.7	20	02-SEP-17
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Bismuth (Bi)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Boron (B)-Dissolved		0.72	0.71		mg/L	0.8	20	02-SEP-17
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-SEP-17
Cesium (Cs)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Cobalt (Co)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-SEP-17
Copper (Cu)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Gallium (Ga)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	02-SEP-17
Lead (Pb)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	02-SEP-17
Lithium (Li)-Dissolved		0.032	0.031		mg/L	3.0	20	02-SEP-17
Manganese (Mn)-Dissolved		0.00058	0.00052		mg/L	11	20	02-SEP-17
Molybdenum (Mo)-Dissolved		0.0021	<0.0020	RPD-NA	mg/L	N/A	20	02-SEP-17
Nickel (Ni)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Phosphorus (P)-Dissolved		<1.0	<1.0	RPD-NA	mg/L	N/A	20	02-SEP-17
Rhenium (Re)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Rubidium (Rb)-Dissolved		0.0215	0.0214		mg/L	0.4	20	02-SEP-17
Selenium (Se)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	02-SEP-17
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-SEP-17
Tellurium (Te)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-SEP-17
Thorium (Th)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Tin (Sn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	02-SEP-17

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3820092								
WG2603544-3 DUP		**L1980315-5**						
Titanium (Ti)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	02-SEP-17
Tungsten (W)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	02-SEP-17
Uranium (U)-Dissolved		0.00144	0.00146		mg/L	1.6	20	02-SEP-17
Vanadium (V)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Yttrium (Y)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Zinc (Zn)-Dissolved		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	02-SEP-17
Zirconium (Zr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Batch R3821052								
WG2603544-2 LCS								
Antimony (Sb)-Dissolved			91.0		%		80-120	05-SEP-17
Antimony (Sb)-Dissolved			91.0		%		80-120	05-SEP-17
MET-DIS-C-ICP-VA	**Seawater**							
Batch R3814123								
WG2603544-2 LCS								
Calcium (Ca)-Dissolved			97.7		%		80-120	29-AUG-17
Magnesium (Mg)-Dissolved			98.0		%		80-120	29-AUG-17
Potassium (K)-Dissolved			98.4		%		80-120	29-AUG-17
Silicon (Si)-Dissolved			100.6		%		80-120	29-AUG-17
Sodium (Na)-Dissolved			104.6		%		80-120	29-AUG-17
Strontium (Sr)-Dissolved			105.2		%		80-120	29-AUG-17
WG2603544-1 MB		**LF**						
Calcium (Ca)-Dissolved			<0.50		mg/L		0.5	29-AUG-17
Magnesium (Mg)-Dissolved			<1.0		mg/L		1	29-AUG-17
Potassium (K)-Dissolved			<20		mg/L		20	29-AUG-17
Silicon (Si)-Dissolved			<0.50		mg/L		0.5	29-AUG-17
Sodium (Na)-Dissolved			<20		mg/L		20	29-AUG-17
Strontium (Sr)-Dissolved			<0.050		mg/L		0.05	29-AUG-17
Batch R3814180								
WG2603544-3 DUP		**L1980315-5**						
Calcium (Ca)-Dissolved		77.0	78.7		mg/L	2.2	20	29-AUG-17
Magnesium (Mg)-Dissolved		186	191		mg/L	2.7	20	29-AUG-17
Potassium (K)-Dissolved		55	56		mg/L	3.1	20	29-AUG-17
Silicon (Si)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	29-AUG-17
Sodium (Na)-Dissolved		1470	1510		mg/L	2.6	20	29-AUG-17
Strontium (Sr)-Dissolved		1.11	1.13		mg/L	2.5	20	29-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3816356								
WG2601022-2 LCS								
Aluminum (Al)-Total			81.6		%		80-120	29-AUG-17
Aluminum (Al)-Total			81.6		%		80-120	29-AUG-17
Antimony (Sb)-Total			81.7		%		80-120	29-AUG-17
Antimony (Sb)-Total			81.7		%		80-120	29-AUG-17
Arsenic (As)-Total			105.0		%		80-120	29-AUG-17
Arsenic (As)-Total			105.0		%		80-120	29-AUG-17
Barium (Ba)-Total			92.8		%		80-120	29-AUG-17
Barium (Ba)-Total			92.8		%		80-120	29-AUG-17
Beryllium (Be)-Total			95.9		%		80-120	29-AUG-17
Beryllium (Be)-Total			95.9		%		80-120	29-AUG-17
Bismuth (Bi)-Total			100.0		%		80-120	29-AUG-17
Bismuth (Bi)-Total			100.0		%		80-120	29-AUG-17
Boron (B)-Total			115.0		%		80-120	29-AUG-17
Boron (B)-Total			115.0		%		80-120	29-AUG-17
Cadmium (Cd)-Total			96.6		%		80-120	29-AUG-17
Cadmium (Cd)-Total			96.6		%		80-120	29-AUG-17
Cesium (Cs)-Total			97.8		%		80-120	29-AUG-17
Cesium (Cs)-Total			97.8		%		80-120	29-AUG-17
Chromium (Cr)-Total			104.6		%		80-120	29-AUG-17
Chromium (Cr)-Total			104.6		%		80-120	29-AUG-17
Cobalt (Co)-Total			92.3		%		80-120	29-AUG-17
Cobalt (Co)-Total			92.3		%		80-120	29-AUG-17
Copper (Cu)-Total			100.9		%		80-120	29-AUG-17
Copper (Cu)-Total			100.9		%		80-120	29-AUG-17
Gallium (Ga)-Total			92.5		%		80-120	29-AUG-17
Gallium (Ga)-Total			92.5		%		80-120	29-AUG-17
Iron (Fe)-Total			106.1		%		80-120	29-AUG-17
Iron (Fe)-Total			106.1		%		80-120	29-AUG-17
Lead (Pb)-Total			101.6		%		80-120	29-AUG-17
Lead (Pb)-Total			101.6		%		80-120	29-AUG-17
Lithium (Li)-Total			105.0		%		80-120	29-AUG-17
Lithium (Li)-Total			105.0		%		80-120	29-AUG-17
Manganese (Mn)-Total			99.4		%		80-120	29-AUG-17
Manganese (Mn)-Total			99.4		%		80-120	29-AUG-17

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3816356								
WG2601022-2 LCS								
Molybdenum (Mo)-Total			88.5		%		80-120	29-AUG-17
Molybdenum (Mo)-Total			88.5		%		80-120	29-AUG-17
Nickel (Ni)-Total			95.3		%		80-120	29-AUG-17
Nickel (Ni)-Total			95.3		%		80-120	29-AUG-17
Phosphorus (P)-Total			113.2		%		80-120	29-AUG-17
Phosphorus (P)-Total			113.2		%		80-120	29-AUG-17
Rhenium (Re)-Total			97.4		%		80-120	29-AUG-17
Rhenium (Re)-Total			97.4		%		80-120	29-AUG-17
Rubidium (Rb)-Total			96.9		%		80-120	29-AUG-17
Rubidium (Rb)-Total			96.9		%		80-120	29-AUG-17
Selenium (Se)-Total			103.5		%		80-120	29-AUG-17
Selenium (Se)-Total			103.5		%		80-120	29-AUG-17
Silver (Ag)-Total			91.3		%		80-120	29-AUG-17
Silver (Ag)-Total			91.3		%		80-120	29-AUG-17
Tellurium (Te)-Total			92.2		%		80-120	29-AUG-17
Tellurium (Te)-Total			92.2		%		80-120	29-AUG-17
Thallium (Tl)-Total			92.7		%		80-120	29-AUG-17
Thallium (Tl)-Total			92.7		%		80-120	29-AUG-17
Thorium (Th)-Total			116.3		%		80-120	29-AUG-17
Thorium (Th)-Total			116.3		%		80-120	29-AUG-17
Tin (Sn)-Total			103.6		%		80-120	29-AUG-17
Tin (Sn)-Total			103.6		%		80-120	29-AUG-17
Titanium (Ti)-Total			99.6		%		80-120	29-AUG-17
Titanium (Ti)-Total			99.6		%		80-120	29-AUG-17
Tungsten (W)-Total			104.8		%		80-120	29-AUG-17
Tungsten (W)-Total			104.8		%		80-120	29-AUG-17
Uranium (U)-Total			93.6		%		80-120	29-AUG-17
Uranium (U)-Total			93.6		%		80-120	29-AUG-17
Vanadium (V)-Total			93.5		%		80-120	29-AUG-17
Vanadium (V)-Total			93.5		%		80-120	29-AUG-17
Yttrium (Y)-Total			99.3		%		80-120	29-AUG-17
Yttrium (Y)-Total			99.3		%		80-120	29-AUG-17
Zinc (Zn)-Total			94.7		%		80-120	29-AUG-17
Zinc (Zn)-Total			94.7		%		80-120	29-AUG-17

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3816356								
WG2601022-2 LCS								
Zirconium (Zr)-Total			104.0		%		80-120	29-AUG-17
Zirconium (Zr)-Total			104.0		%		80-120	29-AUG-17
WG2601022-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	29-AUG-17
Aluminum (Al)-Total			<0.0050		mg/L		0.005	29-AUG-17
Antimony (Sb)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Antimony (Sb)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Arsenic (As)-Total			<0.0020		mg/L		0.002	29-AUG-17
Arsenic (As)-Total			<0.0020		mg/L		0.002	29-AUG-17
Barium (Ba)-Total			<0.0010		mg/L		0.001	29-AUG-17
Barium (Ba)-Total			<0.0010		mg/L		0.001	29-AUG-17
Beryllium (Be)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Beryllium (Be)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Boron (B)-Total			<0.10		mg/L		0.1	29-AUG-17
Boron (B)-Total			<0.10		mg/L		0.1	29-AUG-17
Cadmium (Cd)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Cadmium (Cd)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Cesium (Cs)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Cesium (Cs)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Gallium (Ga)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Gallium (Ga)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Iron (Fe)-Total			<0.010		mg/L		0.01	29-AUG-17
Iron (Fe)-Total			<0.010		mg/L		0.01	29-AUG-17
Lead (Pb)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Lead (Pb)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Lithium (Li)-Total			<0.020		mg/L		0.02	29-AUG-17

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3816356								
WG2601022-1 MB								
Lithium (Li)-Total			<0.020		mg/L		0.02	29-AUG-17
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	29-AUG-17
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	29-AUG-17
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	29-AUG-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	29-AUG-17
Rhenium (Re)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Rhenium (Re)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Rubidium (Rb)-Total			<0.0050		mg/L		0.005	29-AUG-17
Rubidium (Rb)-Total			<0.0050		mg/L		0.005	29-AUG-17
Selenium (Se)-Total			<0.00020		mg/L		0.0002	29-AUG-17
Selenium (Se)-Total			<0.00020		mg/L		0.0002	29-AUG-17
Silver (Ag)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Silver (Ag)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Tellurium (Te)-Total			<0.000010		mg/L		0.00001	29-AUG-17
Tellurium (Te)-Total			<0.000010		mg/L		0.00001	29-AUG-17
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Thorium (Th)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Thorium (Th)-Total			<0.0000050		mg/L		0.000005	29-AUG-17
Tin (Sn)-Total			<0.0010		mg/L		0.001	29-AUG-17
Tin (Sn)-Total			<0.0010		mg/L		0.001	29-AUG-17
Titanium (Ti)-Total			<0.00020		mg/L		0.0002	29-AUG-17
Titanium (Ti)-Total			<0.00020		mg/L		0.0002	29-AUG-17
Tungsten (W)-Total			<0.0010		mg/L		0.001	29-AUG-17
Tungsten (W)-Total			<0.0010		mg/L		0.001	29-AUG-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	29-AUG-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Yttrium (Y)-Total			<0.00050		mg/L		0.0005	29-AUG-17

ALS Environmental

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3816356								
WG2601022-1 MB								
Yttrium (Y)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	29-AUG-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	29-AUG-17
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	29-AUG-17
Batch R3820092								
WG2601022-3 DUP		**L1980315-1**						
Aluminum (Al)-Total		0.0106	0.0129	J	mg/L	0.0024	0.01	02-SEP-17
Antimony (Sb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Arsenic (As)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	02-SEP-17
Barium (Ba)-Total		0.0050	0.0051		mg/L	1.8	20	02-SEP-17
Beryllium (Be)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Bismuth (Bi)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Boron (B)-Total		0.80	0.79		mg/L	0.6	20	02-SEP-17
Cadmium (Cd)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-SEP-17
Cesium (Cs)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Cobalt (Co)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-SEP-17
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Gallium (Ga)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Iron (Fe)-Total		0.013	0.012		mg/L	6.3	20	02-SEP-17
Lead (Pb)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	02-SEP-17
Lithium (Li)-Total		0.035	0.035		mg/L	2.1	20	02-SEP-17
Manganese (Mn)-Total		0.00070	0.00075		mg/L	6.3	20	02-SEP-17
Molybdenum (Mo)-Total		0.0022	0.0022		mg/L	1.1	20	02-SEP-17
Nickel (Ni)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Phosphorus (P)-Total		<1.0	<1.0	RPD-NA	mg/L	N/A	20	02-SEP-17
Rhenium (Re)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Rubidium (Rb)-Total		0.0241	0.0247		mg/L	2.5	20	02-SEP-17
Selenium (Se)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	02-SEP-17
Silver (Ag)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-SEP-17
Tellurium (Te)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Thallium (Tl)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-SEP-17
Thorium (Th)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3820092								
WG2601022-3 DUP		**L1980315-1**						
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	02-SEP-17
Titanium (Ti)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	02-SEP-17
Tungsten (W)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	02-SEP-17
Uranium (U)-Total		0.00158	0.00160		mg/L	0.9	20	02-SEP-17
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Yttrium (Y)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	02-SEP-17
Zirconium (Zr)-Total		0.00070	<0.00050	RPD-NA	mg/L	N/A	20	02-SEP-17
MET-TOT-C-ICP-VA	**Seawater**							
Batch R3811788								
WG2601022-3 DUP		**L1980315-1**						
Calcium (Ca)-Total		77.7	77.3		mg/L	0.5	20	25-AUG-17
Magnesium (Mg)-Total		195	193		mg/L	0.8	20	25-AUG-17
Potassium (K)-Total		61	60		mg/L	1.2	20	25-AUG-17
Silicon (Si)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	20	25-AUG-17
Sodium (Na)-Total		1710	1690		mg/L	1.4	20	25-AUG-17
Strontium (Sr)-Total		1.17	1.16		mg/L	1.2	20	25-AUG-17
WG2601022-2 LCS								
Calcium (Ca)-Total			92.2		%		80-120	25-AUG-17
Magnesium (Mg)-Total			92.5		%		80-120	25-AUG-17
Potassium (K)-Total			94.7		%		80-120	25-AUG-17
Silicon (Si)-Total			95.6		%		80-120	25-AUG-17
Sodium (Na)-Total			98.7		%		80-120	25-AUG-17
Strontium (Sr)-Total			93.6		%		80-120	25-AUG-17
WG2601022-1 MB								
Calcium (Ca)-Total			<0.50		mg/L		0.5	25-AUG-17
Magnesium (Mg)-Total			<1.0		mg/L		1	25-AUG-17
Potassium (K)-Total			<20		mg/L		20	25-AUG-17
Silicon (Si)-Total			<0.50		mg/L		0.5	25-AUG-17
Sodium (Na)-Total			<20		mg/L		20	25-AUG-17
Strontium (Sr)-Total			<0.050		mg/L		0.05	25-AUG-17
NH3-F-VA	**Seawater**							

Quality Control Report

Workorder: L1980315 Report Date: 07-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-VA	**Seawater**							
Batch R3812568								
WG2601383-2 LCS								
Ammonia, Total (as N)			97.1		%		85-115	26-AUG-17
WG2601383-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	26-AUG-17
PH-C-PCT-VA	**Seawater**							
Batch R3812968								
WG2601360-2 CRM		**VA-PH7-BUF**						
pH			7.02		pH		6.9-7.1	27-AUG-17
WG2601360-5 DUP		**L1980315-5**						
pH		7.96	7.96	J	pH	0.00	0.3	27-AUG-17
TKN-C-F-VA	**Seawater**							
Batch R3813783								
WG2602440-2 LCS								
Total Kjeldahl Nitrogen			97.9		%		75-125	29-AUG-17
WG2602440-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	29-AUG-17
TSS-C-VA	**Seawater**							
Batch R3821051								
WG2609469-2 LCS								
Total Suspended Solids			97.7		%		85-115	06-SEP-17
WG2609469-1 MB								
Total Suspended Solids			<2.0		mg/L		2	06-SEP-17
TURBIDITY-C-VA	**Seawater**							
Batch R3809321								
WG2600893-2 CRM		**VA-FORM-40**						
Turbidity			98.3		%		85-115	24-AUG-17
WG2600893-3 DUP		**L1980315-2**						
Turbidity		0.42	0.42		NTU	0.2	15	24-AUG-17
WG2600893-1 MB								
Turbidity			<0.10		NTU		0.1	24-AUG-17

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
RRQC	Refer to report remarks for information regarding this QC result.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Total Suspended Solids by Gravimetric							
	1	22-AUG-17 09:58	06-SEP-17 09:42	7	15	days	EHT
	2	22-AUG-17 09:22	06-SEP-17 09:42	7	15	days	EHT
	3	22-AUG-17 10:40	06-SEP-17 09:42	7	15	days	EHT
	4	22-AUG-17 10:27	06-SEP-17 09:42	7	15	days	EHT
	5	22-AUG-17 10:10	06-SEP-17 09:42	7	15	days	EHT
pH by Meter (Automated) (seawater)							
	1	22-AUG-17 09:58	27-AUG-17 08:36	0.25	119	hours	EHTR-FM
	2	22-AUG-17 09:22	27-AUG-17 08:36	0.25	119	hours	EHTR-FM
	3	22-AUG-17 10:40	27-AUG-17 08:36	0.25	118	hours	EHTR-FM
	4	22-AUG-17 10:27	27-AUG-17 08:36	0.25	118	hours	EHTR-FM
	5	22-AUG-17 10:10	27-AUG-17 08:36	0.25	118	hours	EHTR-FM
Anions and Nutrients							
Nitrate in Seawater by IC							
	1	22-AUG-17 09:58	06-SEP-17 17:18	3	15	days	EHT
	2	22-AUG-17 09:22	06-SEP-17 17:18	3	15	days	EHTL
	3	22-AUG-17 10:40	06-SEP-17 17:18	3	15	days	EHT
	4	22-AUG-17 10:27	06-SEP-17 17:18	3	15	days	EHT
	5	22-AUG-17 10:10	06-SEP-17 17:18	3	15	days	EHT
Nitrite in Seawater by IC							
	1	22-AUG-17 09:58	06-SEP-17 17:18	3	15	days	EHT
	2	22-AUG-17 09:22	06-SEP-17 17:18	3	15	days	EHTL
	3	22-AUG-17 10:40	06-SEP-17 17:18	3	15	days	EHT
	4	22-AUG-17 10:27	06-SEP-17 17:18	3	15	days	EHT
	5	22-AUG-17 10:10	06-SEP-17 17:18	3	15	days	EHT

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1980315 were received on 24-AUG-17 09:05.

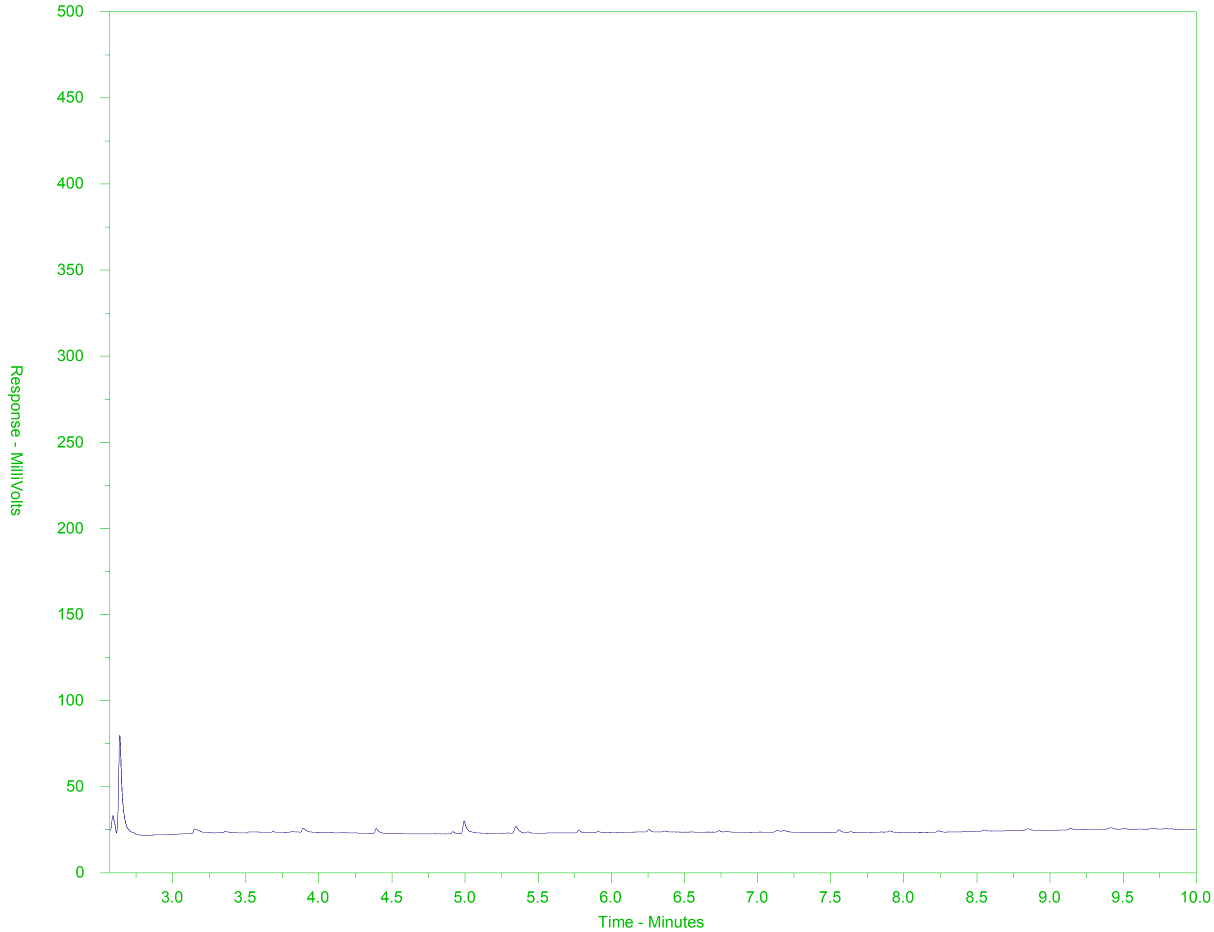
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1980315-L-1
Client Sample ID: SOURCE



← 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.

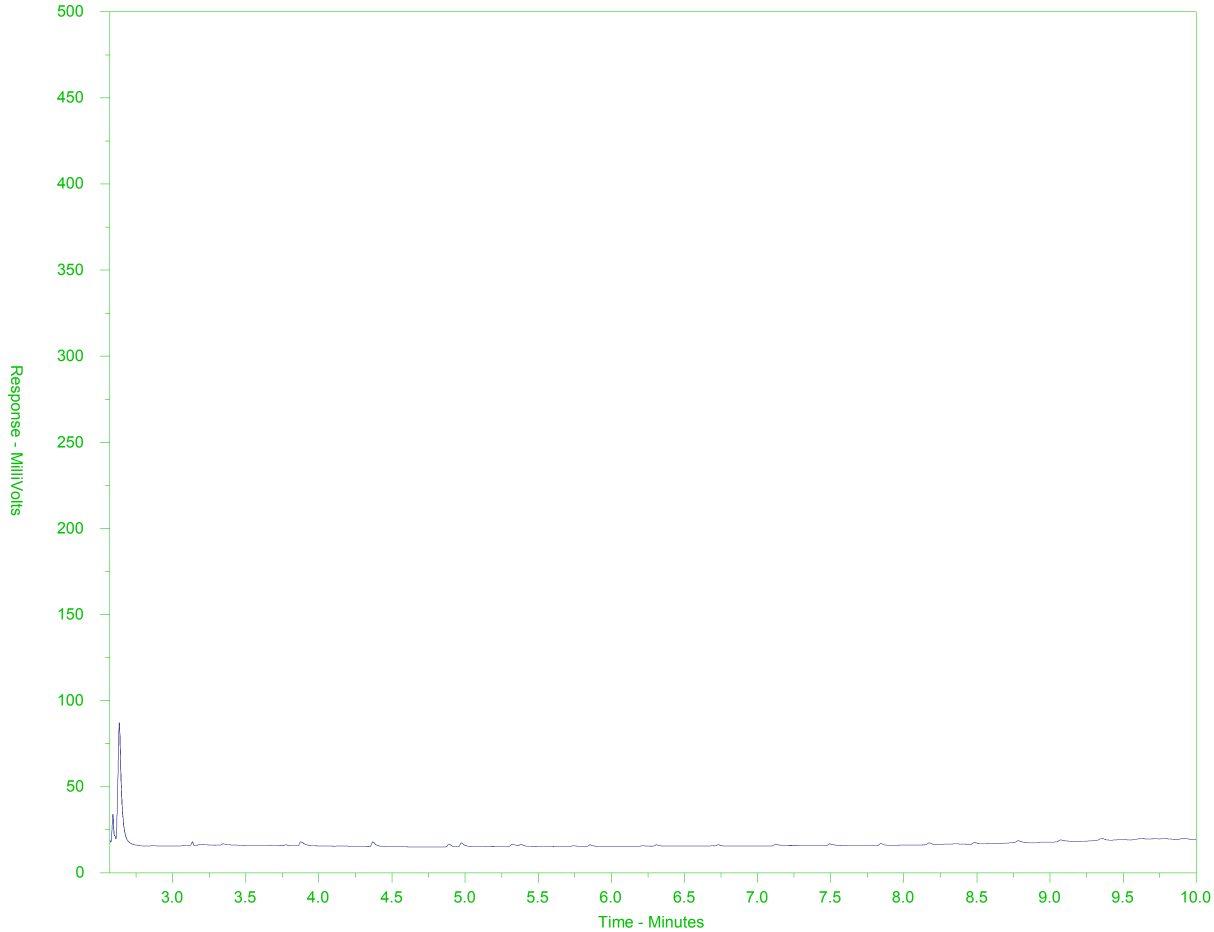
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1980315-L-2
Client Sample ID: WNW



← 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.

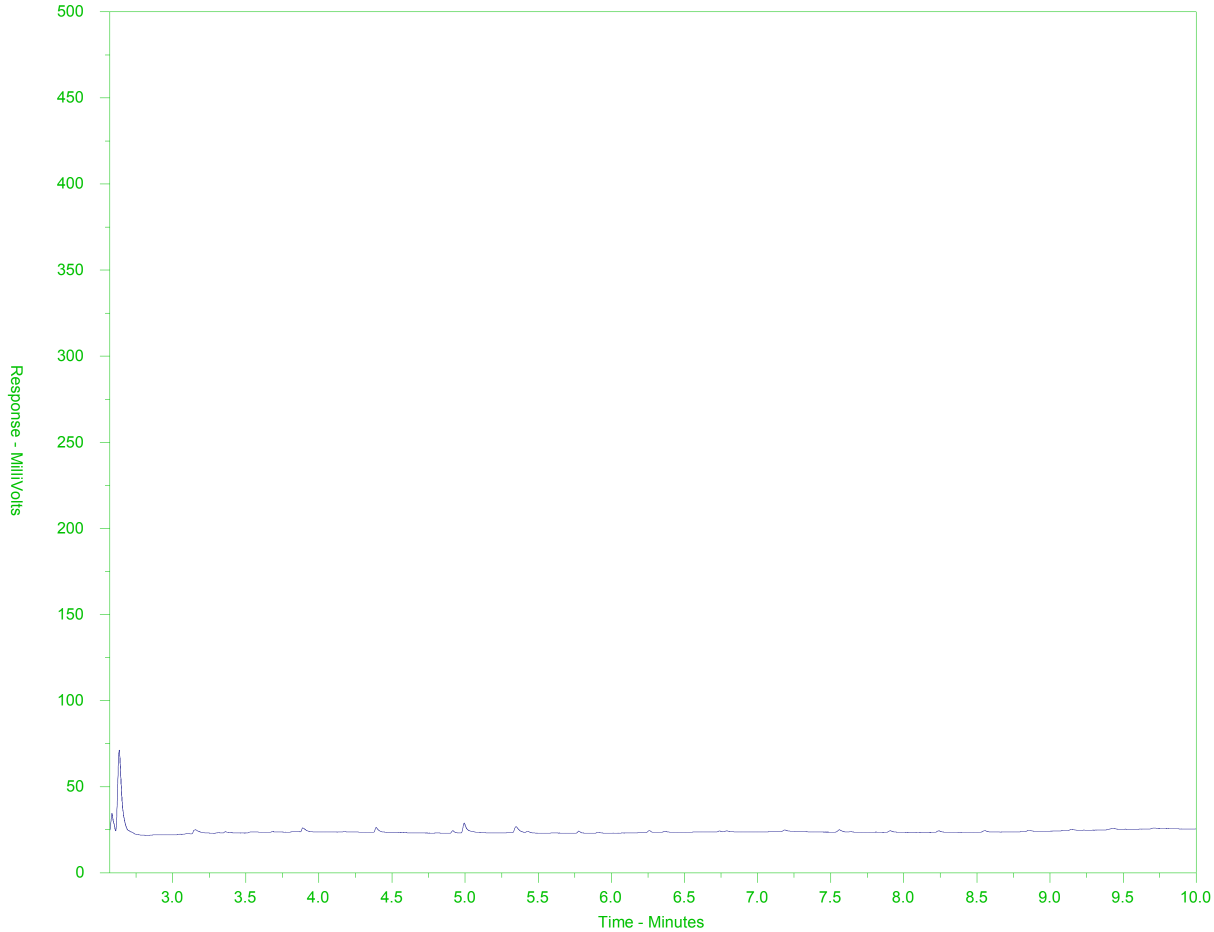
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1980315-L-3
Client Sample ID: NORTH



← 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.

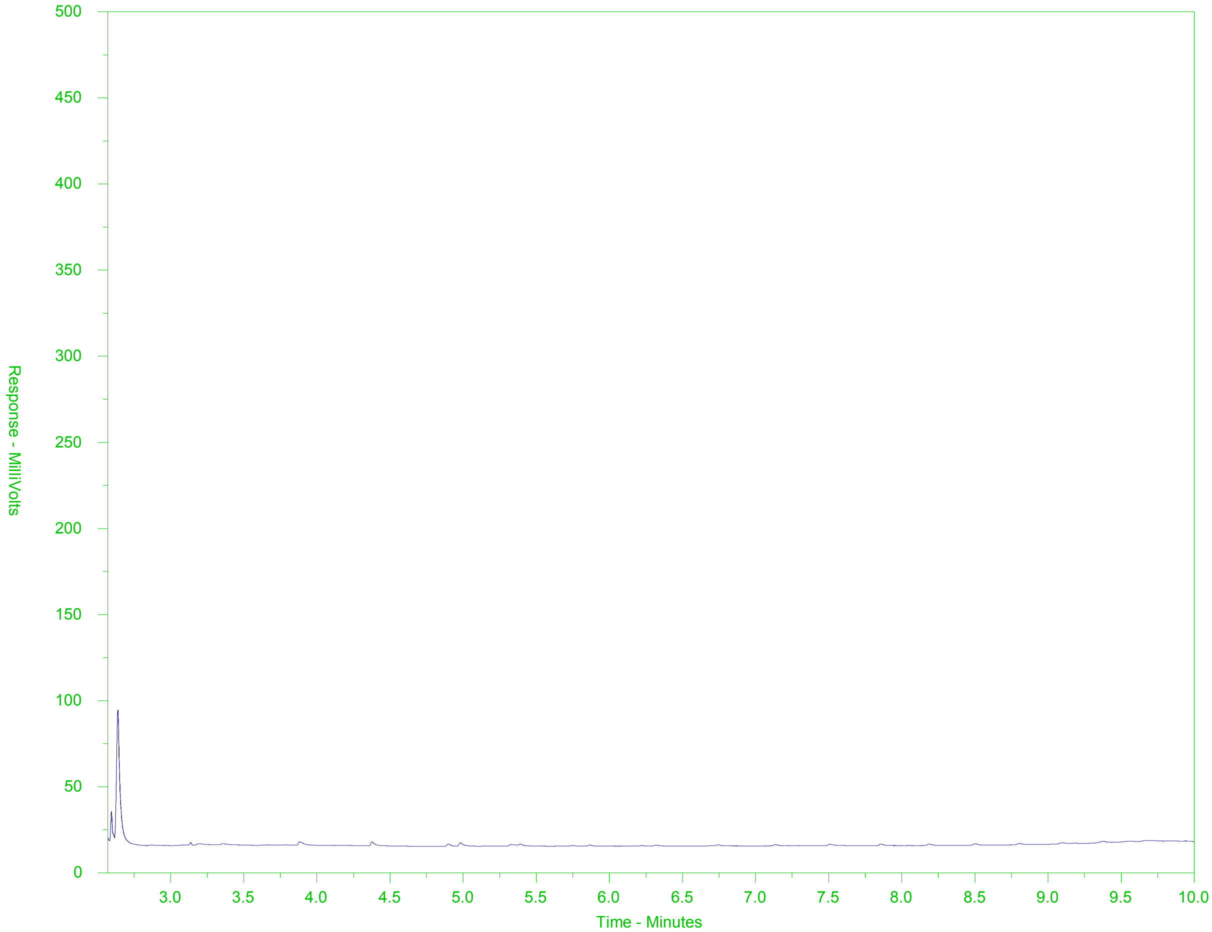
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1980315-L-4
Client Sample ID: ENE



← 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.

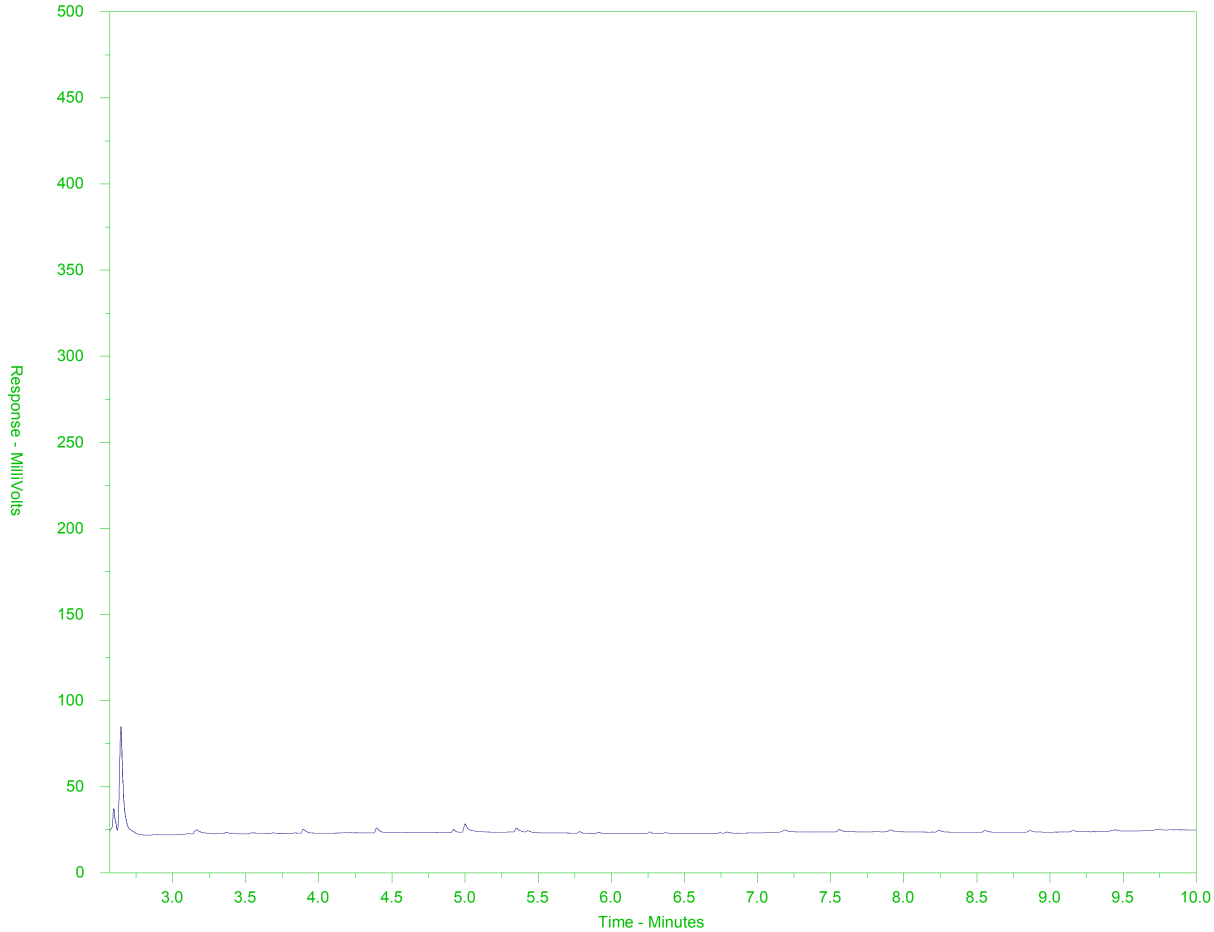
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1980315-L-5
Client Sample ID: DUP A



← 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.

APPENDIX B-1
WATER ANALYTICAL DATA

Chain of Custody (COC) / Analytical Request Form

L1980315-COFC

COC Number: 15 - XXXXXX

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To — Contact and company name below will appear on the final report

Company:	Golder Associatex Ltd.
Contact:	John Sherrin / Arman Ospan
Phone:	1 (250) 881 7372

Company address below will appear on the final report

Street:	2nd floor 3795 Carey Rd.
City/Province:	Victoria BC
Postal Code:	V8Z 6T8

Invoice To

Same as Report To	☑ YES ☐ NO
Copy of Invoice with Report	☐ YES ☑ NO
Company:	
Contact:	

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	jsherrin@golder.com
Email 2	aospan@golder.com
Email 3	mspani@golder.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax	
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:

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

Project Information

ALS Account # / Quote #:	BR191034
Job #:	1663724/10000/1003
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:

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	General (pH, Alkalinity, Turbidity, Conductivity, Anions, TSS)	TOC, Ammonia, TKN (P)	Dissolved Metals	Total Metals (P)	Dissolved Mercury	Total Mercury (P)	Hydrocarbons (PAH/LEPH/HEPH) (P)	Fecal Coliforms (P)	Number of Containers
	Source	22-Aug-17	9:58	Seawater	X	X	X	X	X	X	X	X	9
	WNW	22-Aug-17	9:22	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	North	22-Aug-17	10:40	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	ENE	22-Aug-17	10:27	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	DUP A	22-Aug-17	10:10	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9

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)

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: 5.4 8.5

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Michelle Spani	Date: Aug 22 2017	13:30	Received by: Shaun	Date: Aug 24	Time: 905	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**.

GOLDER ASSOCIATES LTD.
ATTN: John Sherrin
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8

Date Received: 06-SEP-17
Report Date: 29-SEP-17 14:08 (MT)
Version: FINAL

Client Phone: 250-881-7372

Certificate of Analysis

Lab Work Order #: L1986378
Project P.O. #: NOT SUBMITTED
Job Reference: 1663724/10000/1003
C of C Numbers:
Legal Site Desc:

Comments:

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1986378-1	L1986378-2	L1986378-3	L1986378-4	
	Description	Seawater	Seawater	Seawater	Seawater	
	Sampled Date	31-AUG-17	31-AUG-17	31-AUG-17	31-AUG-17	
	Sampled Time	10:54	10:21	10:10	10:33	
	Client ID	SOURCE	WNW	NORTH	ENE	
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Conductivity (uS/cm)	36800	36500	37000	36800	
	Hardness (as CaCO3) (mg/L)	4070	4050	4150	3940	
	pH (pH)	7.90	7.89	7.91	7.90	
	Turbidity (NTU)	0.34	0.27	0.39	0.39	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	95.5	97.7	95.9	97.3	
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Bromide (Br) (mg/L)	43.9	43.5	45.7	44.8	
	Chloride (Cl) (mg/L)	12600	12500	13200	12900	
	Fluoride (F) (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Nitrate (as N) (mg/L)	<0.50	<0.50	<0.50	<0.50	
	Nitrite (as N) (mg/L)	<0.10	<0.10	<0.10	<0.10	
	Total Kjeldahl Nitrogen (mg/L)	0.068	0.066	0.061	0.073	
	Sulfate (SO4) (mg/L)	1790	1770	1870	1830	
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	1.08	1.07	1.22	1.17	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0111	0.0291	0.0077	0.0077	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Barium (Ba)-Total (mg/L)	0.0085	0.0084	0.0084	0.0079	
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Total (mg/L)	3.24	3.32	3.48	3.20	
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Calcium (Ca)-Total (mg/L)	306	309	335	312	
	Cesium (Cs)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Cobalt (Co)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	0.00091	<0.00050	
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	<0.010	0.010	<0.010	<0.010	
	Lead (Pb)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	
	Lithium (Li)-Total (mg/L)	0.138	0.135	0.147	0.133	
	Magnesium (Mg)-Total (mg/L)	825	787	829	826	
	Manganese (Mn)-Total (mg/L)	0.00088	0.00098	0.00091	0.00086	
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Total (mg/L)	0.0072	0.0079	0.0078	0.0072	
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1986378-1	L1986378-2	L1986378-3	L1986378-4
	Description	Seawater	Seawater	Seawater	Seawater
	Sampled Date	31-AUG-17	31-AUG-17	31-AUG-17	31-AUG-17
	Sampled Time	10:54	10:21	10:10	10:33
	Client ID	SOURCE	WNW	NORTH	ENE
Grouping	**Analyte**				
SEAWATER					
Total Metals	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	234	235	237	228
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Total (mg/L)	0.0866	0.0885	0.0946	0.0901
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Total (mg/L)	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)	6340	6450	6800	6430
	Strontium (Sr)-Total (mg/L)	4.27	4.22	4.28	4.54
	Sulfur (S)-Total (mg/L)	615	584	614	615
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Total (mg/L)	0.00239	0.00235	0.00247	0.00246
	Vanadium (V)-Total (mg/L)	0.00092	0.00085	0.00091	0.00092
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0030	0.0041	0.0039	0.0043
	Zirconium (Zr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Dissolved (mg/L)	0.0084	0.0080	0.0081	0.0079
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	3.27	3.22	3.16	3.18
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Dissolved (mg/L)	311	302	325	314
	Cesium (Cs)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1986378-1	L1986378-2	L1986378-3	L1986378-4
	Description	Seawater	Seawater	Seawater	Seawater
	Sampled Date	31-AUG-17	31-AUG-17	31-AUG-17	31-AUG-17
	Sampled Time	10:54	10:21	10:10	10:33
	Client ID	SOURCE	WNW	NORTH	ENE
SEAWATER					
Dissolved Metals	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Dissolved (mg/L)	0.140	0.136	0.135	0.135
	Magnesium (Mg)-Dissolved (mg/L)	799	799	809	767
	Manganese (Mn)-Dissolved (mg/L)	<0.00020	0.00040	0.00044	0.00035
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.0074	0.0071	0.0072	0.0073
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	228	224	244	240
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Dissolved (mg/L)	0.0878	0.0868	0.0901	0.0892
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Dissolved (mg/L)	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Dissolved (mg/L)	6410	6160	6460	6510
	Strontium (Sr)-Dissolved (mg/L)	4.39	4.32	4.24	4.30
	Sulfur (S)-Dissolved (mg/L)	591	597	607	568
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Dissolved (mg/L)	0.00236	0.00244	0.00238	0.00238
	Vanadium (V)-Dissolved (mg/L)	0.00080	0.00083	0.00086	0.00076
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1986378-1	L1986378-2	L1986378-3	L1986378-4	
	Description	Seawater	Seawater	Seawater	Seawater	
	Sampled Date	31-AUG-17	31-AUG-17	31-AUG-17	31-AUG-17	
	Sampled Time	10:54	10:21	10:10	10:33	
	Client ID	SOURCE	WNW	NORTH	ENE	
Grouping	**Analyte**					
WATER						
Hydrocarbons	EPH10-19 (mg/L)	<0.050	<0.050	<0.050	<0.050	
	EPH19-32 (mg/L)	<0.050	<0.050	<0.050	<0.050	
	LEPH (mg/L)	<0.050	<0.050	<0.050	<0.050	
	HEPH (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Surrogate: 2-Bromobenzotrifluoride (%)	66.7	69.5	73.2	62.4	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Acenaphthylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Acridine (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Benz(a)anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Benzo(a)pyrene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Benzo(b&j)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Benzo(g,h,i)perylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Benzo(k)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Chrysene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Dibenz(a,h)anthracene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Fluorene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Phenanthrene (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	
	Pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Surrogate: Acridine d9 (%)	111.3	109.6	116.1	89.9	
	Surrogate: Chrysene d12 (%)	110.7	113.3	107.4	90.0	
	Surrogate: Naphthalene d8 (%)	87.2	88.9	81.8	79.1	
	Surrogate: Phenanthrene d10 (%)	101.2	102.0	94.3	91.2	

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Seawater	Alkalinity Spec by Titration (Seawater)	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-C-BR-IC-VA	Seawater	Bromide by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-CL-IC-VA	Seawater	Chloride by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-F-IC-VA	Seawater	Fluoride by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-NO2-IC-VA	Seawater	Nitrite in Seawater by IC	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-C-NO3-IC-VA	Seawater	Nitrate in Seawater by IC	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-C-SO4-IC-VA	Seawater	Sulfate by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-C-TOC-VA	Seawater	TOC by combustion (seawater)	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-C-PCT-VA	Seawater	Conductivity (Automated) (seawater)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EPH-L-ME-FID-VA	Water	EPH in Water (Low Level)	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.

HARDNESS-CALC-VA	Seawater	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-C-CVAFS-VA	Seawater	Diss. Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-C-CVAFS-VA	Seawater	Total Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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).

MET-D-L-HRMS-VA	Seawater	Diss. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-T-L-HRMS-VA	Seawater	Tot. Metals in Seawater by HR-ICPMS	EPA 200.8

Reference Information

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

NH3-F-VA	Seawater	Ammonia in Seawater by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

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.

PH-C-PCT-VA	Seawater	pH by Meter (Automated) (seawater)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

It is recommended that this analysis be conducted in the field.

TKN-C-F-VA	Seawater	TKN in Seawater by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TURBIDITY-C-VA	Seawater	Turbidity by Meter in Seawater	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Client: GOLDER ASSOCIATES LTD.
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8
Contact: John Sherrin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EPH-L-ME-FID-VA	**Water**							
Batch R3822073								
WG2611886-2 LCS								
EPH10-19			125.2		%		50-150	09-SEP-17
EPH19-32			129.5		%		50-150	09-SEP-17
WG2611886-1 MB								
EPH10-19			<0.050		mg/L		0.05	09-SEP-17
EPH19-32			<0.050		mg/L		0.05	09-SEP-17
Surrogate: 2-Bromobenzotrifluoride			47.7	RRQC	%		60-140	09-SEP-17
PAH-ME-MS-VA	**Water**							
Batch R3821899								
WG2611886-2 LCS								
Acenaphthene			110.4		%		60-130	12-SEP-17
Acenaphthylene			115.5		%		60-130	12-SEP-17
Acridine			118.8		%		60-130	12-SEP-17
Anthracene			113.1		%		60-130	12-SEP-17
Benz(a)anthracene			113.2		%		60-130	12-SEP-17
Benzo(a)pyrene			116.1		%		60-130	12-SEP-17
Benzo(b&j)fluoranthene			128.0		%		60-130	12-SEP-17
Benzo(g,h,i)perylene			125.4		%		60-130	12-SEP-17
Benzo(k)fluoranthene			123.1		%		60-130	12-SEP-17
Chrysene			120.6		%		60-130	12-SEP-17
Dibenz(a,h)anthracene			113.1		%		60-130	12-SEP-17
Fluoranthene			119.1		%		60-130	12-SEP-17
Fluorene			110.7		%		60-130	12-SEP-17
Indeno(1,2,3-c,d)pyrene			125.0		%		60-130	12-SEP-17
Naphthalene			104.2		%		50-130	12-SEP-17
Phenanthrene			123.4		%		60-130	12-SEP-17
Pyrene			117.3		%		60-130	12-SEP-17
Quinoline			129.2		%		60-130	12-SEP-17
WG2611886-1 MB								
Acenaphthene			<0.000010		mg/L		0.00001	12-SEP-17
Acenaphthylene			<0.000010		mg/L		0.00001	12-SEP-17
Acridine			<0.000010		mg/L		0.00001	12-SEP-17
Anthracene			<0.000010		mg/L		0.00001	12-SEP-17
Benz(a)anthracene			<0.000010		mg/L		0.00001	12-SEP-17
Benzo(a)pyrene			<0.000005C		mg/L		0.000005	12-SEP-17
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	12-SEP-17

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ME-MS-VA	**Water**							
Batch R3821899								
WG2611886-1 MB								
Benzo(g,h,i)perylene			<0.000010		mg/L		0.00001	12-SEP-17
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	12-SEP-17
Chrysene			<0.000010		mg/L		0.00001	12-SEP-17
Dibenz(a,h)anthracene			<0.0000050		mg/L		0.000005	12-SEP-17
Fluoranthene			<0.000010		mg/L		0.00001	12-SEP-17
Fluorene			<0.000010		mg/L		0.00001	12-SEP-17
Indeno(1,2,3-c,d)pyrene			<0.000010		mg/L		0.00001	12-SEP-17
Naphthalene			<0.000050		mg/L		0.00005	12-SEP-17
Phenanthrene			<0.000020		mg/L		0.00002	12-SEP-17
Pyrene			<0.000010		mg/L		0.00001	12-SEP-17
Quinoline			<0.000050		mg/L		0.00005	12-SEP-17
Surrogate: Acridine d9			113.3		%		60-130	12-SEP-17
Surrogate: Chrysene d12			115.1		%		60-130	12-SEP-17
Surrogate: Naphthalene d8			84.1		%		50-130	12-SEP-17
Surrogate: Phenanthrene d10			105.8		%		60-130	12-SEP-17
ALK-TITR-VA	**Seawater**							
Batch R3822165								
WG2610279-3 CRM		**VA-ALK-TITR-CONTROL**						
Alkalinity, Total (as CaCO3)			101.5		%		85-115	07-SEP-17
WG2610279-5 DUP		**L1986378-1**						
Alkalinity, Total (as CaCO3)		95.5	94.5		mg/L	1.1	20	07-SEP-17
WG2610279-1 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	07-SEP-17
ANIONS-C-BR-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-3 DUP		**L1986378-4**						
Bromide (Br)		44.8	50.3		mg/L	12	20	28-SEP-17
WG2627183-2 LCS								
Bromide (Br)			99.0		%		85-115	28-SEP-17
WG2627183-1 MB								
Bromide (Br)			<5.0		mg/L		5	28-SEP-17
ANIONS-C-CL-IC-VA	**Seawater**							

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-CL-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-3 DUP		**L1986378-4**						
Chloride (Cl)		12900	14400		mg/L	11	20	28-SEP-17
WG2627183-2 LCS								
Chloride (Cl)			100.3		%		90-110	28-SEP-17
WG2627183-1 MB								
Chloride (Cl)			<50		mg/L		50	28-SEP-17
ANIONS-C-F-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-3 DUP		**L1986378-4**						
Fluoride (F)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	28-SEP-17
WG2627183-2 LCS								
Fluoride (F)			99.3		%		90-110	28-SEP-17
WG2627183-1 MB								
Fluoride (F)			<1.0		mg/L		1	28-SEP-17
ANIONS-C-NO2-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-3 DUP		**L1986378-4**						
Nitrite (as N)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	28-SEP-17
WG2627183-2 LCS								
Nitrite (as N)			99.5		%		90-110	28-SEP-17
WG2627183-1 MB								
Nitrite (as N)			<0.10		mg/L		0.1	28-SEP-17
ANIONS-C-NO3-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-3 DUP		**L1986378-4**						
Nitrate (as N)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	28-SEP-17
WG2627183-2 LCS								
Nitrate (as N)			100.1		%		90-110	28-SEP-17
WG2627183-1 MB								
Nitrate (as N)			<0.50		mg/L		0.5	28-SEP-17
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-3 DUP		**L1986378-4**						
Sulfate (SO4)		1830	2050		mg/L	12	20	28-SEP-17
WG2627183-2 LCS								
Sulfate (SO4)			101.0		%		90-110	28-SEP-17
WG2627183-1 MB								

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3841209								
WG2627183-1 MB								
Sulfate (SO4)			<30		mg/L		30	28-SEP-17
CARBONS-C-TOC-VA	**Seawater**							
Batch R3822812								
WG2611198-4 LCS								
Total Organic Carbon			101.4		%		80-120	08-SEP-17
WG2611198-3 MB								
Total Organic Carbon			<0.50		mg/L		0.5	08-SEP-17
WG2611198-2 MS		**L1986378-1**						
Total Organic Carbon			104.6		%		70-130	08-SEP-17
EC-C-PCT-VA	**Seawater**							
Batch R3822165								
WG2610279-4 CRM		**VA-EC-PCT-CONTROL**						
Conductivity			102.2		%		90-110	07-SEP-17
WG2610279-5 DUP		**L1986378-1**						
Conductivity		36800	36700		uS/cm	0.3	10	07-SEP-17
WG2610279-1 MB								
Conductivity			<2.0		uS/cm		2	07-SEP-17
HG-DIS-C-CVAFS-VA	**Seawater**							
Batch R3821740								
WG2610285-14 LCS								
Mercury (Hg)-Dissolved			105.0		%		80-120	07-SEP-17
WG2610285-13 MB		**NP**						
Mercury (Hg)-Dissolved			<0.000010		mg/L		0.00001	07-SEP-17
HG-TOT-C-CVAFS-VA	**Seawater**							
Batch R3821740								
WG2610688-2 LCS								
Mercury (Hg)-Total			107.3		%		80-120	07-SEP-17
WG2610688-1 MB								
Mercury (Hg)-Total			<0.000010		mg/L		0.00001	07-SEP-17
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837673								
WG2611196-2 LCS								
Aluminum (Al)-Dissolved			104.0		%		80-120	22-SEP-17
Antimony (Sb)-Dissolved			80.5		%		80-120	22-SEP-17
Arsenic (As)-Dissolved			98.9		%		80-120	22-SEP-17

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837673								
WG2611196-2 LCS								
Barium (Ba)-Dissolved			91.6		%		80-120	22-SEP-17
Beryllium (Be)-Dissolved			91.7		%		80-120	22-SEP-17
Bismuth (Bi)-Dissolved			85.4		%		80-120	22-SEP-17
Boron (B)-Dissolved			107.7		%		80-120	22-SEP-17
Cadmium (Cd)-Dissolved			91.4		%		80-120	22-SEP-17
Calcium (Ca)-Dissolved			102.2		%		80-120	22-SEP-17
Cesium (Cs)-Dissolved			96.3		%		80-120	22-SEP-17
Chromium (Cr)-Dissolved			95.7		%		80-120	22-SEP-17
Cobalt (Co)-Dissolved			92.4		%		80-120	22-SEP-17
Copper (Cu)-Dissolved			91.6		%		80-120	22-SEP-17
Gallium (Ga)-Dissolved			92.0		%		80-120	22-SEP-17
Iron (Fe)-Dissolved			93.0		%		80-120	22-SEP-17
Lead (Pb)-Dissolved			96.6		%		80-120	22-SEP-17
Lithium (Li)-Dissolved			100.7		%		80-120	22-SEP-17
Magnesium (Mg)-Dissolved			107.0		%		80-120	22-SEP-17
Manganese (Mn)-Dissolved			97.7		%		80-120	22-SEP-17
Molybdenum (Mo)-Dissolved			88.6		%		80-120	22-SEP-17
Nickel (Ni)-Dissolved			99.2		%		80-120	22-SEP-17
Phosphorus (P)-Dissolved			107.4		%		80-120	22-SEP-17
Potassium (K)-Dissolved			104.3		%		80-120	22-SEP-17
Rhenium (Re)-Dissolved			87.5		%		80-120	22-SEP-17
Rubidium (Rb)-Dissolved			100.5		%		80-120	22-SEP-17
Selenium (Se)-Dissolved			104.2		%		80-120	22-SEP-17
Silicon (Si)-Dissolved			114.4		%		80-120	22-SEP-17
Silver (Ag)-Dissolved			88.9		%		80-120	22-SEP-17
Strontium (Sr)-Dissolved			88.8		%		80-120	22-SEP-17
Sulfur (S)-Dissolved			109.0		%		70-130	22-SEP-17
Tellurium (Te)-Dissolved			95.1		%		80-120	22-SEP-17
Thallium (Tl)-Dissolved			84.5		%		80-120	22-SEP-17
Thorium (Th)-Dissolved			107.1		%		80-120	22-SEP-17
Tin (Sn)-Dissolved			105.8		%		80-120	22-SEP-17
Titanium (Ti)-Dissolved			95.7		%		80-120	22-SEP-17
Tungsten (W)-Dissolved			93.9		%		80-120	22-SEP-17
Uranium (U)-Dissolved			93.1		%		80-120	22-SEP-17

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837673								
WG2611196-2 LCS								
Vanadium (V)-Dissolved			100.1		%		80-120	22-SEP-17
Yttrium (Y)-Dissolved			101.8		%		80-120	22-SEP-17
Zinc (Zn)-Dissolved			90.5		%		80-120	22-SEP-17
Zirconium (Zr)-Dissolved			96.8		%		80-120	22-SEP-17
Batch R3837732								
WG2611196-2 LCS								
Sodium (Na)-Dissolved			112.3		%		80-120	23-SEP-17
WG2611196-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	23-SEP-17
Antimony (Sb)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	23-SEP-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	23-SEP-17
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Bismuth (Bi)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	23-SEP-17
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Calcium (Ca)-Dissolved			<1.0		mg/L		1	23-SEP-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	23-SEP-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	23-SEP-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	23-SEP-17
Magnesium (Mg)-Dissolved			<1.0		mg/L		1	23-SEP-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	23-SEP-17
Molybdenum (Mo)-Dissolved			<0.0020		mg/L		0.002	23-SEP-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	23-SEP-17
Potassium (K)-Dissolved			<1.0		mg/L		1	23-SEP-17
Rhenium (Re)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	23-SEP-17
Selenium (Se)-Dissolved			<0.0020		mg/L		0.002	23-SEP-17
Silicon (Si)-Dissolved			<1.0		mg/L		1	23-SEP-17

ALS Environmental

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2611196-1 MB		**NP**						
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	23-SEP-17
Sodium (Na)-Dissolved			<1.0		mg/L		1	23-SEP-17
Strontium (Sr)-Dissolved			<0.010		mg/L		0.01	23-SEP-17
Sulfur (S)-Dissolved			<5.0		mg/L		5	23-SEP-17
Tellurium (Te)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	23-SEP-17
Titanium (Ti)-Dissolved			<0.0050		mg/L		0.005	23-SEP-17
Tungsten (W)-Dissolved			<0.0010		mg/L		0.001	23-SEP-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Yttrium (Y)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Zirconium (Zr)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Batch R3839047								
WG2611196-1 MB		**NP**						
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	25-SEP-17
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	25-SEP-17
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612238-2 LCS								
Aluminum (Al)-Total			89.9		%		80-120	13-SEP-17
Antimony (Sb)-Total			92.0		%		80-120	13-SEP-17
Arsenic (As)-Total			96.0		%		80-120	13-SEP-17
Barium (Ba)-Total			91.6		%		80-120	13-SEP-17
Beryllium (Be)-Total			87.7		%		80-120	13-SEP-17
Bismuth (Bi)-Total			93.6		%		80-120	13-SEP-17
Boron (B)-Total			107.0		%		80-120	13-SEP-17
Cadmium (Cd)-Total			93.2		%		80-120	13-SEP-17
Calcium (Ca)-Total			91.8		%		80-120	13-SEP-17
Cesium (Cs)-Total			95.5		%		80-120	13-SEP-17
Chromium (Cr)-Total			99.2		%		80-120	13-SEP-17
Cobalt (Co)-Total			89.9		%		80-120	13-SEP-17
Copper (Cu)-Total			92.7		%		80-120	13-SEP-17
Gallium (Ga)-Total			103.2		%		80-120	13-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612238-2 LCS								
Iron (Fe)-Total			101.5		%		80-120	13-SEP-17
Lead (Pb)-Total			104.8		%		80-120	13-SEP-17
Lithium (Li)-Total			99.2		%		80-120	13-SEP-17
Manganese (Mn)-Total			107.2		%		80-120	13-SEP-17
Molybdenum (Mo)-Total			95.9		%		80-120	13-SEP-17
Nickel (Ni)-Total			98.8		%		80-120	13-SEP-17
Phosphorus (P)-Total			97.1		%		80-120	13-SEP-17
Potassium (K)-Total			98.5		%		80-120	13-SEP-17
Rhenium (Re)-Total			100.9		%		80-120	13-SEP-17
Rubidium (Rb)-Total			101.8		%		80-120	13-SEP-17
Selenium (Se)-Total			89.7		%		80-120	13-SEP-17
Silicon (Si)-Total			103.7		%		80-120	13-SEP-17
Silver (Ag)-Total			110.7		%		80-120	13-SEP-17
Sodium (Na)-Total			117.3		%		80-120	13-SEP-17
Strontium (Sr)-Total			91.2		%		80-120	13-SEP-17
Sulfur (S)-Total			104.8		%		70-130	13-SEP-17
Tellurium (Te)-Total			89.1		%		80-120	13-SEP-17
Thallium (Tl)-Total			93.5		%		80-120	13-SEP-17
Thorium (Th)-Total			100.6		%		80-120	13-SEP-17
Tin (Sn)-Total			104.8		%		80-120	13-SEP-17
Titanium (Ti)-Total			89.6		%		80-120	13-SEP-17
Tungsten (W)-Total			88.2		%		80-120	13-SEP-17
Uranium (U)-Total			93.6		%		80-120	13-SEP-17
Vanadium (V)-Total			92.8		%		80-120	13-SEP-17
Yttrium (Y)-Total			99.7		%		80-120	13-SEP-17
Zinc (Zn)-Total			89.1		%		80-120	13-SEP-17
Zirconium (Zr)-Total			97.2		%		80-120	13-SEP-17
WG2612238-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	13-SEP-17
Antimony (Sb)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Arsenic (As)-Total			<0.0020		mg/L		0.002	13-SEP-17
Barium (Ba)-Total			<0.0010		mg/L		0.001	13-SEP-17
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Bismuth (Bi)-Total			<0.00050		mg/L		0.0005	13-SEP-17

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612238-1 MB								
Boron (B)-Total			<0.10		mg/L		0.1	13-SEP-17
Cadmium (Cd)-Total			<0.000050		mg/L		0.00005	13-SEP-17
Calcium (Ca)-Total			<1.0		mg/L		1	13-SEP-17
Cesium (Cs)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	13-SEP-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Gallium (Ga)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Iron (Fe)-Total			<0.010		mg/L		0.01	13-SEP-17
Lead (Pb)-Total			<0.00030		mg/L		0.0003	13-SEP-17
Lithium (Li)-Total			<0.020		mg/L		0.02	13-SEP-17
Magnesium (Mg)-Total			<1.0		mg/L		1	13-SEP-17
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	13-SEP-17
Molybdenum (Mo)-Total			<0.0020		mg/L		0.002	13-SEP-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	13-SEP-17
Potassium (K)-Total			<1.0		mg/L		1	13-SEP-17
Rhenium (Re)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Rubidium (Rb)-Total			<0.0050		mg/L		0.005	13-SEP-17
Selenium (Se)-Total			<0.0020		mg/L		0.002	13-SEP-17
Silicon (Si)-Total			<1.0		mg/L		1	13-SEP-17
Silver (Ag)-Total			<0.00010		mg/L		0.0001	13-SEP-17
Sodium (Na)-Total			<1.0		mg/L		1	13-SEP-17
Strontium (Sr)-Total			<0.010		mg/L		0.01	13-SEP-17
Sulfur (S)-Total			<5.0		mg/L		5	13-SEP-17
Tellurium (Te)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Thorium (Th)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Tin (Sn)-Total			<0.0010		mg/L		0.001	13-SEP-17
Titanium (Ti)-Total			<0.0050		mg/L		0.005	13-SEP-17
Tungsten (W)-Total			<0.0010		mg/L		0.001	13-SEP-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	13-SEP-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Yttrium (Y)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	13-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612238-1 MB								
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Batch R3835061								
WG2612238-2 LCS								
Magnesium (Mg)-Total			105.3		%		80-120	21-SEP-17
Batch R3835187								
WG2612238-1 MB								
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	20-SEP-17
NH3-F-VA	**Seawater**							
Batch R3821085								
WG2610091-3 DUP		**L1986378-4**						
Ammonia, Total (as N)		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	06-SEP-17
WG2610091-2 LCS								
Ammonia, Total (as N)			96.7		%		85-115	06-SEP-17
WG2610091-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	06-SEP-17
WG2610091-4 MS		**L1986378-4**						
Ammonia, Total (as N)			99.3		%		75-125	06-SEP-17
PH-C-PCT-VA	**Seawater**							
Batch R3822165								
WG2610279-2 CRM		**VA-PH7-BUF**						
pH			7.00		pH		6.9-7.1	07-SEP-17
WG2610279-5 DUP		**L1986378-1**						
pH		7.90	7.91	J	pH	0.01	0.3	07-SEP-17
TKN-C-F-VA	**Seawater**							
Batch R3823291								
WG2612080-3 DUP		**L1986378-3**						
Total Kjeldahl Nitrogen		0.061	0.065		mg/L	6.7	20	10-SEP-17
WG2612080-2 LCS								
Total Kjeldahl Nitrogen			102.2		%		75-125	10-SEP-17
WG2612080-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	10-SEP-17
WG2612080-4 MS		**L1986378-4**						
Total Kjeldahl Nitrogen			108.2		%		70-130	10-SEP-17
TURBIDITY-C-VA	**Seawater**							

Quality Control Report

Workorder: L1986378 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-C-VA	**Seawater**							
Batch R3821912								
WG2610996-2 CRM		**VA-FORM-40**						
Turbidity			91.8		%		85-115	07-SEP-17
WG2610996-3 DUP		**L1986378-1**						
Turbidity		0.34	0.34		NTU	0.6	15	07-SEP-17
WG2610996-1 MB								
Turbidity			<0.10		NTU		0.1	07-SEP-17

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
RRQC	Refer to report remarks for information regarding this QC result.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Turbidity by Meter in Seawater							
	1	31-AUG-17 10:54	07-SEP-17 19:42	3	7	days	EHTR
	2	31-AUG-17 10:21	07-SEP-17 19:42	3	7	days	EHTR
	3	31-AUG-17 10:10	07-SEP-17 19:42	3	7	days	EHTR
	4	31-AUG-17 10:33	07-SEP-17 19:42	3	7	days	EHTR
pH by Meter (Automated) (seawater)							
	1	31-AUG-17 10:54	07-SEP-17 09:12	0.25	166	hours	EHTR-FM
	2	31-AUG-17 10:21	07-SEP-17 09:12	0.25	167	hours	EHTR-FM
	3	31-AUG-17 10:10	07-SEP-17 09:12	0.25	167	hours	EHTR-FM
	4	31-AUG-17 10:33	07-SEP-17 09:12	0.25	167	hours	EHTR-FM
Anions and Nutrients							
Nitrate in Seawater by IC							
	1	31-AUG-17 10:54	28-SEP-17 07:17	3	28	days	EHTR
	2	31-AUG-17 10:21	28-SEP-17 07:17	3	28	days	EHTR
	3	31-AUG-17 10:10	28-SEP-17 07:17	3	28	days	EHTR
	4	31-AUG-17 10:33	28-SEP-17 07:17	3	28	days	EHTR
Nitrite in Seawater by IC							
	1	31-AUG-17 10:54	28-SEP-17 07:17	3	28	days	EHTR
	2	31-AUG-17 10:21	28-SEP-17 07:17	3	28	days	EHTR
	3	31-AUG-17 10:10	28-SEP-17 07:17	3	28	days	EHTR
	4	31-AUG-17 10:33	28-SEP-17 07:17	3	28	days	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1986378 were received on 06-SEP-17 08:30.

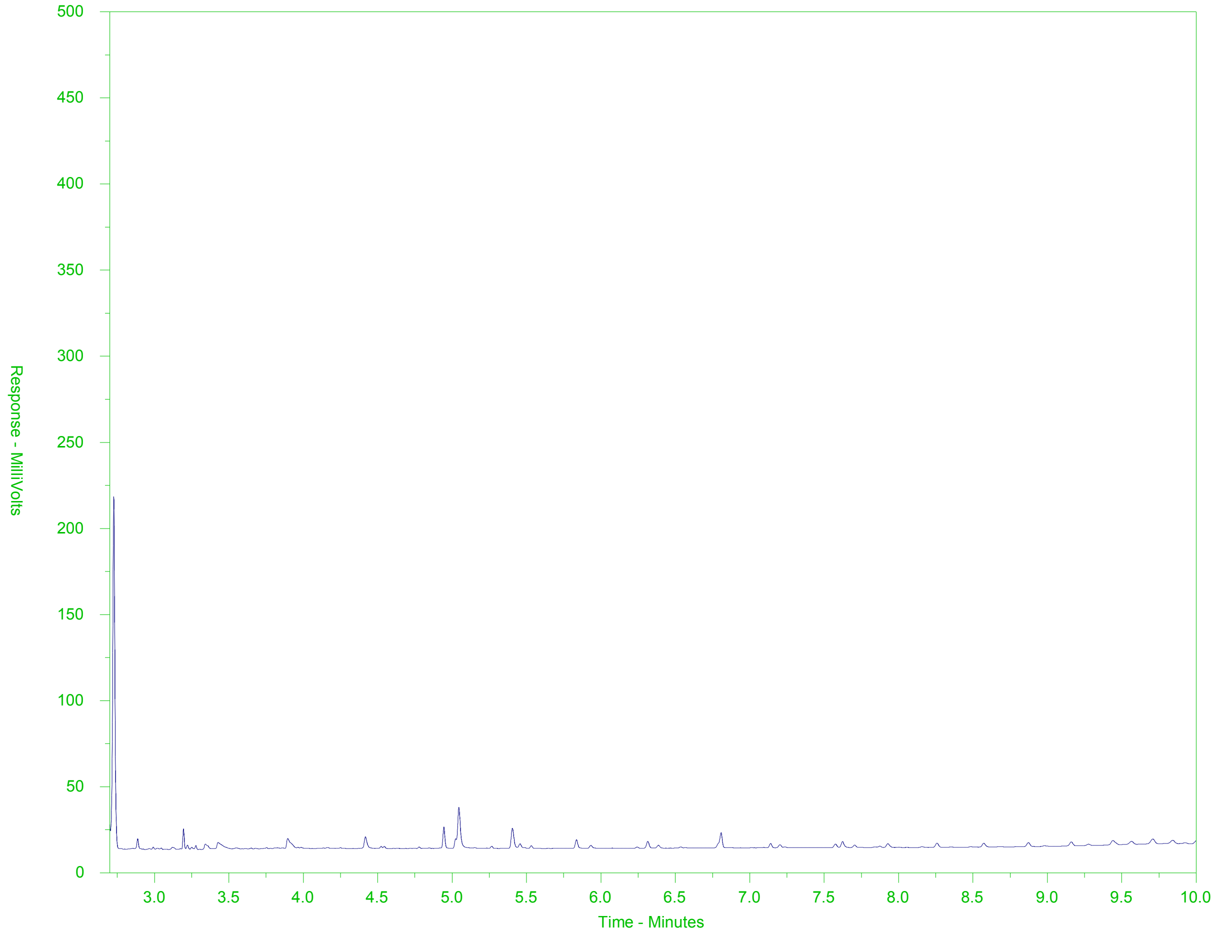
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1986378-L-1
Client Sample ID: SOURCE



← 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.

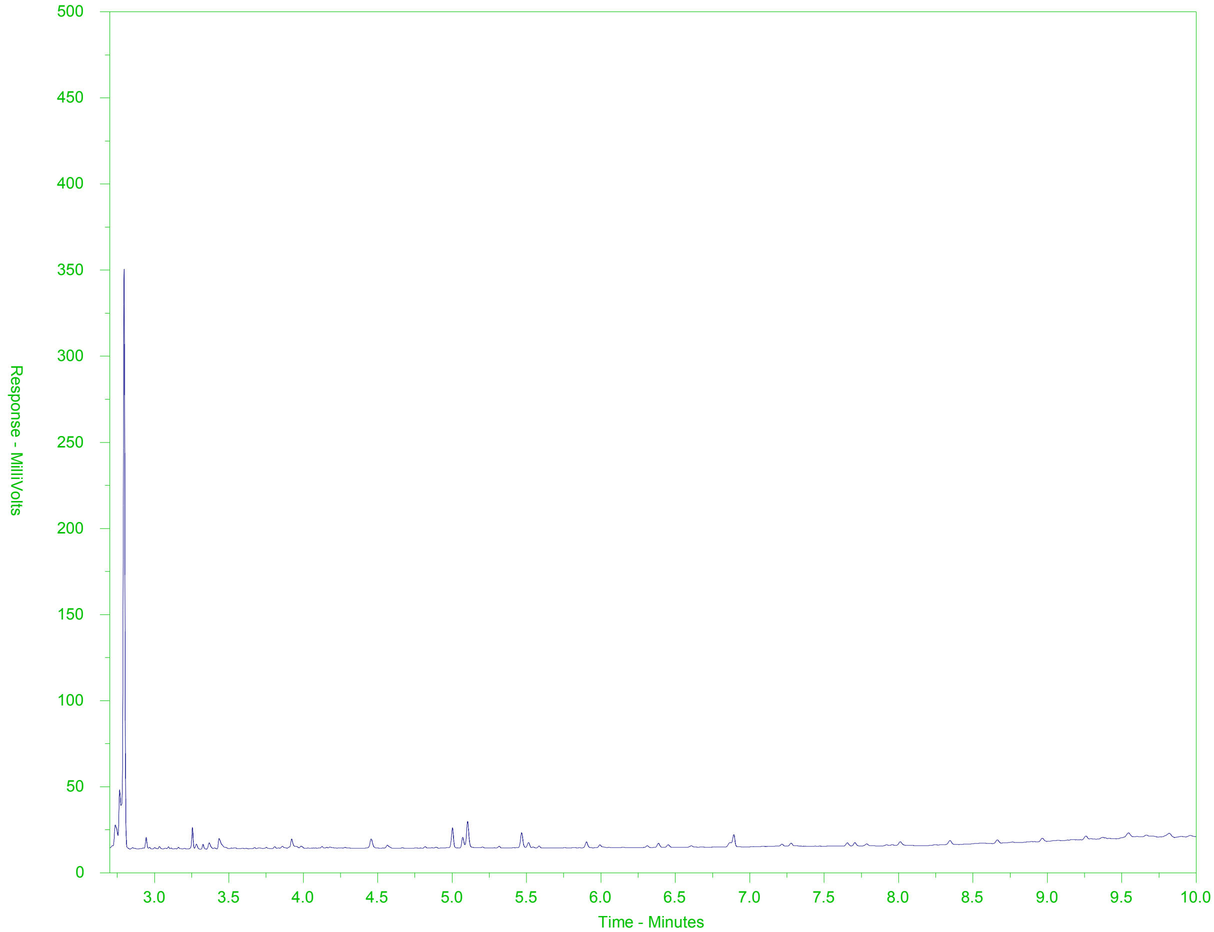
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1986378-L-2
Client Sample ID: WNW



← 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.

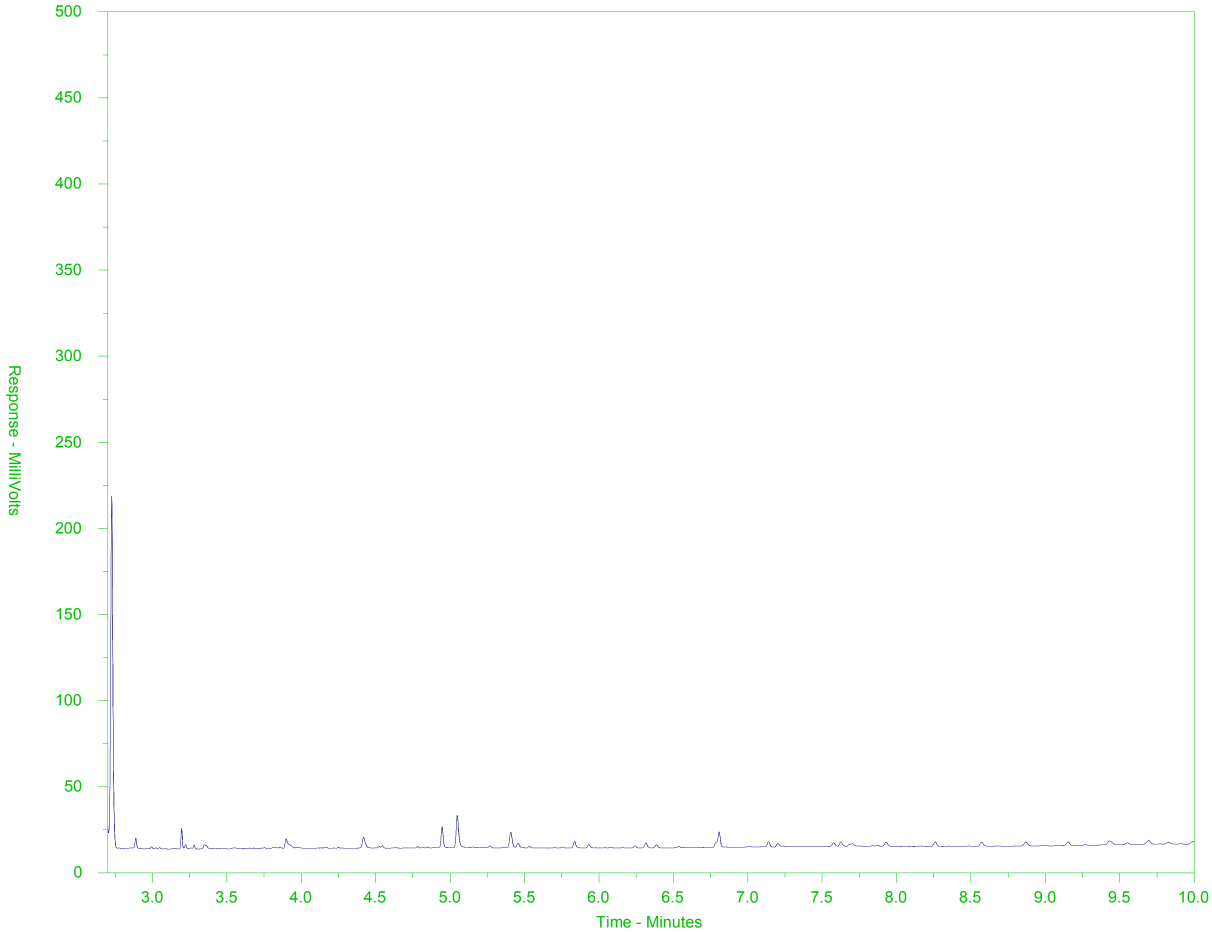
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1986378-L-3
Client Sample ID: NORTH



← 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.

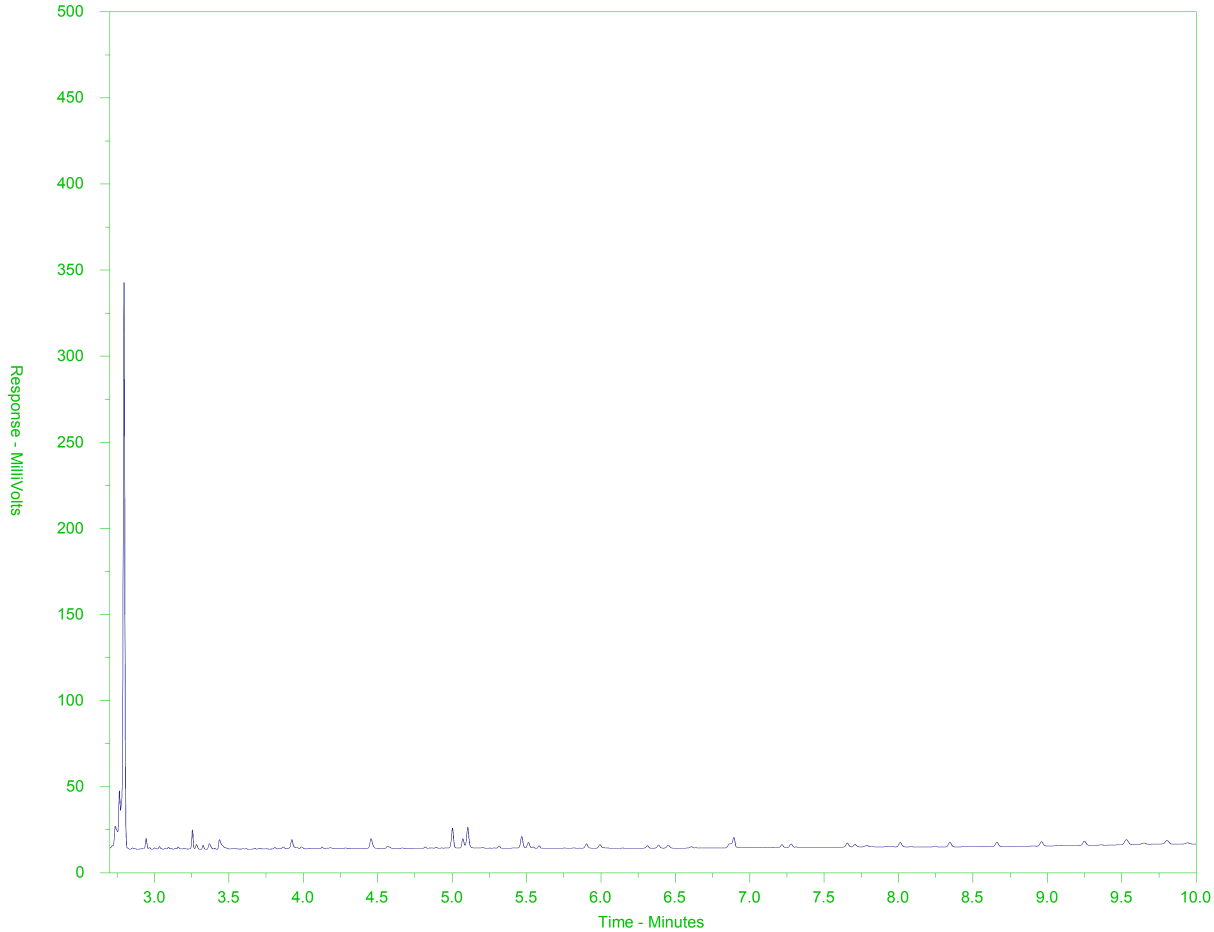
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1986378-L-4
Client Sample ID: ENE



← 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.

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

APPENDIX B-1

WATER ANALYTICAL DATA 3

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	
Company:	Golder Associatex Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Contact:	John Sherrin / Arman Ospan	Quality Control (QC) Report with Report	☑ YES ☐ NO
Phone:	1 (250) 881 7372	☐ 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:	2nd floor 3795 Carey Rd.	Email 1 or Fax	jsherrin@golder.com
City/Province:	Victoria BC	Email 2	aospan@golder.com
Postal Code:	V8Z 6T8	Email 3	mspani@golder.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:		Email 1 or Fax	
Contact:		Email 2	
Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	BR191034	AFE/Cost Center:	PO#
Job #:	1663724/10000/1003	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

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] ☐
	2 day [P2] ☐	
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm	

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	General (pH, Alkalinity, Turbidity, Conductivity, Anions, TSS)	TOC, Ammonia, TKN (P)	Dissolved Metals	Total Metals (P)	Dissolved Mercury	Total Mercury (P)	Hydrocarbons (PAH/LEPH/HEPH) (P)	Fecal Coliforms (P)	Number of Containers
	Source	31-Aug-17	10:54	Seawater	X	X	X	X	X	X	X	X	9
	WNW	31-Aug-17	10:21	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	North	31-Aug-17	10:10	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	ENE	31-Aug-17	10:33	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9

Charge

L1986378-COFC

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	2.8°C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: John Sherrin	Date: Aug 31 2017	12:30	Received by: Krista	Date: Sept. 05	Time: 11:15	Received by: Amanraj Mann	Date: Sept 6 2017	Time: 9:30 am

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**.

GOLDER ASSOCIATES LTD.
ATTN: JOHN SHERRIN
3795 Carey Road, Second Floor
Victoria B.C. V8Z 6T8

Date Received: 07-SEP-17
Report Date: 27-SEP-17 16:50 (MT)
Version: FINAL

Client Phone: 250-881-7372

Certificate of Analysis

Lab Work Order #: L1987356

Project P.O. #: NOT SUBMITTED
Job Reference: 1663724/10000/1003
C of C Numbers:
Legal Site Desc:

Amber Springer

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1987356-1	L1987356-2	L1987356-3	L1987356-4
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER
	Sampled Date	05-SEP-17	05-SEP-17	05-SEP-17	05-SEP-17
	Sampled Time	09:15	09:30	09:45	10:00
	Client ID	WNW	N	ENE	SOURCE
Grouping	**Analyte**				
SEAWATER					
Physical Tests	Conductivity (uS/cm)	11300	14800	14000	12500
	Hardness (as CaCO3) (mg/L)	1240	1560	1490	1370
	pH (pH)	7.99	7.97	8.00	8.00
	Total Suspended Solids (mg/L)	<2.0	<2.0	<2.0	<2.0
	Turbidity (NTU)	0.74	0.44	0.32	0.34
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	92.3	93.6	93.9	95.6
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	10.8	16.6	16.1	15.0
	Chloride (Cl) (mg/L)	3820	4960	4860	4550
	Fluoride (F) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Nitrate (as N) (mg/L)	<0.50	<0.50	<0.50	<0.50
	Nitrite (as N) (mg/L)	<0.10	<0.10	<0.10	<0.10
	Total Kjeldahl Nitrogen (mg/L)	0.083	0.073	0.065	0.104
	Sulfate (SO4) (mg/L)	533	687	678	638
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	18.5	1.57	15.4	21.8
Total Metals	Aluminum (Al)-Total (mg/L)	0.0081	0.0091	0.0095	0.0137
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Total (mg/L)	0.0049	0.0060	0.0054	0.0053
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	1.02	1.30	1.24	1.18
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Total (mg/L)	105	130	124	113
	Cesium (Cs)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Total (mg/L)	0.00073	0.00082	0.00064	0.00054
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.013	<0.010	0.013	0.017
	Lead (Pb)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Total (mg/L)	0.033	0.047	0.043	0.038
	Magnesium (Mg)-Total (mg/L)	243	307	285	258
	Manganese (Mn)-Total (mg/L)	0.00083	0.00083	0.00095	0.00091
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.0021	0.0028	0.0026	0.0026

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1987356-1	L1987356-2	L1987356-3	L1987356-4	
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER	
	Sampled Date	05-SEP-17	05-SEP-17	05-SEP-17	05-SEP-17	
	Sampled Time	09:15	09:30	09:45	10:00	
	Client ID	WNW	N	ENE	SOURCE	
Grouping	**Analyte**					
SEAWATER						
Total Metals	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	70.3	93.2	84.3	76.5	
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Rubidium (Rb)-Total (mg/L)	0.0225	0.0323	0.0297	0.0265	
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Silicon (Si)-Total (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Sodium (Na)-Total (mg/L)	1910	2670	2400	2040	
	Strontium (Sr)-Total (mg/L)	1.47	1.85	1.83	1.61	
	Sulfur (S)-Total (mg/L)	177	225	219	189	
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Titanium (Ti)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Tungsten (W)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Uranium (U)-Total (mg/L)	0.00172	0.00176	0.00203	0.00262	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Barium (Ba)-Dissolved (mg/L)	0.0050	0.0056	0.0051	0.0051	
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Dissolved (mg/L)	1.04	1.30	1.25	1.16	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Calcium (Ca)-Dissolved (mg/L)	98.1	121	122	109	
	Cesium (Cs)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Copper (Cu)-Dissolved (mg/L)	<0.00050	0.00068	<0.00050	0.00058	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1987356-1	L1987356-2	L1987356-3	L1987356-4	
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER	
	Sampled Date	05-SEP-17	05-SEP-17	05-SEP-17	05-SEP-17	
	Sampled Time	09:15	09:30	09:45	10:00	
	Client ID	WNW	N	ENE	SOURCE	
Grouping	**Analyte**					
SEAWATER						
Dissolved Metals	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	
	Lithium (Li)-Dissolved (mg/L)	0.034	0.045	0.043	0.037	
	Magnesium (Mg)-Dissolved (mg/L)	242	306	288	267	
	Manganese (Mn)-Dissolved (mg/L)	0.00062	0.00053	0.00056	0.00054	
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Dissolved (mg/L)	0.0022	0.0029	0.0027	0.0025	
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	66.5	82.8	84.7	72.1	
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Rubidium (Rb)-Dissolved (mg/L)	0.0227	0.0312	0.0289	0.0259	
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Silicon (Si)-Dissolved (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Sodium (Na)-Dissolved (mg/L)	1820	2380	2200	1940	
	Strontium (Sr)-Dissolved (mg/L)	1.47	1.86	1.83	1.59	
	Sulfur (S)-Dissolved (mg/L)	176	225	204	192	
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Tungsten (W)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Uranium (U)-Dissolved (mg/L)	0.00179	0.00167	0.00190	0.00257	
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1987356-1	L1987356-2	L1987356-3	L1987356-4
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER
	Sampled Date	05-SEP-17	05-SEP-17	05-SEP-17	05-SEP-17
	Sampled Time	09:15	09:30	09:45	10:00
	Client ID	WNW	N	ENE	SOURCE
Grouping	**Analyte**				
WATER					
Bacteriological Tests	Coliform Bacteria - Fecal (CFU/100mL)	1 PEHR	1	2	1
Hydrocarbons	EPH10-19 (mg/L)	<0.050	<0.050	<0.050	<0.050
	EPH19-32 (mg/L)	<0.050	<0.050	<0.050	<0.050
	LEPH (mg/L)	<0.050	<0.050	<0.050	<0.050
	HEPH (mg/L)	<0.050	<0.050	<0.050	<0.050
	Surrogate: 2-Bromobenzotrifluoride (%)	83.1	85.6	74.8	78.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Acenaphthylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Acridine (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benz(a)anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(a)pyrene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Benzo(b&j)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(g,h,i)perylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(k)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Chrysene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Dibenz(a,h)anthracene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Fluorene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Phenanthrene (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Surrogate: Acridine d9 (%)	73.7	77.3	73.8	74.1
	Surrogate: Chrysene d12 (%)	94.2	98.6	96.1	93.7
	Surrogate: Naphthalene d8 (%)	79.3	95.5	81.6	82.9
	Surrogate: Phenanthrene d10 (%)	85.0	91.6	87.7	87.2

* 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	Zinc (Zn)-Total	MB-LOR	L1987356-1, -2, -3, -4
Matrix Spike	Bromide (Br)	MS-B	L1987356-1, -2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Seawater	Alkalinity Spec by Titration (Seawater)	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-C-BR-IC-VA	Seawater	Bromide by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-CL-IC-VA	Seawater	Chloride by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-F-IC-VA	Seawater	Fluoride by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-NO2-IC-VA	Seawater	Nitrite in Seawater by IC	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-C-NO3-IC-VA	Seawater	Nitrate in Seawater by IC	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-C-SO4-IC-VA	Seawater	Sulfate by IC (seawater)	EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-C-TOC-VA	Seawater	TOC by combustion (seawater)	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-C-PCT-VA	Seawater	Conductivity (Automated) (seawater)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EPH-L-ME-FID-VA	Water	EPH in Water (Low Level)	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.

FCOLI-MF-ENV-VA	Water	Fecal coliform by membrane filtration	APHA METHOD 9222

This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation of the filter with the appropriate growth medium, positive results require further testing (up to an additional 48 hours) to confirm and quantify the total coliform. This method is used for non-turbid water with a low background bacteria level.

HARDNESS-CALC-VA	Seawater	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-C-CVAFS-VA	Seawater	Diss. Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-C-CVAFS-VA	Seawater	Total Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

Reference Information

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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).

MET-D-L-HRMS-VA	Seawater	Diss. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-T-L-HRMS-VA	Seawater	Tot. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

NH3-F-VA	Seawater	Ammonia in Seawater by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

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.

PH-C-PCT-VA	Seawater	pH by Meter (Automated) (seawater)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

It is recommended that this analysis be conducted in the field.

TKN-C-F-VA	Seawater	TKN in Seawater by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-C-VA	Seawater	Total Suspended Solids by Gravimetric	APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) is determined by filtering a sample through a glass fibre filter. TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-C-VA	Seawater	Turbidity by Meter in Seawater	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Client: GOLDER ASSOCIATES LTD.
3795 Carey Road, Second Floor
Victoria B.C. V8Z 6T8
Contact: JOHN SHERRIN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EPH-L-ME-FID-VA	**Water**							
Batch R3822073								
WG2613453-2 LCS								
EPH10-19			89.1		%		50-150	13-SEP-17
EPH19-32			89.1		%		50-150	13-SEP-17
WG2613453-1 MB								
EPH10-19			<0.050		mg/L		0.05	13-SEP-17
EPH19-32			<0.050		mg/L		0.05	13-SEP-17
Surrogate: 2-Bromobenzotrifluoride			74.9		%		60-140	13-SEP-17
FCOLI-MF-ENV-VA	**Water**							
Batch R3822884								
WG2611128-2 MB								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	07-SEP-17
PAH-ME-MS-VA	**Water**							
Batch R3826088								
WG2613453-2 LCS								
Acenaphthene			109.0		%		60-130	14-SEP-17
Acenaphthylene			112.7		%		60-130	14-SEP-17
Acridine			116.8		%		60-130	14-SEP-17
Anthracene			109.6		%		60-130	14-SEP-17
Benz(a)anthracene			115.1		%		60-130	14-SEP-17
Benzo(a)pyrene			111.5		%		60-130	14-SEP-17
Benzo(b&j)fluoranthene			122.6		%		60-130	14-SEP-17
Benzo(g,h,i)perylene			107.4		%		60-130	14-SEP-17
Benzo(k)fluoranthene			119.6		%		60-130	14-SEP-17
Chrysene			117.0		%		60-130	14-SEP-17
Dibenz(a,h)anthracene			116.3		%		60-130	14-SEP-17
Fluoranthene			120.0		%		60-130	14-SEP-17
Fluorene			114.5		%		60-130	14-SEP-17
Indeno(1,2,3-c,d)pyrene			111.2		%		60-130	14-SEP-17
Naphthalene			111.0		%		50-130	14-SEP-17
Phenanthrene			117.3		%		60-130	14-SEP-17
Pyrene			116.7		%		60-130	14-SEP-17
Quinoline			126.2		%		60-130	14-SEP-17
WG2613453-1 MB								
Acenaphthene			<0.000010		mg/L		0.00001	14-SEP-17
Acenaphthylene			<0.000010		mg/L		0.00001	14-SEP-17

ALS Environmental

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ME-MS-VA	**Water**							
Batch R3826088								
WG2613453-1 MB								
Acridine			<0.000010		mg/L		0.00001	14-SEP-17
Anthracene			<0.000010		mg/L		0.00001	14-SEP-17
Benz(a)anthracene			<0.000010		mg/L		0.00001	14-SEP-17
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	14-SEP-17
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	14-SEP-17
Benzo(g,h,i)perylene			<0.000010		mg/L		0.00001	14-SEP-17
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	14-SEP-17
Chrysene			<0.000010		mg/L		0.00001	14-SEP-17
Dibenz(a,h)anthracene			<0.0000050		mg/L		0.000005	14-SEP-17
Fluoranthene			<0.000010		mg/L		0.00001	14-SEP-17
Fluorene			<0.000010		mg/L		0.00001	14-SEP-17
Indeno(1,2,3-c,d)pyrene			<0.000010		mg/L		0.00001	14-SEP-17
Naphthalene			<0.000050		mg/L		0.00005	14-SEP-17
Phenanthrene			<0.000020		mg/L		0.00002	14-SEP-17
Pyrene			<0.000010		mg/L		0.00001	14-SEP-17
Quinoline			<0.000050		mg/L		0.00005	14-SEP-17
Surrogate: Acridine d9			79.5		%		60-130	14-SEP-17
Surrogate: Chrysene d12			103.5		%		60-130	14-SEP-17
Surrogate: Naphthalene d8			86.9		%		50-130	14-SEP-17
Surrogate: Phenanthrene d10			89.8		%		60-130	14-SEP-17
ALK-TITR-VA	**Seawater**							
Batch R3823234								
WG2611470-3 CRM		**VA-ALK-TITR-CONTROL**						
Alkalinity, Total (as CaCO3)			100.6		%		85-115	09-SEP-17
WG2611470-5 DUP		**L1987356-3**						
Alkalinity, Total (as CaCO3)		93.9	94.7		mg/L	0.8	20	09-SEP-17
ANIONS-C-BR-IC-VA	**Seawater**							
Batch R3823001								
WG2611038-3 DUP		**L1987356-4**						
Bromide (Br)		15.0	15.0		mg/L	0.5	20	07-SEP-17
WG2611038-2 LCS								
Bromide (Br)			97.7		%		85-115	07-SEP-17
WG2611038-1 MB								
Bromide (Br)			<5.0		mg/L		5	07-SEP-17

ALS Environmental

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-BR-IC-VA	**Seawater**							
Batch R3824687								
WG2612492-3 DUP		**L1987356-2**						
Bromide (Br)		16.6	16.6		mg/L	0.2	20	10-SEP-17
WG2612492-2 LCS								
Bromide (Br)			98.6		%		85-115	10-SEP-17
WG2612492-1 MB								
Bromide (Br)			<5.0		mg/L		5	10-SEP-17
WG2612492-4 MS		**L1987356-1**						
Bromide (Br)			N/A	MS-B	%		-	10-SEP-17
ANIONS-C-CL-IC-VA	**Seawater**							
Batch R3823001								
WG2611038-3 DUP		**L1987356-4**						
Chloride (Cl)		4550	4530		mg/L	0.6	20	07-SEP-17
WG2611038-2 LCS								
Chloride (Cl)			100.0		%		90-110	07-SEP-17
WG2611038-1 MB								
Chloride (Cl)			<50		mg/L		50	07-SEP-17
Batch R3824687								
WG2612492-3 DUP		**L1987356-2**						
Chloride (Cl)		4960	5010		mg/L	1.0	20	10-SEP-17
WG2612492-2 LCS								
Chloride (Cl)			99.6		%		90-110	10-SEP-17
WG2612492-1 MB								
Chloride (Cl)			<50		mg/L		50	10-SEP-17
ANIONS-C-F-IC-VA	**Seawater**							
Batch R3823001								
WG2611038-3 DUP		**L1987356-4**						
Fluoride (F)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	07-SEP-17
WG2611038-2 LCS								
Fluoride (F)			100.1		%		90-110	07-SEP-17
WG2611038-1 MB								
Fluoride (F)			<1.0		mg/L		1	07-SEP-17
Batch R3824687								
WG2612492-3 DUP		**L1987356-2**						
Fluoride (F)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	10-SEP-17
WG2612492-2 LCS								
Fluoride (F)			99.0		%		90-110	10-SEP-17
WG2612492-1 MB								
Fluoride (F)			<1.0		mg/L		1	10-SEP-17

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-NO2-IC-VA	**Seawater**							
Batch R3823001								
WG2611038-3 DUP		**L1987356-4**						
Nitrite (as N)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	07-SEP-17
WG2611038-2 LCS								
Nitrite (as N)			98.9		%		90-110	07-SEP-17
WG2611038-1 MB								
Nitrite (as N)			<0.10		mg/L		0.1	07-SEP-17
Batch R3824687								
WG2612492-3 DUP		**L1987356-2**						
Nitrite (as N)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	10-SEP-17
WG2612492-2 LCS								
Nitrite (as N)			98.2		%		90-110	10-SEP-17
WG2612492-1 MB								
Nitrite (as N)			<0.10		mg/L		0.1	10-SEP-17
ANIONS-C-NO3-IC-VA	**Seawater**							
Batch R3823001								
WG2611038-3 DUP		**L1987356-4**						
Nitrate (as N)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	07-SEP-17
WG2611038-2 LCS								
Nitrate (as N)			100.4		%		90-110	07-SEP-17
WG2611038-1 MB								
Nitrate (as N)			<0.50		mg/L		0.5	07-SEP-17
Batch R3824687								
WG2612492-3 DUP		**L1987356-2**						
Nitrate (as N)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	10-SEP-17
WG2612492-2 LCS								
Nitrate (as N)			99.4		%		90-110	10-SEP-17
WG2612492-1 MB								
Nitrate (as N)			<0.50		mg/L		0.5	10-SEP-17
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3823001								
WG2611038-3 DUP		**L1987356-4**						
Sulfate (SO4)		638	627		mg/L	1.8	20	07-SEP-17
WG2611038-2 LCS								
Sulfate (SO4)			100.9		%		90-110	07-SEP-17
WG2611038-1 MB								
Sulfate (SO4)			<30		mg/L		30	07-SEP-17

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3824687								
WG2612492-3 DUP		**L1987356-2**						
Sulfate (SO4)		687	694		mg/L	1.0	20	10-SEP-17
WG2612492-2 LCS								
Sulfate (SO4)			100.3		%		90-110	10-SEP-17
WG2612492-1 MB								
Sulfate (SO4)			<30		mg/L		30	10-SEP-17
CARBONS-C-TOC-VA	**Seawater**							
Batch R3822812								
WG2611198-4 LCS								
Total Organic Carbon			101.4		%		80-120	08-SEP-17
WG2611198-3 MB								
Total Organic Carbon			<0.50		mg/L		0.5	08-SEP-17
EC-C-PCT-VA	**Seawater**							
Batch R3823234								
WG2611470-4 CRM		**VA-EC-PCT-CONTROL**						
Conductivity			97.9		%		90-110	09-SEP-17
WG2611470-5 DUP		**L1987356-3**						
Conductivity		14000	14000		uS/cm	0.1	10	09-SEP-17
WG2611470-1 MB								
Conductivity			<2.0		uS/cm		2	09-SEP-17
HG-DIS-C-CVAFS-VA	**Seawater**							
Batch R3822577								
WG2611860-14 LCS								
Mercury (Hg)-Dissolved			105.8		%		80-120	08-SEP-17
Batch R3822693								
WG2611860-13 MB		**NP**						
Mercury (Hg)-Dissolved			<0.000010		mg/L		0.00001	08-SEP-17
HG-TOT-C-CVAFS-VA	**Seawater**							
Batch R3822577								
WG2611779-2 LCS								
Mercury (Hg)-Total			110.1		%		80-120	08-SEP-17
WG2611779-1 MB								
Mercury (Hg)-Total			<0.000010		mg/L		0.00001	08-SEP-17
MET-D-L-HRMS-VA	**Seawater**							

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612354-2 LCS								
Aluminum (Al)-Dissolved			86.1		%		80-120	13-SEP-17
Antimony (Sb)-Dissolved			85.1		%		80-120	13-SEP-17
Arsenic (As)-Dissolved			93.2		%		80-120	13-SEP-17
Barium (Ba)-Dissolved			94.4		%		80-120	13-SEP-17
Beryllium (Be)-Dissolved			95.4		%		80-120	13-SEP-17
Bismuth (Bi)-Dissolved			97.7		%		80-120	13-SEP-17
Boron (B)-Dissolved			107.9		%		80-120	13-SEP-17
Cadmium (Cd)-Dissolved			97.5		%		80-120	13-SEP-17
Calcium (Ca)-Dissolved			89.4		%		80-120	13-SEP-17
Cesium (Cs)-Dissolved			102.1		%		80-120	13-SEP-17
Chromium (Cr)-Dissolved			101.6		%		80-120	13-SEP-17
Cobalt (Co)-Dissolved			86.2		%		80-120	13-SEP-17
Copper (Cu)-Dissolved			89.0		%		80-120	13-SEP-17
Gallium (Ga)-Dissolved			102.0		%		80-120	13-SEP-17
Iron (Fe)-Dissolved			112.0		%		80-120	13-SEP-17
Lead (Pb)-Dissolved			107.0		%		80-120	13-SEP-17
Lithium (Li)-Dissolved			101.2		%		80-120	13-SEP-17
Magnesium (Mg)-Dissolved			115.6		%		80-120	13-SEP-17
Manganese (Mn)-Dissolved			104.0		%		80-120	13-SEP-17
Molybdenum (Mo)-Dissolved			91.0		%		80-120	13-SEP-17
Nickel (Ni)-Dissolved			97.0		%		80-120	13-SEP-17
Phosphorus (P)-Dissolved			94.7		%		80-120	13-SEP-17
Potassium (K)-Dissolved			94.9		%		80-120	13-SEP-17
Rhenium (Re)-Dissolved			100.2		%		80-120	13-SEP-17
Rubidium (Rb)-Dissolved			95.7		%		80-120	13-SEP-17
Selenium (Se)-Dissolved			86.0		%		80-120	13-SEP-17
Silicon (Si)-Dissolved			96.5		%		80-120	13-SEP-17
Silver (Ag)-Dissolved			107.7		%		80-120	13-SEP-17
Sodium (Na)-Dissolved			114.8		%		80-120	13-SEP-17
Strontium (Sr)-Dissolved			85.2		%		80-120	13-SEP-17
Sulfur (S)-Dissolved			104.7		%		70-130	13-SEP-17
Tellurium (Te)-Dissolved			95.7		%		80-120	13-SEP-17
Thallium (Tl)-Dissolved			94.7		%		80-120	13-SEP-17
Thorium (Th)-Dissolved			114.3		%		80-120	13-SEP-17

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612354-2 LCS								
Tin (Sn)-Dissolved			119.0		%		80-120	13-SEP-17
Titanium (Ti)-Dissolved			89.2		%		80-120	13-SEP-17
Tungsten (W)-Dissolved			92.1		%		80-120	13-SEP-17
Uranium (U)-Dissolved			99.6		%		80-120	13-SEP-17
Vanadium (V)-Dissolved			92.0		%		80-120	13-SEP-17
Yttrium (Y)-Dissolved			105.1		%		80-120	13-SEP-17
Zinc (Zn)-Dissolved			87.9		%		80-120	13-SEP-17
Zirconium (Zr)-Dissolved			102.0		%		80-120	13-SEP-17
WG2612354-1 MB		**LF**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	13-SEP-17
Antimony (Sb)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	13-SEP-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	13-SEP-17
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Bismuth (Bi)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	13-SEP-17
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	13-SEP-17
Calcium (Ca)-Dissolved			<1.0		mg/L		1	13-SEP-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	13-SEP-17
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	13-SEP-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	13-SEP-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	13-SEP-17
Magnesium (Mg)-Dissolved			<1.0		mg/L		1	13-SEP-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	13-SEP-17
Molybdenum (Mo)-Dissolved			<0.0020		mg/L		0.002	13-SEP-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	13-SEP-17
Potassium (K)-Dissolved			<1.0		mg/L		1	13-SEP-17
Rhenium (Re)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	13-SEP-17

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2612354-1 MB		**LF**						
Selenium (Se)-Dissolved			<0.0020		mg/L		0.002	13-SEP-17
Silicon (Si)-Dissolved			<1.0		mg/L		1	13-SEP-17
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	13-SEP-17
Sodium (Na)-Dissolved			<1.0		mg/L		1	13-SEP-17
Strontium (Sr)-Dissolved			<0.010		mg/L		0.01	13-SEP-17
Sulfur (S)-Dissolved			<5.0		mg/L		5	13-SEP-17
Tellurium (Te)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	13-SEP-17
Titanium (Ti)-Dissolved			<0.0050		mg/L		0.005	13-SEP-17
Tungsten (W)-Dissolved			<0.0010		mg/L		0.001	13-SEP-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	13-SEP-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Yttrium (Y)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	13-SEP-17
Zirconium (Zr)-Dissolved			<0.00050		mg/L		0.0005	13-SEP-17
Batch R3835187								
WG2612354-1 MB		**LF**						
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	20-SEP-17
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2613300-2 LCS								
Aluminum (Al)-Total			97.5		%		80-120	13-SEP-17
Antimony (Sb)-Total			98.2		%		80-120	13-SEP-17
Arsenic (As)-Total			93.9		%		80-120	13-SEP-17
Barium (Ba)-Total			94.8		%		80-120	13-SEP-17
Beryllium (Be)-Total			90.3		%		80-120	13-SEP-17
Bismuth (Bi)-Total			106.0		%		80-120	13-SEP-17
Boron (B)-Total			107.3		%		80-120	13-SEP-17
Cadmium (Cd)-Total			89.2		%		80-120	13-SEP-17
Calcium (Ca)-Total			97.5		%		80-120	13-SEP-17
Cesium (Cs)-Total			104.0		%		80-120	13-SEP-17
Chromium (Cr)-Total			105.2		%		80-120	13-SEP-17
Cobalt (Co)-Total			87.8		%		80-120	13-SEP-17

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2613300-2 LCS								
Copper (Cu)-Total			95.2		%		80-120	13-SEP-17
Gallium (Ga)-Total			95.2		%		80-120	13-SEP-17
Iron (Fe)-Total			105.0		%		80-120	13-SEP-17
Lead (Pb)-Total			116.9		%		80-120	13-SEP-17
Lithium (Li)-Total			101.2		%		80-120	13-SEP-17
Magnesium (Mg)-Total			106.7		%		80-120	13-SEP-17
Manganese (Mn)-Total			103.6		%		80-120	13-SEP-17
Molybdenum (Mo)-Total			92.2		%		80-120	13-SEP-17
Nickel (Ni)-Total			95.4		%		80-120	13-SEP-17
Phosphorus (P)-Total			97.5		%		80-120	13-SEP-17
Potassium (K)-Total			104.8		%		80-120	13-SEP-17
Rhenium (Re)-Total			109.4		%		80-120	13-SEP-17
Rubidium (Rb)-Total			89.6		%		80-120	13-SEP-17
Selenium (Se)-Total			94.4		%		80-120	13-SEP-17
Silicon (Si)-Total			100.9		%		80-120	13-SEP-17
Silver (Ag)-Total			117.6		%		80-120	13-SEP-17
Strontium (Sr)-Total			81.2		%		80-120	13-SEP-17
Sulfur (S)-Total			104.6		%		70-130	13-SEP-17
Tellurium (Te)-Total			93.6		%		80-120	13-SEP-17
Thallium (Tl)-Total			98.6		%		80-120	13-SEP-17
Thorium (Th)-Total			116.1		%		80-120	13-SEP-17
Tin (Sn)-Total			112.7		%		80-120	13-SEP-17
Titanium (Ti)-Total			95.2		%		80-120	13-SEP-17
Tungsten (W)-Total			101.0		%		80-120	13-SEP-17
Uranium (U)-Total			103.9		%		80-120	13-SEP-17
Vanadium (V)-Total			92.0		%		80-120	13-SEP-17
Yttrium (Y)-Total			107.9		%		80-120	13-SEP-17
Zinc (Zn)-Total			92.5		%		80-120	13-SEP-17
Zirconium (Zr)-Total			100.0		%		80-120	13-SEP-17
WG2613300-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	13-SEP-17
Antimony (Sb)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Arsenic (As)-Total			<0.0020		mg/L		0.002	13-SEP-17
Barium (Ba)-Total			<0.0010		mg/L		0.001	13-SEP-17

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2613300-1 MB								
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Bismuth (Bi)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Boron (B)-Total			<0.10		mg/L		0.1	13-SEP-17
Cadmium (Cd)-Total			<0.000050		mg/L		0.00005	13-SEP-17
Calcium (Ca)-Total			<1.0		mg/L		1	13-SEP-17
Cesium (Cs)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	13-SEP-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Gallium (Ga)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Iron (Fe)-Total			<0.010		mg/L		0.01	13-SEP-17
Lead (Pb)-Total			<0.00030		mg/L		0.0003	13-SEP-17
Lithium (Li)-Total			<0.020		mg/L		0.02	13-SEP-17
Magnesium (Mg)-Total			<1.0		mg/L		1	13-SEP-17
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	13-SEP-17
Molybdenum (Mo)-Total			<0.0020		mg/L		0.002	13-SEP-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	13-SEP-17
Potassium (K)-Total			<1.0		mg/L		1	13-SEP-17
Rhenium (Re)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Rubidium (Rb)-Total			<0.0050		mg/L		0.005	13-SEP-17
Selenium (Se)-Total			<0.0020		mg/L		0.002	13-SEP-17
Silicon (Si)-Total			<1.0		mg/L		1	13-SEP-17
Silver (Ag)-Total			<0.00010		mg/L		0.0001	13-SEP-17
Sodium (Na)-Total			<1.0		mg/L		1	13-SEP-17
Strontium (Sr)-Total			<0.010		mg/L		0.01	13-SEP-17
Sulfur (S)-Total			<5.0		mg/L		5	13-SEP-17
Tellurium (Te)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	13-SEP-17
Thorium (Th)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Tin (Sn)-Total			<0.0010		mg/L		0.001	13-SEP-17
Titanium (Ti)-Total			<0.0050		mg/L		0.005	13-SEP-17
Tungsten (W)-Total			<0.0010		mg/L		0.001	13-SEP-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	13-SEP-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3828767								
WG2613300-1 MB								
Vanadium (V)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Yttrium (Y)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	13-SEP-17
Batch R3835061								
WG2613300-2 LCS								
Sodium (Na)-Total			102.3		%		80-120	21-SEP-17
WG2613300-1 MB								
Zinc (Zn)-Total			0.0133	MB-LOR	mg/L		0.003	21-SEP-17
NH3-F-VA	**Seawater**							
Batch R3822674								
WG2611386-3 DUP		**L1987356-4**						
Ammonia, Total (as N)		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	08-SEP-17
WG2611386-2 LCS								
Ammonia, Total (as N)			95.3		%		85-115	08-SEP-17
WG2611386-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	08-SEP-17
WG2611386-4 MS		**L1987356-4**						
Ammonia, Total (as N)			99.2		%		75-125	08-SEP-17
PH-C-PCT-VA	**Seawater**							
Batch R3823234								
WG2611470-2 CRM		**VA-PH7-BUF**						
pH			7.00		pH		6.9-7.1	09-SEP-17
WG2611470-5 DUP		**L1987356-3**						
pH		8.00	7.98	J	pH	0.02	0.3	09-SEP-17
TKN-C-F-VA	**Seawater**							
Batch R3824185								
WG2612523-3 DUP		**L1987356-3**						
Total Kjeldahl Nitrogen		0.065	0.074		mg/L	13	20	11-SEP-17
WG2612523-2 LCS								
Total Kjeldahl Nitrogen			99.4		%		75-125	11-SEP-17
WG2612523-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	11-SEP-17
WG2612523-4 MS		**L1987356-4**						
Total Kjeldahl Nitrogen			103.5		%		70-130	11-SEP-17
TSS-C-VA	**Seawater**							

Quality Control Report

Workorder: L1987356 Report Date: 27-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TSS-C-VA	**Seawater**							
Batch R3822362								
WG2611108-2 LCS								
Total Suspended Solids			91.7		%		85-115	07-SEP-17
WG2611108-1 MB								
Total Suspended Solids			<2.0		mg/L		2	07-SEP-17
TURBIDITY-C-VA	**Seawater**							
Batch R3821912								
WG2610996-2 CRM		**VA-FORM-40**						
Turbidity			91.8		%		85-115	07-SEP-17
WG2610996-1 MB								
Turbidity			<0.10		NTU		0.1	07-SEP-17

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter (Automated) (seawater)							
	1	05-SEP-17 09:15	09-SEP-17 10:07	0.25	97	hours	EHTR-FM
	2	05-SEP-17 09:30	09-SEP-17 10:07	0.25	97	hours	EHTR-FM
	3	05-SEP-17 09:45	09-SEP-17 10:07	0.25	96	hours	EHTR-FM
	4	05-SEP-17 10:00	09-SEP-17 10:07	0.25	96	hours	EHTR-FM
Anions and Nutrients							
Nitrate in Seawater by IC							
	2	05-SEP-17 09:30	10-SEP-17 09:04	3	5	days	EHT
Nitrite in Seawater by IC							
	2	05-SEP-17 09:30	10-SEP-17 09:04	3	5	days	EHT
Bacteriological Tests							
Fecal coliform by membrane filtration							
	1	05-SEP-17 09:15	07-SEP-17 13:00	30	52	hours	EHTR
	2	05-SEP-17 09:30	07-SEP-17 13:00	30	52	hours	EHTR
	3	05-SEP-17 09:45	07-SEP-17 13:00	30	51	hours	EHTR
	4	05-SEP-17 10:00	07-SEP-17 13:00	30	51	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1987356 were received on 07-SEP-17 09:15.

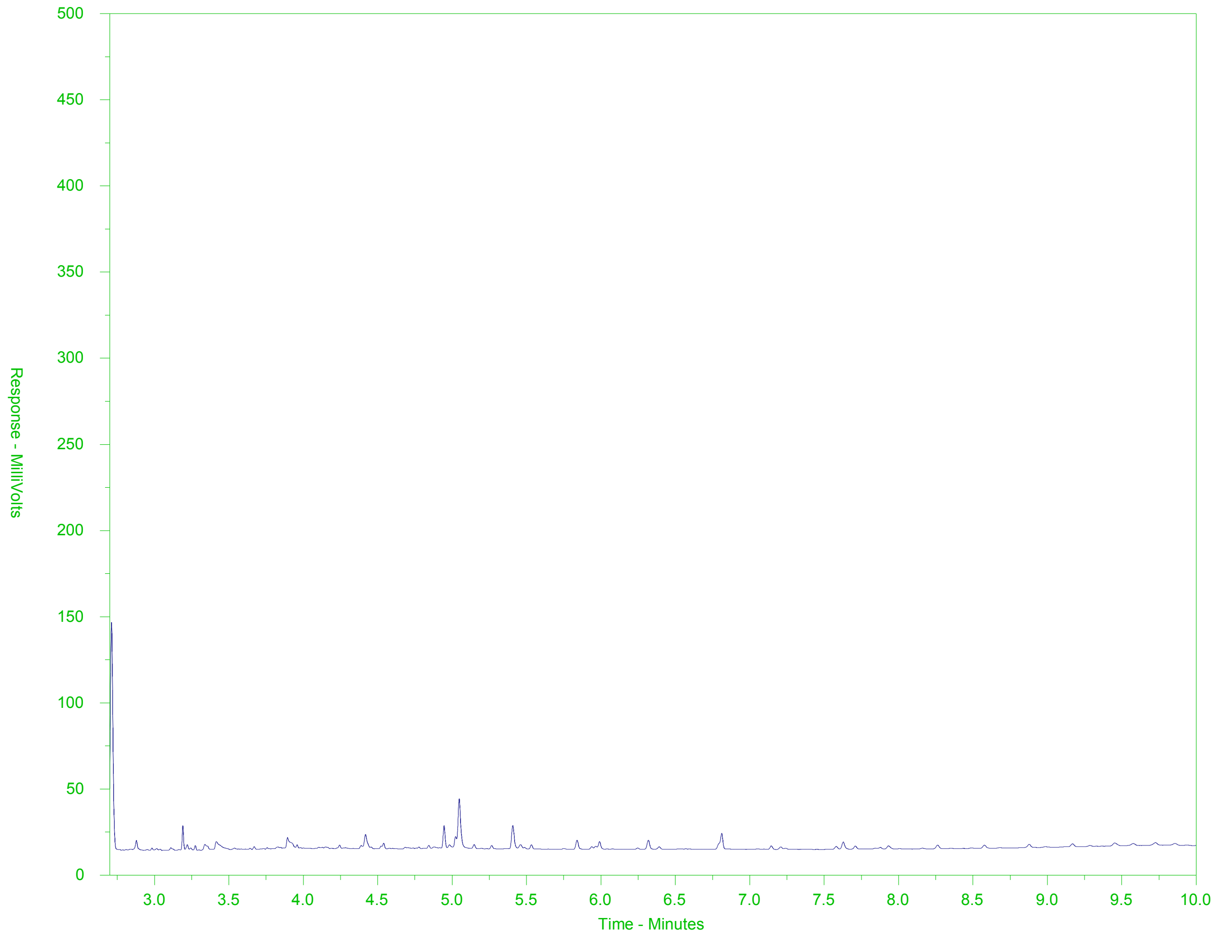
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1987356-L-1
Client Sample ID: WNW



← 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.

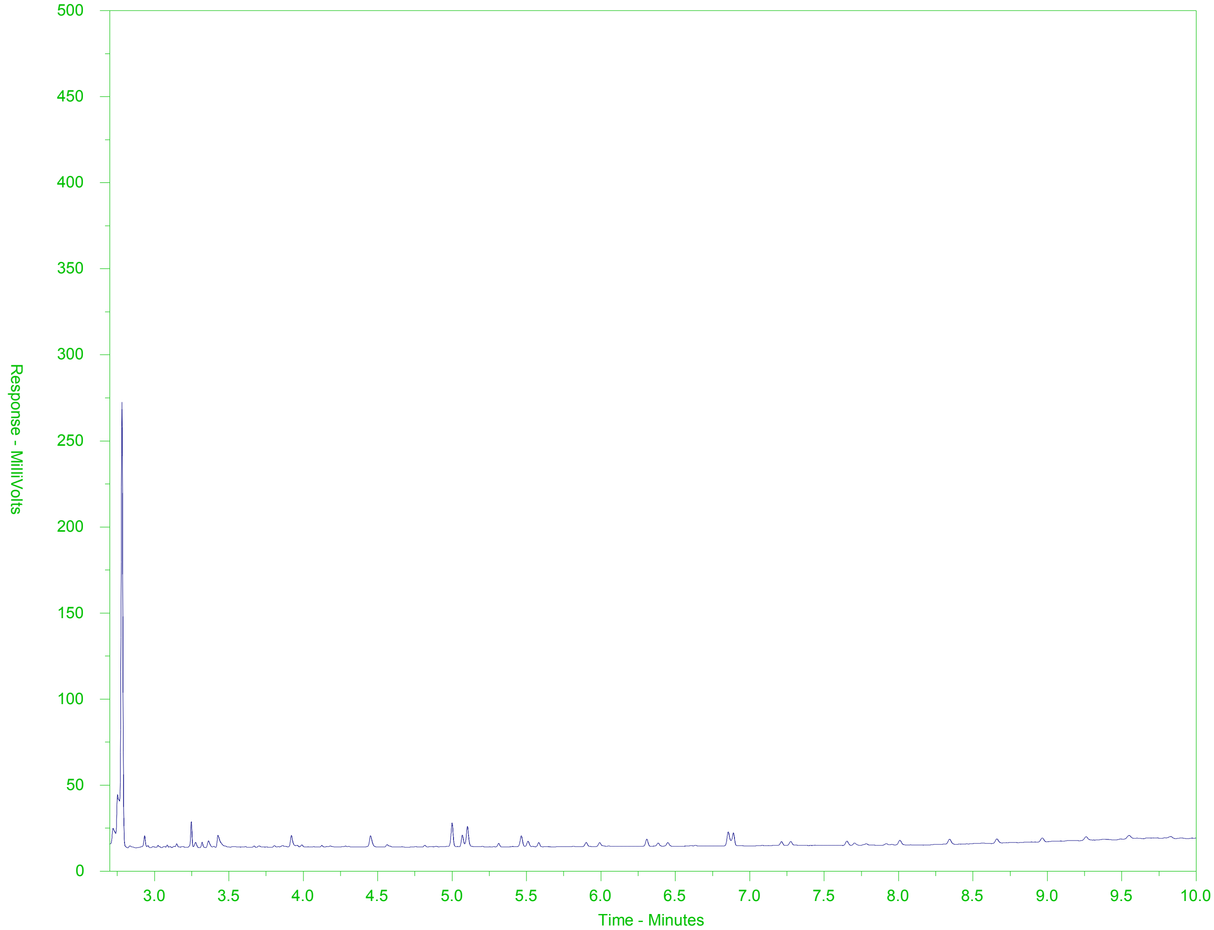
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1987356-L-2
Client Sample ID: N



← 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.

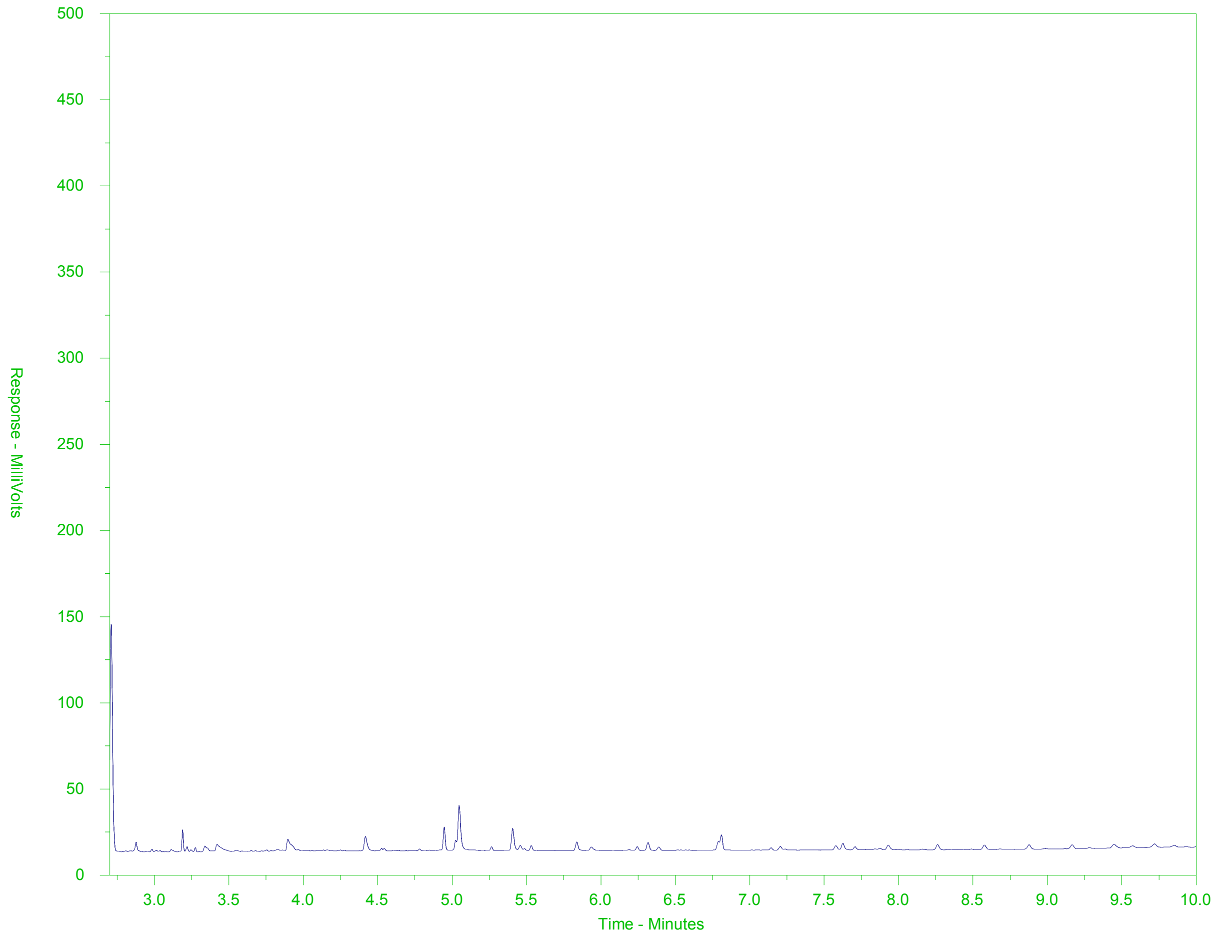
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1987356-L-3
Client Sample ID: ENE



← 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.

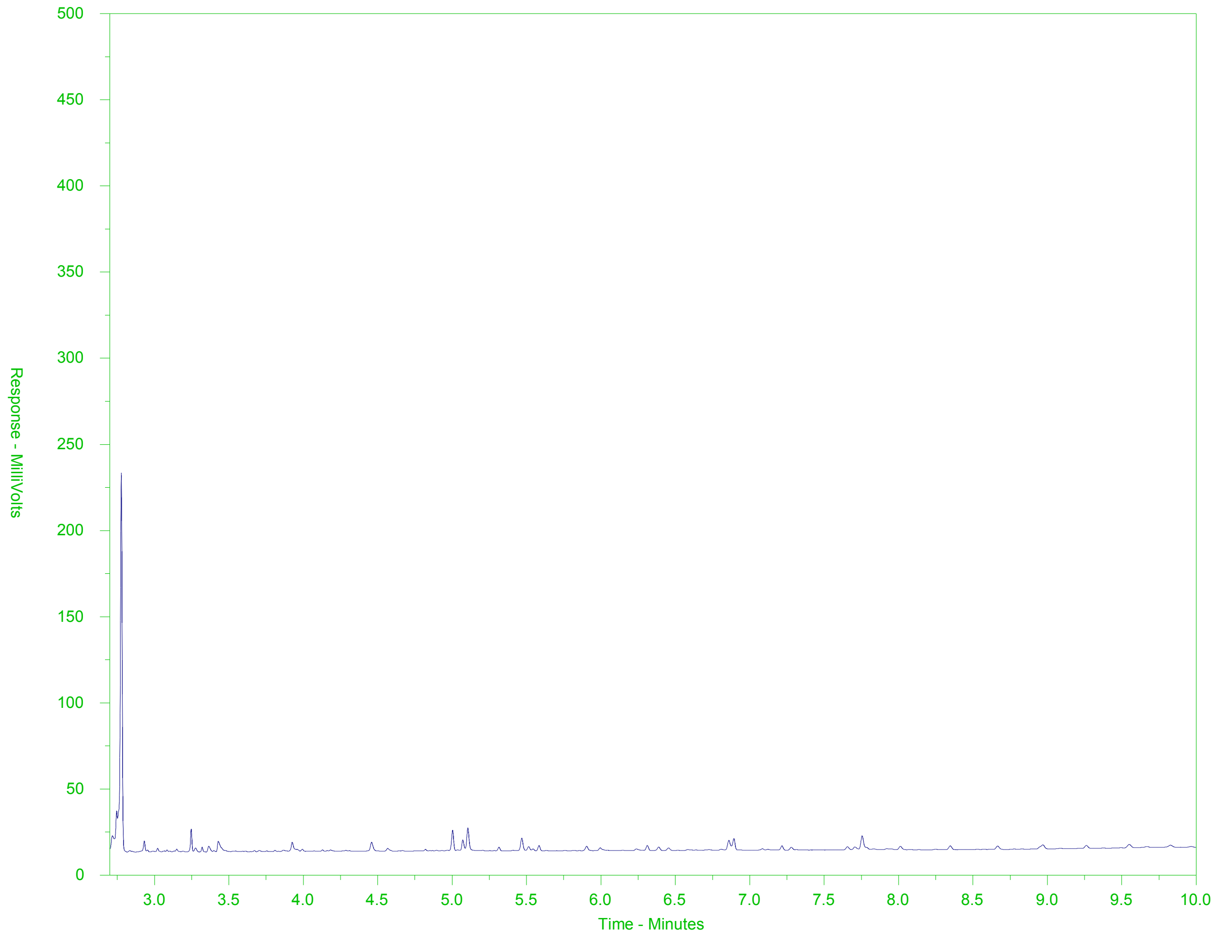
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1987356-L-4
Client Sample ID: SOURCE



← 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

APPENDIX E - WATER QUALITY DATA 4

Canada Toll Free: 1 800 668 9878

L1987356-COFC

COC Number: 15 - XXXXXX

Report To	Contact and companyname below will appear on the final report
Company:	Golder Associatex Ltd.
Contact:	John Sherrin / Arman Ospan
Phone:	1 (250) 881 7372
	Company address below will appear on the final report
Street:	2nd floor 3795 Carey Rd.
City/Province:	Victoria BC
Postal Code:	V8Z 6T8
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	
Contact:	

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 jsherrin@golder.com

Email 2 aospan@golder.com

Email 3 mspani@golder.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

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:

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

Project Information

ALS Account # / Quote #: BR191034

Job #: 1663724/10000/1003

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:

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	General (pH, Alkalinity, Turbidity, Conductivity, Anions, TSS)	TOC, Ammonia, TKN (P)	Dissolved Metals	Total Metals (P)	Dissolved Mercury	Total Mercury (P)	Hydrocarbons (PAH/LEPH/HEPH) (P)	Fecal Coliforms (P)	Number of Containers
	WNW	5-Sep-17	9:15	Seawater	X	X	X	X	X	X	X	X	9
	N	5-Sep-17	9:30	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	ENE	5-Sep-17	9:45	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	Source	5-Sep-17	10:00	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9

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)

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: 9.3

SHIPMENT RELEASE (client use)	INITIAL SHIPMENT RECEPTION (lab use only)	FINAL SHIPMENT RECEPTION (lab use only)
Released by: [signature] Date: 5 Sep 2017 Time: 12:35	Received by: Date: Time:	Received by: PAUL Date: SEP 9 Time: 09:15

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.**

GOLDER ASSOCIATES LTD.
ATTN: John Sherrin
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8

Date Received: 15-SEP-17
Report Date: 29-SEP-17 13:15 (MT)
Version: FINAL

Client Phone: 250-881-7372

Certificate of Analysis

Lab Work Order #: L1992036
Project P.O. #: NOT SUBMITTED
Job Reference: 1663724/10000/1003
C of C Numbers:
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-1	L1992036-2	L1992036-3	L1992036-4	L1992036-5
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER	SEAWATER
	Sampled Date	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17
	Sampled Time	10:45	10:30	10:15	11:00	
	Client ID	WNW	N	ENE	SOURCE	DUP-B
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Conductivity (uS/cm)	36900	33600	38400	37300	37400
	Hardness (as CaCO3) (mg/L)	4010	3610	4220	4060	4100
	pH (pH)	7.91	7.86	7.83	7.88	7.88
	Total Suspended Solids (mg/L)	3.6	4.6	3.6	25.5	14.6
	Turbidity (NTU)	1.08	1.53	1.81	9.60	4.82
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	104	99.3	99.6	105	104
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	49.9	43.8	51.7	47.6	49.5
	Chloride (Cl) (mg/L)	14400	12800	14900	14000	14300
	Fluoride (F) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Nitrate (as N) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nitrite (as N) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Total Kjeldahl Nitrogen (mg/L)	0.058	0.055	0.061	0.087	0.097
	Sulfate (SO4) (mg/L)	2030	1800	2100	1980	2030
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	2.05	1.20	14.5	5.64	8.16
Total Metals	Aluminum (Al)-Total (mg/L)	0.0330	0.0376	0.0498	0.142	0.122
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Total (mg/L)	0.0092	0.0085	0.0093	0.0092	0.0091
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	3.71	3.29	3.60	3.50	3.57
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Total (mg/L)	309	279	323	301	317
	Cesium (Cs)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Total (mg/L)	<0.000050	<0.000050	0.000103	0.000154	0.000138
	Copper (Cu)-Total (mg/L)	<0.00050	0.00060	<0.00050	0.00097	0.00081
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.050	0.051	0.052	0.286	0.231
	Lead (Pb)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00035	0.00031
	Lithium (Li)-Total (mg/L)	0.164	0.146	0.171	0.156	0.162
	Magnesium (Mg)-Total (mg/L)	824	759	827	813	830
	Manganese (Mn)-Total (mg/L)	0.00197	0.00220	0.00226	0.00654	0.00531
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	DLM <0.000030	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.0093	0.0075	0.0087	0.0088	0.0081

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-6				
	Description	SEAWATER				
	Sampled Date	12-SEP-17				
	Sampled Time	09:15				
	Client ID	E-BLANK				
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Conductivity (uS/cm)	<2.0				
	Hardness (as CaCO3) (mg/L)	<4.8				
	pH (pH)	5.32				
	Total Suspended Solids (mg/L)	<2.0				
	Turbidity (NTU)	<0.10				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	<1.0				
	Ammonia, Total (as N) (mg/L)	<0.0050				
	Bromide (Br) (mg/L)	<5.0				
	Chloride (Cl) (mg/L)	<50				
	Fluoride (F) (mg/L)	<1.0				
	Nitrate (as N) (mg/L)	<0.50				
	Nitrite (as N) (mg/L)	<0.10				
	Total Kjeldahl Nitrogen (mg/L)	<0.050				
	Sulfate (SO4) (mg/L)	<30				
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	<0.50				
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0050				
	Antimony (Sb)-Total (mg/L)	<0.00050				
	Arsenic (As)-Total (mg/L)	<0.0020				
	Barium (Ba)-Total (mg/L)	<0.0010				
	Beryllium (Be)-Total (mg/L)	<0.00050				
	Bismuth (Bi)-Total (mg/L)	<0.00050				
	Boron (B)-Total (mg/L)	<0.10				
	Cadmium (Cd)-Total (mg/L)	<0.000050				
	Calcium (Ca)-Total (mg/L)	<1.0				
	Cesium (Cs)-Total (mg/L)	<0.00050				
	Chromium (Cr)-Total (mg/L)	<0.00050				
	Cobalt (Co)-Total (mg/L)	<0.000050				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Gallium (Ga)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	<0.010				
	Lead (Pb)-Total (mg/L)	<0.00030				
	Lithium (Li)-Total (mg/L)	<0.020				
	Magnesium (Mg)-Total (mg/L)	<1.0				
	Manganese (Mn)-Total (mg/L)	<0.00020				
	Mercury (Hg)-Total (mg/L)	<0.000010				
	Molybdenum (Mo)-Total (mg/L)	<0.0020				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-1	L1992036-2	L1992036-3	L1992036-4	L1992036-5
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER	SEAWATER
	Sampled Date	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17
	Sampled Time	10:45	10:30	10:15	11:00	
	Client ID	WNW	N	ENE	SOURCE	DUP-B
Grouping	**Analyte**					
SEAWATER						
Total Metals	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	258	232	275	252	261
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Total (mg/L)	0.105	0.0962	0.109	0.103	0.103
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Total (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)	7100	6480	7490	7030	7290
	Strontium (Sr)-Total (mg/L)	4.61	3.94	4.42	4.54	4.55
	Sulfur (S)-Total (mg/L)	655	595	656	641	654
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Total (mg/L)	<0.0050	<0.0050	<0.0050	0.0088	0.0073
	Tungsten (W)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Total (mg/L)	0.00258	0.00244	0.00307	0.00423	0.00412
	Vanadium (V)-Total (mg/L)	0.00096	0.00091	0.00098	0.00137	0.00128
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0035	0.0035	<0.0030	<0.0030	0.0032
	Zirconium (Zr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Barium (Ba)-Dissolved (mg/L)	0.0088	0.0078	0.0085	0.0081	0.0084
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	3.72	3.30	3.56	3.44	3.66
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Dissolved (mg/L)	298	278	320	307	306
	Cesium (Cs)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-6				
	Description	SEAWATER				
	Sampled Date	12-SEP-17				
	Sampled Time	09:15				
	Client ID	E-BLANK				
Grouping	**Analyte**					
SEAWATER						
Total Metals	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	<1.0				
	Rhenium (Re)-Total (mg/L)	<0.00050				
	Rubidium (Rb)-Total (mg/L)	<0.0050				
	Selenium (Se)-Total (mg/L)	<0.0020				
	Silicon (Si)-Total (mg/L)	<1.0				
	Silver (Ag)-Total (mg/L)	<0.00010				
	Sodium (Na)-Total (mg/L)	<1.0				
	Strontium (Sr)-Total (mg/L)	<0.010				
	Sulfur (S)-Total (mg/L)	<5.0				
	Tellurium (Te)-Total (mg/L)	<0.00050				
	Thallium (Tl)-Total (mg/L)	<0.000050				
	Thorium (Th)-Total (mg/L)	<0.00050				
	Tin (Sn)-Total (mg/L)	<0.0010				
	Titanium (Ti)-Total (mg/L)	<0.0050				
	Tungsten (W)-Total (mg/L)	<0.0010				
	Uranium (U)-Total (mg/L)	<0.000050				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Yttrium (Y)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.00050				
Dissolved Metals	Dissolved Mercury Filtration Location	LAB				
	Dissolved Metals Filtration Location	LAB				
	Aluminum (Al)-Dissolved (mg/L)	<0.0050				
	Antimony (Sb)-Dissolved (mg/L)	<0.00050				
	Arsenic (As)-Dissolved (mg/L)	<0.0020				
	Barium (Ba)-Dissolved (mg/L)	<0.0010				
	Beryllium (Be)-Dissolved (mg/L)	<0.00050				
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050				
	Boron (B)-Dissolved (mg/L)	<0.10				
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050				
	Calcium (Ca)-Dissolved (mg/L)	<1.0				
	Cesium (Cs)-Dissolved (mg/L)	<0.00050				
	Chromium (Cr)-Dissolved (mg/L)	<0.00050				
	Cobalt (Co)-Dissolved (mg/L)	<0.000050				
	Copper (Cu)-Dissolved (mg/L)	<0.00050				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-1	L1992036-2	L1992036-3	L1992036-4	L1992036-5
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER	SEAWATER
	Sampled Date	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17
	Sampled Time	10:45	10:30	10:15	11:00	
	Client ID	WNW	N	ENE	SOURCE	DUP-B
Grouping	**Analyte**					
SEAWATER						
Dissolved Metals	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Dissolved (mg/L)	0.156	0.136	0.166	0.149	0.155
	Magnesium (Mg)-Dissolved (mg/L)	794	710	831	800	810
	Manganese (Mn)-Dissolved (mg/L)	0.00069	0.00071	0.00063	0.00056	0.00048
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.0089	0.0074	0.0090	0.0086	0.0089
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	244	223	265	257	256
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Dissolved (mg/L)	0.0997	0.0889	0.108	0.0992	0.101
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Dissolved (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Dissolved (mg/L)	6770	6310	7400	7150	6940
	Strontium (Sr)-Dissolved (mg/L)	4.19	3.87	4.55	4.34	4.44
	Sulfur (S)-Dissolved (mg/L)	635	578	672	639	648
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Uranium (U)-Dissolved (mg/L)	0.00262	0.00233	0.00315	0.00407	0.00420
	Vanadium (V)-Dissolved (mg/L)	0.00083	0.00082	0.00091	0.00089	0.00090
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-6					
	Description	SEAWATER					
	Sampled Date	12-SEP-17					
	Sampled Time	09:15					
	Client ID	E-BLANK					
Grouping	**Analyte**						
SEAWATER							
Dissolved Metals	Gallium (Ga)-Dissolved (mg/L)	<0.00050					
	Iron (Fe)-Dissolved (mg/L)	<0.010					
	Lead (Pb)-Dissolved (mg/L)	<0.00030					
	Lithium (Li)-Dissolved (mg/L)	<0.020					
	Magnesium (Mg)-Dissolved (mg/L)	<1.0					
	Manganese (Mn)-Dissolved (mg/L)	<0.00020					
	Mercury (Hg)-Dissolved (mg/L)	<0.000010					
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0020					
	Nickel (Ni)-Dissolved (mg/L)	<0.00050					
	Phosphorus (P)-Dissolved (mg/L)	<0.050					
	Potassium (K)-Dissolved (mg/L)	<20					
	Rhenium (Re)-Dissolved (mg/L)	<0.00050					
	Rubidium (Rb)-Dissolved (mg/L)	<0.0050					
	Selenium (Se)-Dissolved (mg/L)	<0.0020					
	Silicon (Si)-Dissolved (mg/L)	<1.0					
	Silver (Ag)-Dissolved (mg/L)	<0.00010					
	Sodium (Na)-Dissolved (mg/L)	<20					
	Strontium (Sr)-Dissolved (mg/L)	<0.050					
	Sulfur (S)-Dissolved (mg/L)	<5.0					
	Tellurium (Te)-Dissolved (mg/L)	<0.00050					
	Thallium (Tl)-Dissolved (mg/L)	<0.000050					
	Thorium (Th)-Dissolved (mg/L)	<0.00050					
	Tin (Sn)-Dissolved (mg/L)	<0.0010					
	Titanium (Ti)-Dissolved (mg/L)	<0.0050					
	Tungsten (W)-Dissolved (mg/L)	<0.0010					
	Uranium (U)-Dissolved (mg/L)	<0.000050					
	Vanadium (V)-Dissolved (mg/L)	<0.00050					
	Yttrium (Y)-Dissolved (mg/L)	<0.00050					
	Zinc (Zn)-Dissolved (mg/L)	<0.0030					
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050					

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1992036-1	L1992036-2	L1992036-3	L1992036-4	L1992036-5
	Description	SEAWATER	SEAWATER	SEAWATER	SEAWATER	SEAWATER
	Sampled Date	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17	10-SEP-17
	Sampled Time	10:45	10:30	10:15	11:00	
	Client ID	WNW	N	ENE	SOURCE	DUP-B
WATER						
Hydrocarbons	EPH10-19 (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	EPH19-32 (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	LEPH (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	HEPH (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: 2-Bromobenzotrifluoride (%)	85.5	135.7	114.8	90.8	94.3
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Acenaphthylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Acridine (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benz(a)anthracene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(a)pyrene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Benzo(b&j)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(g,h,i)perylene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Benzo(k)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Chrysene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Dibenz(a,h)anthracene (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Fluorene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Phenanthrene (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Surrogate: Acridine d9 (%)	100.8	86.6	94.3	101.0	86.5
	Surrogate: Chrysene d12 (%)	107.5	93.8	103.3	110.9	103.5
	Surrogate: Naphthalene d8 (%)	96.0	84.9	87.4	92.5	81.1
	Surrogate: Phenanthrene d10 (%)	107.7	95.5	103.6	111.4	99.4

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1992036-6				
	Description	SEAWATER				
	Sampled Date	12-SEP-17				
	Sampled Time	09:15				
	Client ID	E-BLANK				
Grouping	**Analyte**					
WATER						
Hydrocarbons	EPH10-19 (mg/L)	<0.050				
	EPH19-32 (mg/L)	<0.050				
	LEPH (mg/L)	<0.050				
	HEPH (mg/L)	<0.050				
	Surrogate: 2-Bromobenzotrifluoride (%)	91.6				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010				
	Acenaphthylene (mg/L)	<0.000010				
	Acridine (mg/L)	<0.000010				
	Anthracene (mg/L)	<0.000010				
	Benz(a)anthracene (mg/L)	<0.000010				
	Benzo(a)pyrene (mg/L)	<0.0000050				
	Benzo(b&j)fluoranthene (mg/L)	<0.000010				
	Benzo(g,h,i)perylene (mg/L)	<0.000010				
	Benzo(k)fluoranthene (mg/L)	<0.000010				
	Chrysene (mg/L)	<0.000010				
	Dibenz(a,h)anthracene (mg/L)	<0.0000050				
	Fluoranthene (mg/L)	<0.000010				
	Fluorene (mg/L)	<0.000010				
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010				
	Naphthalene (mg/L)	<0.000050				
	Phenanthrene (mg/L)	<0.000020				
	Pyrene (mg/L)	<0.000010				
	Quinoline (mg/L)	<0.000050				
	Surrogate: Acridine d9 (%)	100.4				
	Surrogate: Chrysene d12 (%)	123.2				
	Surrogate: Naphthalene d8 (%)	85.8				
	Surrogate: Phenanthrene d10 (%)	107.2				

* 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)
Matrix Spike	Bromide (Br)	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Chloride (Cl)	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Sulfate (SO4)	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1992036-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1992036-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Seawater	Alkalinity Spec by Titration (Seawater)	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-C-BR-IC-VA | Seawater | Bromide by IC (seawater) | EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-CL-IC-VA | Seawater | Chloride by IC (seawater) | EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-F-IC-VA | Seawater | Fluoride by IC (seawater) | EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-C-NO2-IC-VA | Seawater | Nitrite in Seawater by IC | EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-C-NO3-IC-VA | Seawater | Nitrate in Seawater by IC | EPA 300.1 (mod)

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-C-SO4-IC-VA | Seawater | Sulfate by IC (seawater) | EPA 300.1 (mod)

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-C-TOC-VA | Seawater | TOC by combustion (seawater) | APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-C-PCT-VA | Seawater | Conductivity (Automated) (seawater) | APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EPH-L-ME-FID-VA | Water | EPH in Water (Low Level) | 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.

HARDNESS-CALC-VA | Seawater | Hardness | APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-C-CVAFS-VA | Seawater | Diss. Mercury in Seawater by CVAFS | PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-C-CVAFS-VA | Seawater | Total Mercury in Seawater by CVAFS | PUGET SOUND PROTOCOLS, EPA 245.7

Reference Information

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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).

MET-D-L-HRMS-VA	Seawater	Diss. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-T-L-HRMS-VA	Seawater	Tot. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

NH3-F-VA	Seawater	Ammonia in Seawater by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

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.

PH-C-PCT-VA	Seawater	pH by Meter (Automated) (seawater)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

It is recommended that this analysis be conducted in the field.

TKN-C-F-VA	Seawater	TKN in Seawater by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-C-VA	Seawater	Total Suspended Solids by Gravimetric	APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) is determined by filtering a sample through a glass fibre filter. TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-C-VA	Seawater	Turbidity by Meter in Seawater	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Client: GOLDER ASSOCIATES LTD.
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8

Contact: John Sherrin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EPH-L-ME-FID-VA	**Water**							
Batch R3830666								
WG2621013-2 LCS								
EPH10-19			106.0		%		50-150	21-SEP-17
EPH19-32			83.2		%		50-150	21-SEP-17
WG2621013-1 MB								
EPH10-19			<0.050		mg/L		0.05	21-SEP-17
EPH19-32			<0.050		mg/L		0.05	21-SEP-17
Surrogate: 2-Bromobenzotrifluoride			81.9		%		60-140	21-SEP-17
PAH-ME-MS-VA	**Water**							
Batch R3835198								
WG2621013-2 LCS								
Acenaphthene			112.9		%		60-130	23-SEP-17
Acenaphthylene			113.4		%		60-130	23-SEP-17
Acridine			108.8		%		60-130	23-SEP-17
Anthracene			108.3		%		60-130	23-SEP-17
Benz(a)anthracene			104.3		%		60-130	23-SEP-17
Benzo(a)pyrene			109.3		%		60-130	23-SEP-17
Benzo(b&j)fluoranthene			115.2		%		60-130	23-SEP-17
Benzo(g,h,i)perylene			109.0		%		60-130	23-SEP-17
Benzo(k)fluoranthene			116.3		%		60-130	23-SEP-17
Chrysene			117.4		%		60-130	23-SEP-17
Dibenz(a,h)anthracene			103.6		%		60-130	23-SEP-17
Fluoranthene			115.8		%		60-130	23-SEP-17
Fluorene			111.8		%		60-130	23-SEP-17
Indeno(1,2,3-c,d)pyrene			113.0		%		60-130	23-SEP-17
Naphthalene			112.2		%		50-130	23-SEP-17
Phenanthrene			114.9		%		60-130	23-SEP-17
Pyrene			115.2		%		60-130	23-SEP-17
Quinoline			119.5		%		60-130	23-SEP-17
WG2621013-1 MB								
Acenaphthene			<0.000010		mg/L		0.00001	23-SEP-17
Acenaphthylene			<0.000010		mg/L		0.00001	23-SEP-17
Acridine			<0.000010		mg/L		0.00001	23-SEP-17
Anthracene			<0.000010		mg/L		0.00001	23-SEP-17
Benz(a)anthracene			<0.000010		mg/L		0.00001	23-SEP-17
Benzo(a)pyrene			<0.000005C		mg/L		0.000005	23-SEP-17
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	23-SEP-17

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ME-MS-VA	**Water**							
Batch R3835198								
WG2621013-1 MB								
Benzo(g,h,i)perylene			<0.000010		mg/L		0.00001	23-SEP-17
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	23-SEP-17
Chrysene			<0.000010		mg/L		0.00001	23-SEP-17
Dibenz(a,h)anthracene			<0.0000050		mg/L		0.000005	23-SEP-17
Fluoranthene			<0.000010		mg/L		0.00001	23-SEP-17
Fluorene			<0.000010		mg/L		0.00001	23-SEP-17
Indeno(1,2,3-c,d)pyrene			<0.000010		mg/L		0.00001	23-SEP-17
Naphthalene			<0.000050		mg/L		0.00005	23-SEP-17
Phenanthrene			<0.000020		mg/L		0.00002	23-SEP-17
Pyrene			<0.000010		mg/L		0.00001	23-SEP-17
Quinoline			<0.000050		mg/L		0.00005	23-SEP-17
Surrogate: Acridine d9			96.7		%		60-130	23-SEP-17
Surrogate: Chrysene d12			119.2		%		60-130	23-SEP-17
Surrogate: Naphthalene d8			83.4		%		50-130	23-SEP-17
Surrogate: Phenanthrene d10			101.1		%		60-130	23-SEP-17
ALK-TITR-VA	**Seawater**							
Batch R3834165								
WG2619656-8 CRM		**VA-ALK-TITR-CONTROL**						
Alkalinity, Total (as CaCO3)			101.1		%		85-115	20-SEP-17
WG2619656-10 DUP		**L1992036-2**						
Alkalinity, Total (as CaCO3)		99.3	98.3		mg/L	1.0	20	20-SEP-17
WG2619656-6 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	20-SEP-17
ANIONS-C-BR-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-3 DUP		**L1992036-6**						
Bromide (Br)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618320-2 LCS								
Bromide (Br)			103.1		%		85-115	18-SEP-17
WG2618320-1 MB								
Bromide (Br)			<5.0		mg/L		5	18-SEP-17
WG2618320-4 MS		**L1992036-5**						
Bromide (Br)			N/A	MS-B	%		-	18-SEP-17
ANIONS-C-CL-IC-VA	**Seawater**							

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-CL-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-3 DUP		**L1992036-6**						
Chloride (Cl)		<50	<50	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618320-2 LCS								
Chloride (Cl)			102.2		%		90-110	18-SEP-17
WG2618320-1 MB								
Chloride (Cl)			<50		mg/L		50	18-SEP-17
WG2618320-4 MS		**L1992036-5**						
Chloride (Cl)			N/A	MS-B	%		-	18-SEP-17
ANIONS-C-F-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-3 DUP		**L1992036-6**						
Fluoride (F)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618320-2 LCS								
Fluoride (F)			100.1		%		90-110	18-SEP-17
WG2618320-1 MB								
Fluoride (F)			<1.0		mg/L		1	18-SEP-17
ANIONS-C-NO2-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-3 DUP		**L1992036-6**						
Nitrite (as N)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618320-2 LCS								
Nitrite (as N)			99.5		%		90-110	18-SEP-17
WG2618320-1 MB								
Nitrite (as N)			<0.10		mg/L		0.1	18-SEP-17
ANIONS-C-NO3-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-3 DUP		**L1992036-6**						
Nitrate (as N)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618320-2 LCS								
Nitrate (as N)			102.6		%		90-110	18-SEP-17
WG2618320-1 MB								
Nitrate (as N)			<0.50		mg/L		0.5	18-SEP-17
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-3 DUP		**L1992036-6**						
Sulfate (SO4)		<30	<30	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618320-2 LCS								

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Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-C-SO4-IC-VA	**Seawater**							
Batch R3835164								
WG2618320-2 LCS								
Sulfate (SO4)			103.0		%		90-110	18-SEP-17
WG2618320-1 MB								
Sulfate (SO4)			<30		mg/L		30	18-SEP-17
WG2618320-4 MS		**L1992036-5**						
Sulfate (SO4)			N/A	MS-B	%		-	18-SEP-17
CARBONS-C-TOC-VA	**Seawater**							
Batch R3830402								
WG2617517-5 LCS								
Total Organic Carbon			102.4		%		80-120	16-SEP-17
WG2617517-4 MB								
Total Organic Carbon			<0.50		mg/L		0.5	16-SEP-17
EC-C-PCT-VA	**Seawater**							
Batch R3834165								
WG2619656-9 CRM		**VA-EC-PCT-CONTROL**						
Conductivity			103.4		%		90-110	20-SEP-17
WG2619656-10 DUP		**L1992036-2**						
Conductivity		33600	34000		uS/cm	1.2	10	20-SEP-17
WG2619656-6 MB								
Conductivity			<2.0		uS/cm		2	20-SEP-17
HG-DIS-C-CVAFS-VA	**Seawater**							
Batch R3835215								
WG2621411-2 LCS								
Mercury (Hg)-Dissolved			99.4		%		80-120	21-SEP-17
WG2621411-1 MB		**LF**						
Mercury (Hg)-Dissolved			<0.000010		mg/L		0.00001	21-SEP-17
HG-TOT-C-CVAFS-VA	**Seawater**							
Batch R3831214								
WG2618774-3 DUP		**L1992036-1**						
Mercury (Hg)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618774-2 LCS								
Mercury (Hg)-Total			97.8		%		80-120	18-SEP-17
WG2618774-1 MB								
Mercury (Hg)-Total			<0.000010		mg/L		0.00001	18-SEP-17
MET-D-L-HRMS-VA	**Seawater**							

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Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2619733-2 LCS								
Aluminum (Al)-Dissolved			104.9		%		80-120	23-SEP-17
Antimony (Sb)-Dissolved			86.9		%		80-120	23-SEP-17
Arsenic (As)-Dissolved			105.9		%		80-120	23-SEP-17
Barium (Ba)-Dissolved			98.4		%		80-120	23-SEP-17
Beryllium (Be)-Dissolved			96.5		%		80-120	23-SEP-17
Bismuth (Bi)-Dissolved			97.3		%		80-120	23-SEP-17
Boron (B)-Dissolved			111.9		%		80-120	23-SEP-17
Cadmium (Cd)-Dissolved			95.4		%		80-120	23-SEP-17
Calcium (Ca)-Dissolved			108.0		%		80-120	23-SEP-17
Cesium (Cs)-Dissolved			103.4		%		80-120	23-SEP-17
Chromium (Cr)-Dissolved			97.6		%		80-120	23-SEP-17
Cobalt (Co)-Dissolved			101.2		%		80-120	23-SEP-17
Copper (Cu)-Dissolved			97.2		%		80-120	23-SEP-17
Gallium (Ga)-Dissolved			101.2		%		80-120	23-SEP-17
Iron (Fe)-Dissolved			99.4		%		80-120	23-SEP-17
Lead (Pb)-Dissolved			99.9		%		80-120	23-SEP-17
Lithium (Li)-Dissolved			100.0		%		80-120	23-SEP-17
Magnesium (Mg)-Dissolved			102.9		%		80-120	23-SEP-17
Manganese (Mn)-Dissolved			108.1		%		80-120	23-SEP-17
Molybdenum (Mo)-Dissolved			92.0		%		80-120	23-SEP-17
Nickel (Ni)-Dissolved			96.6		%		80-120	23-SEP-17
Phosphorus (P)-Dissolved			106.6		%		80-120	23-SEP-17
Potassium (K)-Dissolved			104.1		%		80-120	23-SEP-17
Rhenium (Re)-Dissolved			96.6		%		80-120	23-SEP-17
Rubidium (Rb)-Dissolved			108.0		%		80-120	23-SEP-17
Selenium (Se)-Dissolved			109.4		%		80-120	23-SEP-17
Silicon (Si)-Dissolved			101.7		%		80-120	23-SEP-17
Silver (Ag)-Dissolved			89.8		%		80-120	23-SEP-17
Strontium (Sr)-Dissolved			89.4		%		80-120	23-SEP-17
Sulfur (S)-Dissolved			112.8		%		70-130	23-SEP-17
Tellurium (Te)-Dissolved			96.8		%		80-120	23-SEP-17
Thallium (Tl)-Dissolved			94.1		%		80-120	23-SEP-17
Thorium (Th)-Dissolved			108.1		%		80-120	23-SEP-17
Tin (Sn)-Dissolved			104.8		%		80-120	23-SEP-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2619733-2 LCS								
Titanium (Ti)-Dissolved			100.4		%		80-120	23-SEP-17
Tungsten (W)-Dissolved			101.0		%		80-120	23-SEP-17
Uranium (U)-Dissolved			93.4		%		80-120	23-SEP-17
Vanadium (V)-Dissolved			101.6		%		80-120	23-SEP-17
Yttrium (Y)-Dissolved			104.7		%		80-120	23-SEP-17
Zinc (Zn)-Dissolved			95.2		%		80-120	23-SEP-17
Zirconium (Zr)-Dissolved			100.0		%		80-120	23-SEP-17
WG2619733-1 MB		**LF**						
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	23-SEP-17
Antimony (Sb)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Arsenic (As)-Dissolved			<0.0020		mg/L		0.002	23-SEP-17
Barium (Ba)-Dissolved			<0.0010		mg/L		0.001	23-SEP-17
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Bismuth (Bi)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Boron (B)-Dissolved			<0.10		mg/L		0.1	23-SEP-17
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Calcium (Ca)-Dissolved			<1.0		mg/L		1	23-SEP-17
Cesium (Cs)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Cobalt (Co)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Gallium (Ga)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	23-SEP-17
Lead (Pb)-Dissolved			<0.00030		mg/L		0.0003	23-SEP-17
Lithium (Li)-Dissolved			<0.020		mg/L		0.02	23-SEP-17
Magnesium (Mg)-Dissolved			<1.0		mg/L		1	23-SEP-17
Manganese (Mn)-Dissolved			<0.00020		mg/L		0.0002	23-SEP-17
Molybdenum (Mo)-Dissolved			<0.0020		mg/L		0.002	23-SEP-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	23-SEP-17
Potassium (K)-Dissolved			<1.0		mg/L		1	23-SEP-17
Rhenium (Re)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Rubidium (Rb)-Dissolved			<0.0050		mg/L		0.005	23-SEP-17
Selenium (Se)-Dissolved			<0.0020		mg/L		0.002	23-SEP-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2619733-1 MB		**LF**						
Silicon (Si)-Dissolved			<1.0		mg/L		1	23-SEP-17
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	23-SEP-17
Sodium (Na)-Dissolved			<1.0		mg/L		1	23-SEP-17
Strontium (Sr)-Dissolved			<0.010		mg/L		0.01	23-SEP-17
Sulfur (S)-Dissolved			<5.0		mg/L		5	23-SEP-17
Tellurium (Te)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Thorium (Th)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Tin (Sn)-Dissolved			<0.0010		mg/L		0.001	23-SEP-17
Titanium (Ti)-Dissolved			<0.0050		mg/L		0.005	23-SEP-17
Tungsten (W)-Dissolved			<0.0010		mg/L		0.001	23-SEP-17
Uranium (U)-Dissolved			<0.000050		mg/L		0.00005	23-SEP-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Yttrium (Y)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	23-SEP-17
Zirconium (Zr)-Dissolved			<0.00050		mg/L		0.0005	23-SEP-17
Batch R3839056								
WG2619733-3 DUP		**L1992036-1**						
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Arsenic (As)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	25-SEP-17
Barium (Ba)-Dissolved		0.0088	0.0085		mg/L	3.4	20	25-SEP-17
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Bismuth (Bi)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Boron (B)-Dissolved		3.72	3.65		mg/L	1.9	20	25-SEP-17
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	25-SEP-17
Calcium (Ca)-Dissolved		298	306		mg/L	2.9	20	25-SEP-17
Cesium (Cs)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Cobalt (Co)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	25-SEP-17
Gallium (Ga)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	25-SEP-17
Lead (Pb)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	25-SEP-17
Lithium (Li)-Dissolved		0.156	0.158		mg/L	1.3	20	25-SEP-17
Magnesium (Mg)-Dissolved		794	804		mg/L	1.3	20	25-SEP-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3839056								
WG2619733-3 DUP		**L1992036-1**						
Manganese (Mn)-Dissolved		0.00069	0.00073		mg/L	5.4	20	25-SEP-17
Molybdenum (Mo)-Dissolved		0.0089	0.0086		mg/L	4.1	20	25-SEP-17
Nickel (Ni)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Phosphorus (P)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-17
Potassium (K)-Dissolved		244	248		mg/L	1.8	20	25-SEP-17
Rhenium (Re)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Rubidium (Rb)-Dissolved		0.0997	0.0986		mg/L	1.1	20	25-SEP-17
Selenium (Se)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	25-SEP-17
Silicon (Si)-Dissolved		<1.0	<1.0	RPD-NA	mg/L	N/A	25	25-SEP-17
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	25-SEP-17
Sodium (Na)-Dissolved		6770	6960		mg/L	2.8	20	25-SEP-17
Strontium (Sr)-Dissolved		4.19	4.37		mg/L	4.1	20	25-SEP-17
Sulfur (S)-Dissolved		635	645		mg/L	1.5	25	25-SEP-17
Tellurium (Te)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	25-SEP-17
Thorium (Th)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Tin (Sn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	25-SEP-17
Titanium (Ti)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	25-SEP-17
Tungsten (W)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	25-SEP-17
Uranium (U)-Dissolved		0.00262	0.00262		mg/L	0.0	20	25-SEP-17
Vanadium (V)-Dissolved		0.00083	0.00091		mg/L	8.7	20	25-SEP-17
Yttrium (Y)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Zinc (Zn)-Dissolved		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	25-SEP-17
Zirconium (Zr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
WG2619733-4 MS		**L1992036-2**						
Aluminum (Al)-Dissolved			113.5		%		70-130	25-SEP-17
Antimony (Sb)-Dissolved			98.6		%		70-130	25-SEP-17
Arsenic (As)-Dissolved			100.5		%		70-130	25-SEP-17
Barium (Ba)-Dissolved			111.6		%		70-130	25-SEP-17
Beryllium (Be)-Dissolved			105.4		%		70-130	25-SEP-17
Bismuth (Bi)-Dissolved			105.0		%		70-130	25-SEP-17
Boron (B)-Dissolved			113.6		%		70-130	25-SEP-17
Cadmium (Cd)-Dissolved			95.9		%		70-130	25-SEP-17
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	25-SEP-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3839056								
WG2619733-4 MS		**L1992036-2**						
Cesium (Cs)-Dissolved			118.2		%		70-130	25-SEP-17
Chromium (Cr)-Dissolved			101.0		%		70-130	25-SEP-17
Cobalt (Co)-Dissolved			101.4		%		70-130	25-SEP-17
Copper (Cu)-Dissolved			90.2		%		70-130	25-SEP-17
Gallium (Ga)-Dissolved			99.0		%		70-130	25-SEP-17
Iron (Fe)-Dissolved			97.7		%		70-130	25-SEP-17
Lead (Pb)-Dissolved			107.6		%		70-130	25-SEP-17
Lithium (Li)-Dissolved			107.2		%		70-130	25-SEP-17
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	25-SEP-17
Manganese (Mn)-Dissolved			107.3		%		70-130	25-SEP-17
Molybdenum (Mo)-Dissolved			109.1		%		70-130	25-SEP-17
Nickel (Ni)-Dissolved			94.3		%		70-130	25-SEP-17
Phosphorus (P)-Dissolved			101.5		%		70-130	25-SEP-17
Potassium (K)-Dissolved			N/A	MS-B	%		-	25-SEP-17
Rhenium (Re)-Dissolved			97.8		%		70-130	25-SEP-17
Rubidium (Rb)-Dissolved			95.1		%		70-130	25-SEP-17
Selenium (Se)-Dissolved			100.0		%		70-130	25-SEP-17
Silver (Ag)-Dissolved			94.1		%		70-130	25-SEP-17
Sodium (Na)-Dissolved			N/A	MS-B	%		-	25-SEP-17
Strontium (Sr)-Dissolved			N/A	MS-B	%		-	25-SEP-17
Tellurium (Te)-Dissolved			100.9		%		70-130	25-SEP-17
Thallium (Tl)-Dissolved			106.2		%		70-130	25-SEP-17
Thorium (Th)-Dissolved			110.5		%		70-130	25-SEP-17
Tin (Sn)-Dissolved			113.0		%		70-130	25-SEP-17
Titanium (Ti)-Dissolved			106.1		%		70-130	25-SEP-17
Tungsten (W)-Dissolved			111.0		%		70-130	25-SEP-17
Uranium (U)-Dissolved			113.3		%		70-130	25-SEP-17
Vanadium (V)-Dissolved			102.2		%		70-130	25-SEP-17
Yttrium (Y)-Dissolved			115.8		%		70-130	25-SEP-17
Zinc (Zn)-Dissolved			93.7		%		70-130	25-SEP-17
Zirconium (Zr)-Dissolved			103.8		%		70-130	25-SEP-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-HRMS-VA	**Seawater**							
Batch R3840178								
WG2619733-2 LCS								
Sodium (Na)-Dissolved			93.9		%		80-120	26-SEP-17
Batch R3840508								
WG2619733-3 DUP		**L1992036-1**						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-SEP-17
MET-T-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2620295-2 LCS								
Aluminum (Al)-Total			107.9		%		80-120	23-SEP-17
Antimony (Sb)-Total			90.5		%		80-120	23-SEP-17
Arsenic (As)-Total			108.1		%		80-120	23-SEP-17
Barium (Ba)-Total			98.0		%		80-120	23-SEP-17
Beryllium (Be)-Total			99.0		%		80-120	23-SEP-17
Bismuth (Bi)-Total			97.3		%		80-120	23-SEP-17
Boron (B)-Total			115.1		%		80-120	23-SEP-17
Cadmium (Cd)-Total			96.6		%		80-120	23-SEP-17
Calcium (Ca)-Total			111.6		%		80-120	23-SEP-17
Cesium (Cs)-Total			106.6		%		80-120	23-SEP-17
Chromium (Cr)-Total			102.0		%		80-120	23-SEP-17
Cobalt (Co)-Total			102.8		%		80-120	23-SEP-17
Copper (Cu)-Total			102.0		%		80-120	23-SEP-17
Gallium (Ga)-Total			104.8		%		80-120	23-SEP-17
Iron (Fe)-Total			102.6		%		80-120	23-SEP-17
Lead (Pb)-Total			101.6		%		80-120	23-SEP-17
Lithium (Li)-Total			103.6		%		80-120	23-SEP-17
Magnesium (Mg)-Total			110.0		%		80-120	23-SEP-17
Manganese (Mn)-Total			113.7		%		80-120	23-SEP-17
Molybdenum (Mo)-Total			94.8		%		80-120	23-SEP-17
Nickel (Ni)-Total			103.0		%		80-120	23-SEP-17
Phosphorus (P)-Total			110.2		%		80-120	23-SEP-17
Potassium (K)-Total			111.1		%		80-120	23-SEP-17
Rhenium (Re)-Total			103.1		%		80-120	23-SEP-17
Rubidium (Rb)-Total			109.0		%		80-120	23-SEP-17
Selenium (Se)-Total			115.3		%		80-120	23-SEP-17

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2620295-2 LCS								
Silicon (Si)-Total			110.8		%		80-120	23-SEP-17
Silver (Ag)-Total			100.1		%		80-120	23-SEP-17
Strontium (Sr)-Total			91.4		%		80-120	23-SEP-17
Sulfur (S)-Total			115.3		%		70-130	23-SEP-17
Tellurium (Te)-Total			103.4		%		80-120	23-SEP-17
Thallium (Tl)-Total			94.0		%		80-120	23-SEP-17
Thorium (Th)-Total			111.6		%		80-120	23-SEP-17
Tin (Sn)-Total			103.9		%		80-120	23-SEP-17
Titanium (Ti)-Total			105.2		%		80-120	23-SEP-17
Tungsten (W)-Total			104.0		%		80-120	23-SEP-17
Uranium (U)-Total			98.6		%		80-120	23-SEP-17
Vanadium (V)-Total			105.8		%		80-120	23-SEP-17
Yttrium (Y)-Total			113.4		%		80-120	23-SEP-17
Zinc (Zn)-Total			97.4		%		80-120	23-SEP-17
Zirconium (Zr)-Total			106.0		%		80-120	23-SEP-17
WG2620295-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	23-SEP-17
Antimony (Sb)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Arsenic (As)-Total			<0.0020		mg/L		0.002	23-SEP-17
Barium (Ba)-Total			<0.0010		mg/L		0.001	23-SEP-17
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Bismuth (Bi)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Boron (B)-Total			<0.10		mg/L		0.1	23-SEP-17
Cadmium (Cd)-Total			<0.000050		mg/L		0.00005	23-SEP-17
Calcium (Ca)-Total			<1.0		mg/L		1	23-SEP-17
Cesium (Cs)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Cobalt (Co)-Total			<0.000050		mg/L		0.00005	23-SEP-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Gallium (Ga)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Iron (Fe)-Total			<0.010		mg/L		0.01	23-SEP-17
Lead (Pb)-Total			<0.00030		mg/L		0.0003	23-SEP-17
Lithium (Li)-Total			<0.020		mg/L		0.02	23-SEP-17
Magnesium (Mg)-Total			<1.0		mg/L		1	23-SEP-17

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3837732								
WG2620295-1 MB								
Manganese (Mn)-Total			<0.00020		mg/L		0.0002	23-SEP-17
Molybdenum (Mo)-Total			<0.0020		mg/L		0.002	23-SEP-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	23-SEP-17
Potassium (K)-Total			<1.0		mg/L		1	23-SEP-17
Rhenium (Re)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Rubidium (Rb)-Total			<0.0050		mg/L		0.005	23-SEP-17
Selenium (Se)-Total			<0.0020		mg/L		0.002	23-SEP-17
Silicon (Si)-Total			<1.0		mg/L		1	23-SEP-17
Silver (Ag)-Total			<0.00010		mg/L		0.0001	23-SEP-17
Sodium (Na)-Total			<1.0		mg/L		1	23-SEP-17
Strontium (Sr)-Total			<0.010		mg/L		0.01	23-SEP-17
Sulfur (S)-Total			<5.0		mg/L		5	23-SEP-17
Tellurium (Te)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	23-SEP-17
Thorium (Th)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Tin (Sn)-Total			<0.0010		mg/L		0.001	23-SEP-17
Titanium (Ti)-Total			<0.0050		mg/L		0.005	23-SEP-17
Tungsten (W)-Total			<0.0010		mg/L		0.001	23-SEP-17
Uranium (U)-Total			<0.000050		mg/L		0.00005	23-SEP-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Yttrium (Y)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	23-SEP-17
Zirconium (Zr)-Total			<0.00050		mg/L		0.0005	23-SEP-17
Batch R3839056								
WG2620295-3 DUP		**L1992036-1**						
Antimony (Sb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Arsenic (As)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	25-SEP-17
Barium (Ba)-Total		0.0092	0.0088		mg/L	5.0	20	25-SEP-17
Beryllium (Be)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Bismuth (Bi)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Boron (B)-Total		3.71	3.66		mg/L	1.3	20	25-SEP-17
Cadmium (Cd)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	25-SEP-17
Calcium (Ca)-Total		309	317		mg/L	2.5	20	25-SEP-17

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3839056								
WG2620295-3 DUP		**L1992036-1**						
Cesium (Cs)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Cobalt (Co)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	25-SEP-17
Gallium (Ga)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Iron (Fe)-Total		0.050	0.053		mg/L	5.8	20	25-SEP-17
Lead (Pb)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	25-SEP-17
Lithium (Li)-Total		0.164	0.153		mg/L	6.9	20	25-SEP-17
Magnesium (Mg)-Total		824	809		mg/L	1.8	20	25-SEP-17
Manganese (Mn)-Total		0.00197	0.00194		mg/L	1.5	20	25-SEP-17
Molybdenum (Mo)-Total		0.0093	0.0085		mg/L	8.9	20	25-SEP-17
Nickel (Ni)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Phosphorus (P)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-17
Potassium (K)-Total		258	263		mg/L	1.8	20	25-SEP-17
Rhenium (Re)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Rubidium (Rb)-Total		0.105	0.104		mg/L	1.0	20	25-SEP-17
Selenium (Se)-Total		<0.0020	0.0022	RPD-NA	mg/L	N/A	20	25-SEP-17
Silicon (Si)-Total		<1.0	<1.0	RPD-NA	mg/L	N/A	25	25-SEP-17
Silver (Ag)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	25-SEP-17
Sodium (Na)-Total		7100	7060		mg/L	0.6	20	25-SEP-17
Strontium (Sr)-Total		4.61	4.40		mg/L	4.6	20	25-SEP-17
Sulfur (S)-Total		655	641		mg/L	2.0	25	25-SEP-17
Tellurium (Te)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Thallium (Tl)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	25-SEP-17
Thorium (Th)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	25-SEP-17
Titanium (Ti)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	25-SEP-17
Tungsten (W)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	25-SEP-17
Uranium (U)-Total		0.00258	0.00246		mg/L	4.8	20	25-SEP-17
Vanadium (V)-Total		0.00096	0.00094		mg/L	1.8	20	25-SEP-17
Yttrium (Y)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17
Zinc (Zn)-Total		0.0035	<0.0030	RPD-NA	mg/L	N/A	20	25-SEP-17
Zirconium (Zr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	25-SEP-17

ALS Environmental

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-L-HRMS-VA	**Seawater**							
Batch R3840178								
WG2620295-2 LCS								
Sodium (Na)-Total			99.7		%		80-120	26-SEP-17
Batch R3840508								
WG2620295-3 DUP		**L1992036-1**						
Aluminum (Al)-Total		0.0330	0.0370		mg/L	12	20	25-SEP-17
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-SEP-17
NH3-F-VA	**Seawater**							
Batch R3831306								
WG2618115-3 DUP		**L1992036-5**						
Ammonia, Total (as N)		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	18-SEP-17
WG2618115-2 LCS								
Ammonia, Total (as N)			95.1		%		85-115	18-SEP-17
WG2618115-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	18-SEP-17
WG2618115-4 MS		**L1992036-5**						
Ammonia, Total (as N)			92.3		%		75-125	18-SEP-17
PH-C-PCT-VA	**Seawater**							
Batch R3834165								
WG2619656-7 CRM		**VA-PH7-BUF**						
pH			6.99		pH		6.9-7.1	20-SEP-17
WG2619656-10 DUP		**L1992036-2**						
pH		7.86	7.86	J	pH	0.00	0.3	20-SEP-17
TKN-C-F-VA	**Seawater**							
Batch R3836372								
WG2621878-2 LCS								
Total Kjeldahl Nitrogen			99.4		%		75-125	22-SEP-17
WG2621878-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	22-SEP-17
TSS-C-VA	**Seawater**							
Batch R3831221								
WG2617961-2 LCS								
Total Suspended Solids			96.4		%		85-115	17-SEP-17
WG2617961-1 MB								
Total Suspended Solids			<2.0		mg/L		2	17-SEP-17
TURBIDITY-C-VA	**Seawater**							

Quality Control Report

Workorder: L1992036 Report Date: 29-SEP-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-C-VA	**Seawater**							
Batch R3830023								
WG2617580-2 CRM		**VA-FORM-40**						
Turbidity			103.5		%		85-115	16-SEP-17
WG2617580-1 MB								
Turbidity			<0.10		NTU		0.1	16-SEP-17

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Turbidity by Meter in Seawater							
	1	10-SEP-17 10:45	16-SEP-17 09:40	3	6	days	EHTR
	2	10-SEP-17 10:30	16-SEP-17 09:40	3	6	days	EHTR
	3	10-SEP-17 10:15	16-SEP-17 09:40	3	6	days	EHTR
	4	10-SEP-17 11:00	16-SEP-17 09:40	3	6	days	EHTR
	5	10-SEP-17	16-SEP-17 09:40	3	6	days	EHTR
	6	12-SEP-17 09:15	16-SEP-17 09:40	3	4	days	EHTR
pH by Meter (Automated) (seawater)							
	1	10-SEP-17 10:45	20-SEP-17 15:40	0.25	245	hours	EHTR-FM
	2	10-SEP-17 10:30	20-SEP-17 15:40	0.25	245	hours	EHTR-FM
	3	10-SEP-17 10:15	20-SEP-17 15:40	0.25	246	hours	EHTR-FM
	4	10-SEP-17 11:00	20-SEP-17 15:40	0.25	245	hours	EHTR-FM
	5	10-SEP-17	20-SEP-17 15:40	0.25	244	hours	EHTR-FM
	6	12-SEP-17 09:15	20-SEP-17 15:40	0.25	198	hours	EHTR-FM
Anions and Nutrients							
Nitrate in Seawater by IC							
	1	10-SEP-17 10:45	18-SEP-17 07:16	3	8	days	EHTR
	2	10-SEP-17 10:30	18-SEP-17 07:16	3	8	days	EHTR
	3	10-SEP-17 10:15	18-SEP-17 07:16	3	8	days	EHTR
	4	10-SEP-17 11:00	18-SEP-17 07:16	3	8	days	EHTR
	5	10-SEP-17	18-SEP-17 07:16	3	8	days	EHTR
	6	12-SEP-17 09:15	18-SEP-17 07:16	3	6	days	EHTR
Nitrite in Seawater by IC							
	1	10-SEP-17 10:45	18-SEP-17 07:16	3	8	days	EHTR
	2	10-SEP-17 10:30	18-SEP-17 07:16	3	8	days	EHTR
	3	10-SEP-17 10:15	18-SEP-17 07:16	3	8	days	EHTR
	4	10-SEP-17 11:00	18-SEP-17 07:16	3	8	days	EHTR
	5	10-SEP-17	18-SEP-17 07:16	3	8	days	EHTR
	6	12-SEP-17 09:15	18-SEP-17 07:16	3	6	days	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1992036 were received on 15-SEP-17 09:57.

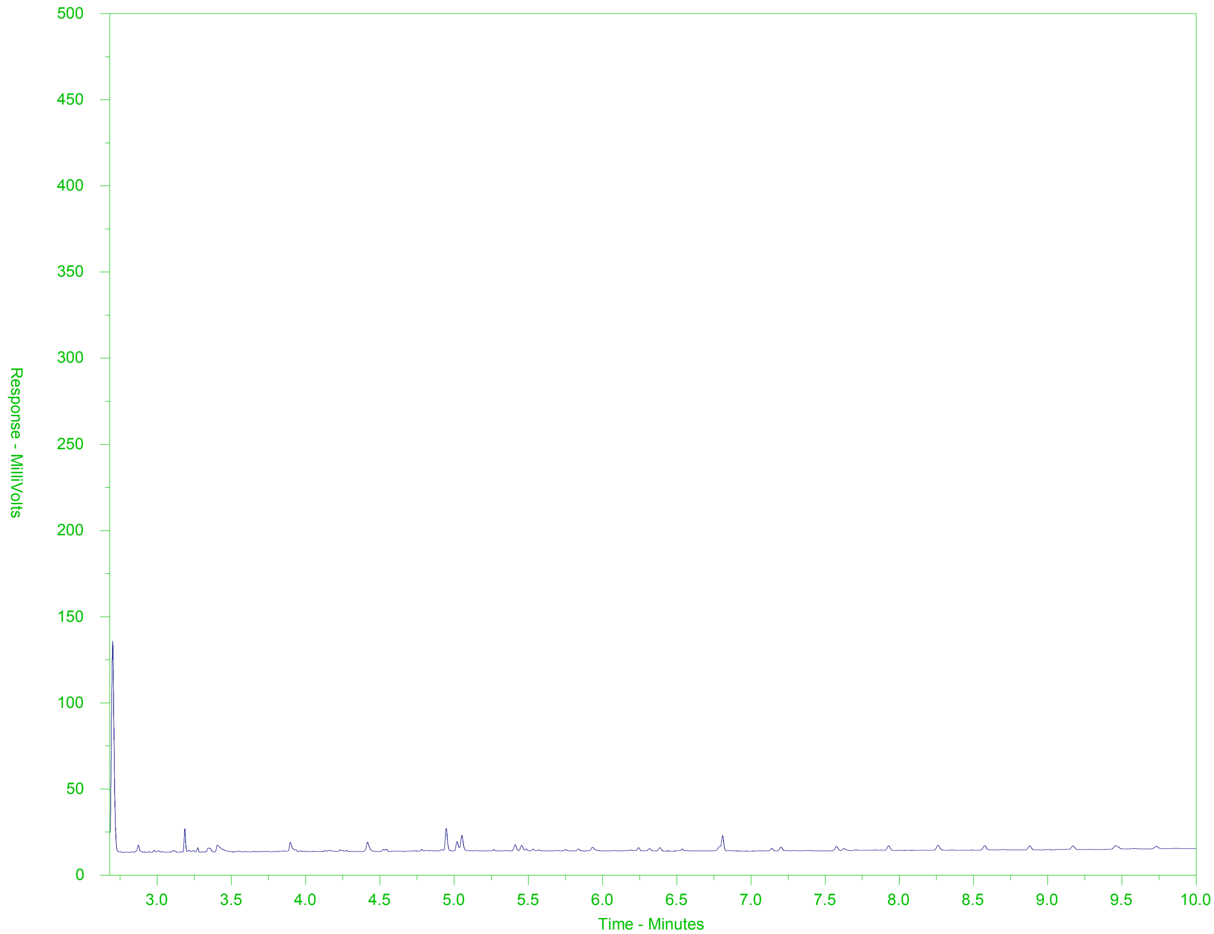
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1992036-L-1
Client Sample ID: WNW



← 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.

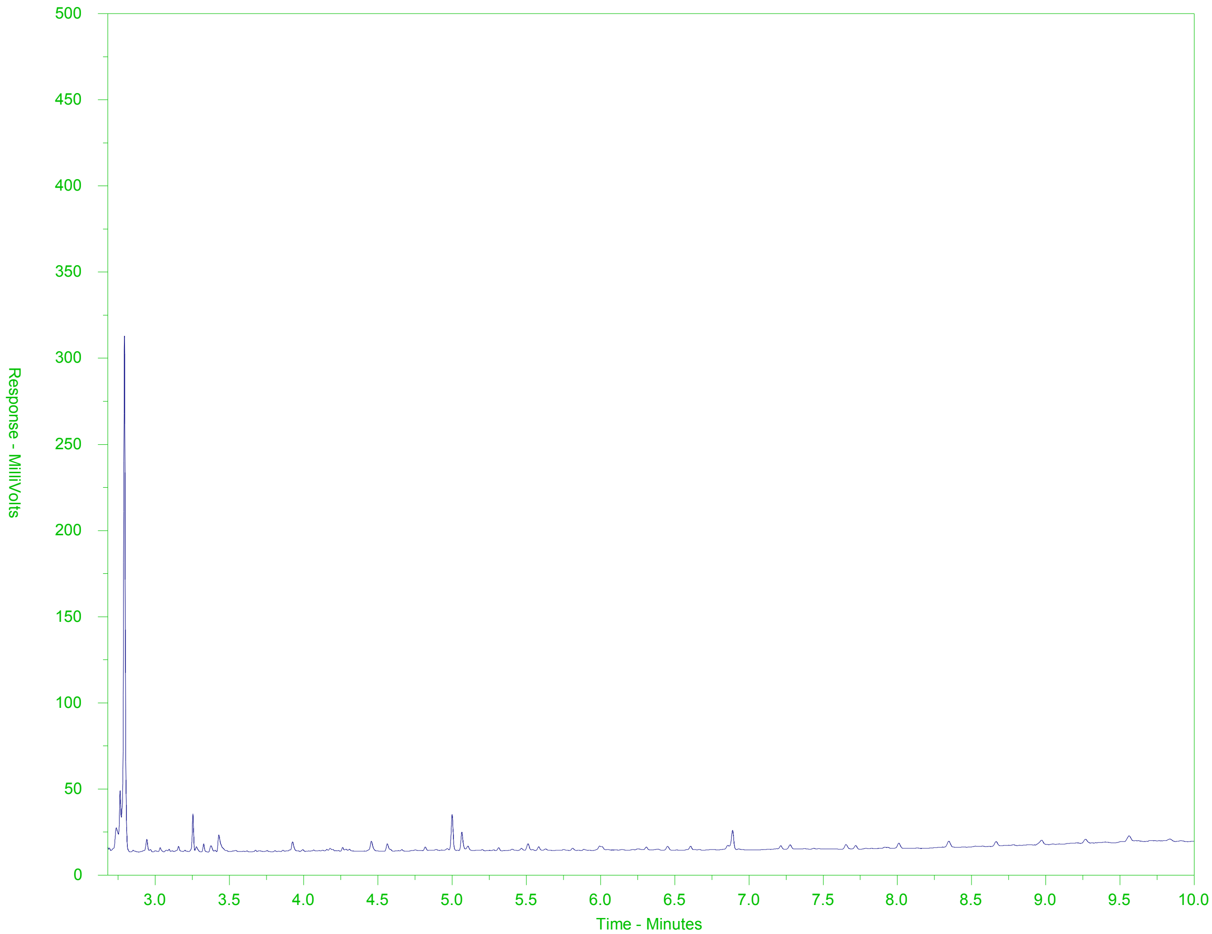
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1992036-L-2
Client Sample ID: N



← 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.

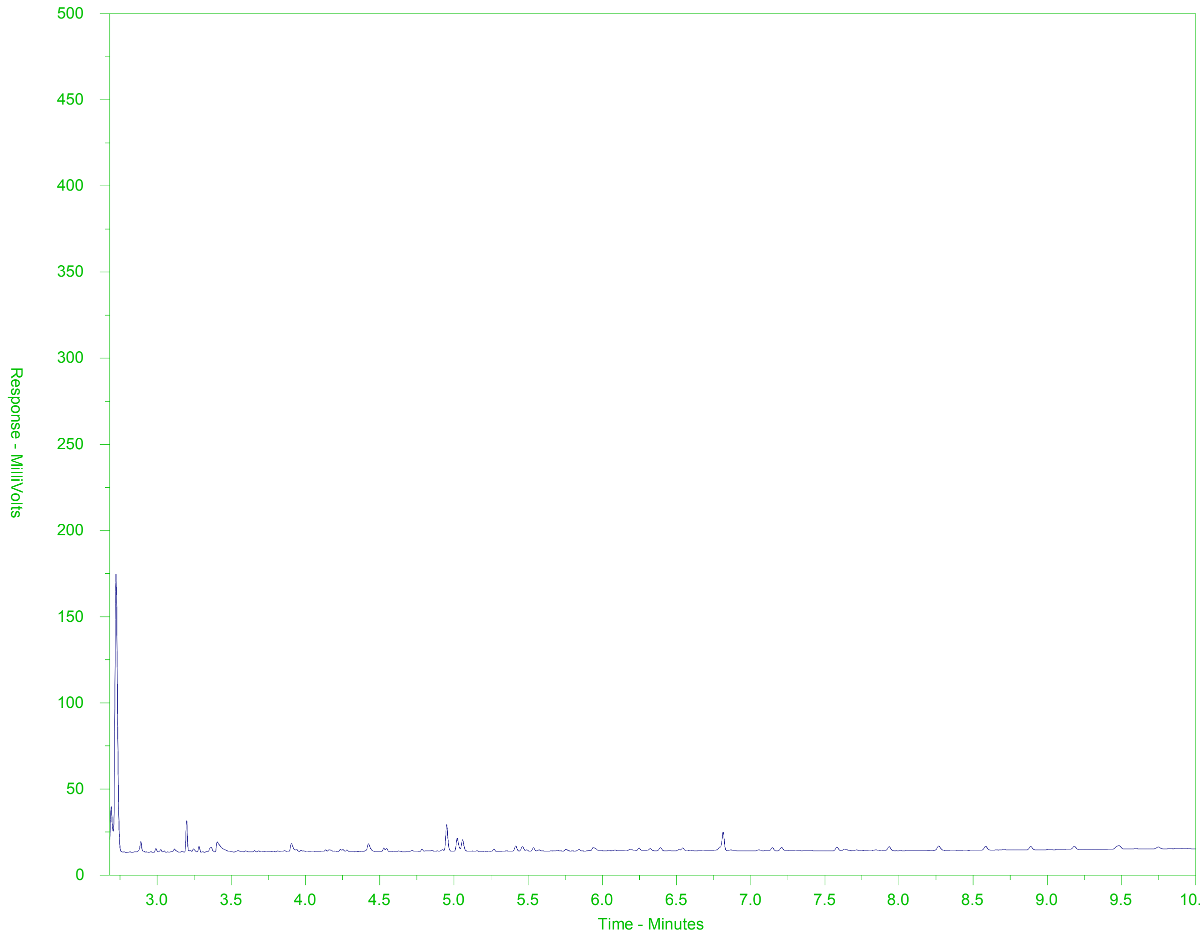
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1992036-L-3
Client Sample ID: ENE



← 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.

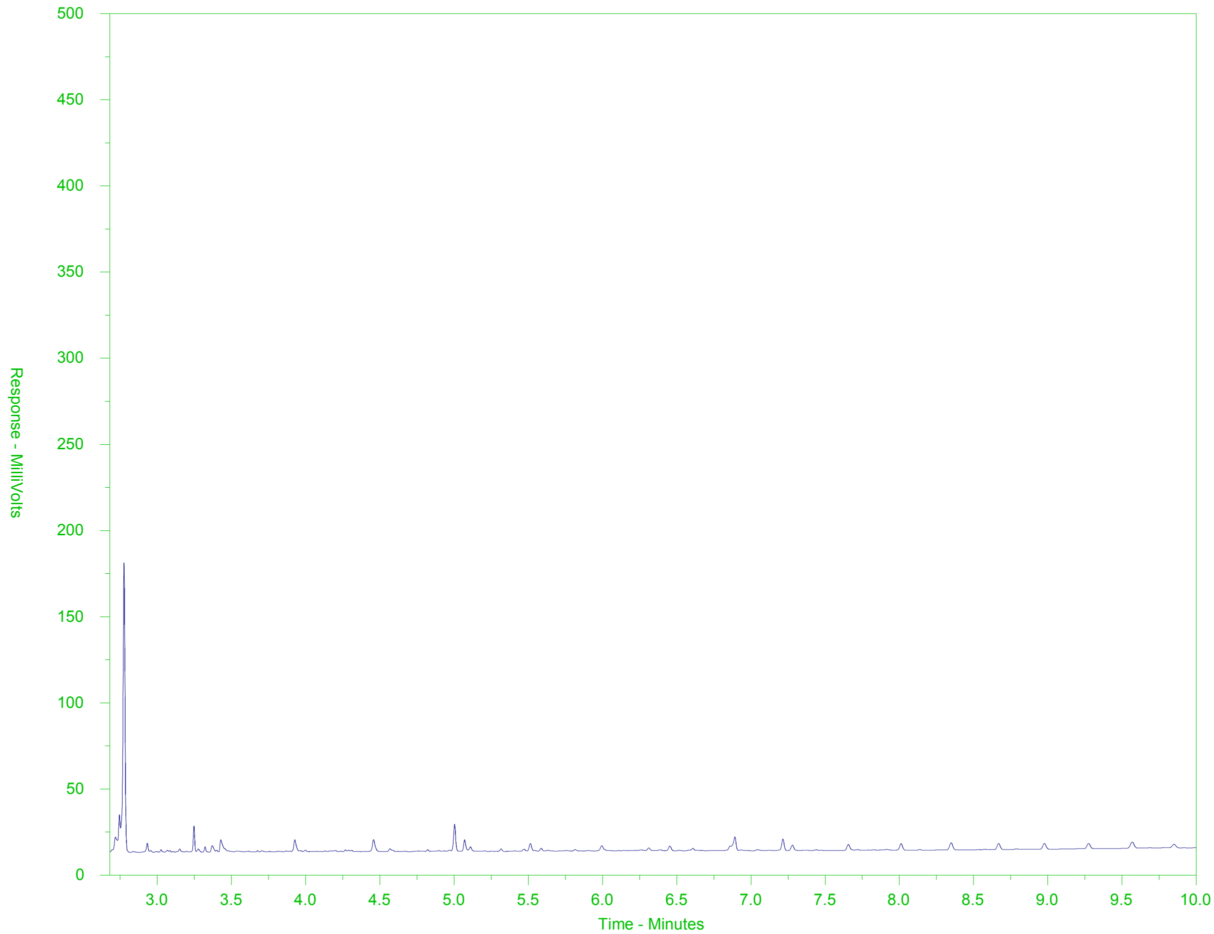
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1992036-L-4
Client Sample ID: SOURCE



← 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.

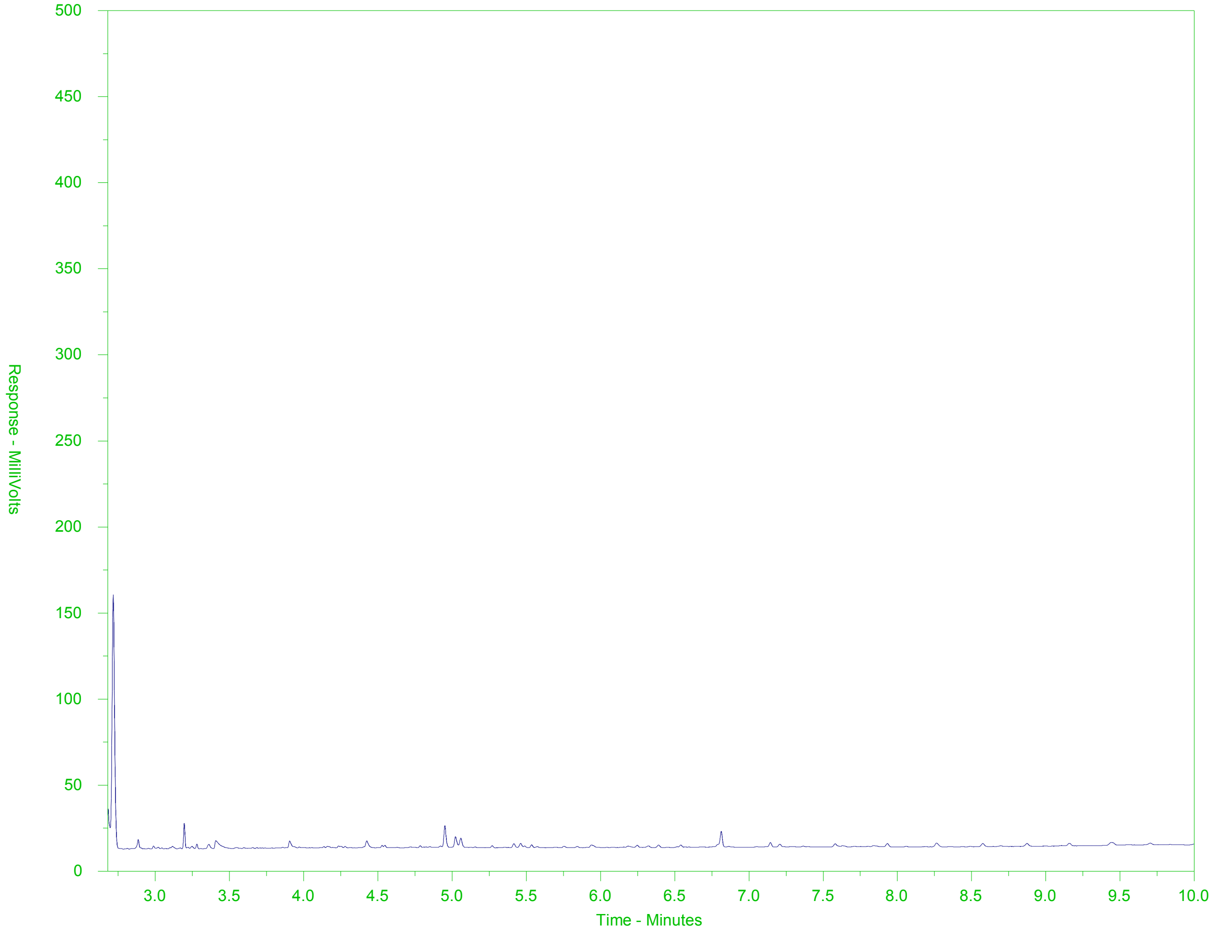
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1992036-L-5
Client Sample ID: DUP-B



← 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.

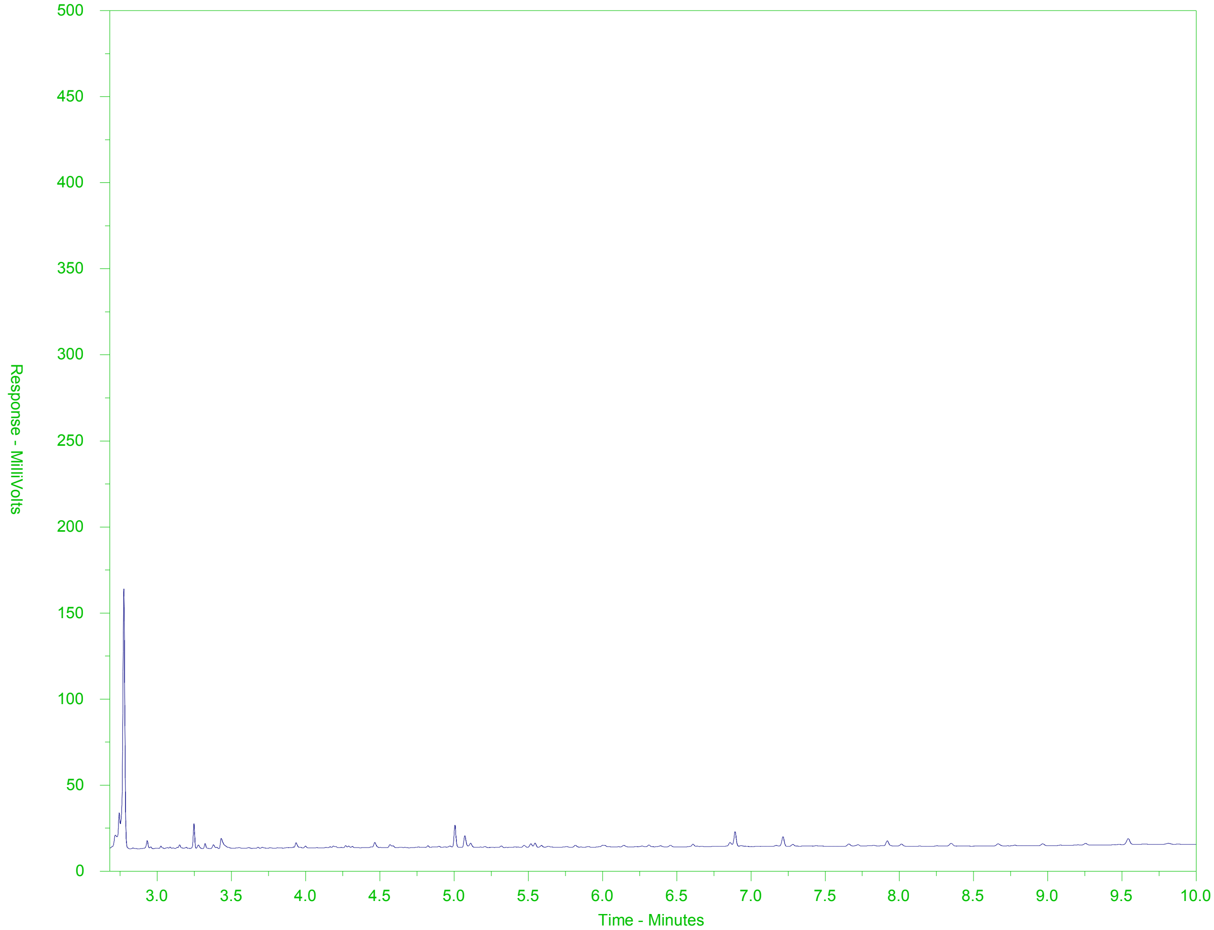
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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: L1992036-L-6
Client Sample ID: E-BLANK



← 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

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1992036-COFC

COC Number: 15 - XXXXXX

Report To — Contact and companyname below will appear on the final report

Company:	Golder Associatex Ltd.
Contact:	John Sherrin / Arman Ospan
Phone:	1 (250) 881 7372
Company address below will appear on the final report	
Street:	2nd floor 3795 Carey Rd.
City/Province:	Victoria BC
Postal Code:	V8Z 6T8

Invoice To

Same as Report To	☑ YES ☐ NO
Copy of Invoice with Report	☐ YES ☑ NO
Company:	
Contact:	

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 jsherrin@golder.com
Email 2 aospan@golder.com
Email 3 mspani@golder.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
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:

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

Project Information

ALS Account # / Quote #: BR191034
Job #: 1663724/10000/1003
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:

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	General (pH, Alkalinity, Turbidity, Conductivity, Anions, TSS)	TOC, Ammonia, TKN (P)	Dissolved Metals	Total Metals (P)	Dissolved Mercury	Total Mercury (P)	Hydrocarbons (PAH/LEPH/HEPH) (P)	Fecal Coliforms (P)	Number of Containers
	WNW	10-Sep-17	10:45	Seawater	X	X	X	X	X	X	X	X	9
	N	10-Sep-17	10:30	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	ENE	10-Sep-17	10:15	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	Source	10-Sep-17	11:00	Seawater	↓	↓	↓	↓	↓	↓	↓	↓	9
	DUP-B	10-Sep-17		Seawater	X	X	X	X	X	X	X	X	9
	E-Blank	12-Sep-17	9:15	Seawater	X	X	X	X	X	X	X	X	9

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)

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: 5

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: 12 Sep 2017 12:30	Received by:	Date:	Time:	Received by: Shaun	Date: Sep. 15	Time: 957

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.

Table B-2: Water screening against CCME Guidelines

Client Sample ID		CCME Marine WQG for Protection of Aquatic Life		Lowest Detection Limit	SOURCE	WNW	NORTH	ENE	Lowest Detection Limit	SOURCE	DUP A (SOURCE)	Relative Percent Difference	WNW	NORTH	ENE
Date Sampled	Units				8-Aug-2017	8-Aug-2017	8-Aug-2017	8-Aug-2017		22-Aug-2017	22-Aug-2017		22-Aug-2017	22-Aug-2017	22-Aug-2017
Time Sampled					11:59	11:10	11:35	11:00		9:58	10:10		9:22	10:40	10:27
ALS Sample ID					L1974199-1	L1974199-2	L1974199-3	L1974199-4		L1980315-1	L1980315-5		L1980315-2	L1980315-3	L1980315-4
Parameter		Short Term	Long Term		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater		Seawater	Seawater	Seawater
Physical Parameters						Wat									
Salinity (calculated by Golder)	PPT			-	7.7	9.7	11.5	10.8	-	5.4	5.2		4.1	6.3	6.5
Conductivity	uS/cm			2.0	13400	16600	19400	18300	2.0	9640	9350	3.1%	7470	11100	11500
Hardness (as CaCO3)	mg/L			4.3	1390	1720	2060	1920	4.3	1100	958	13.8%	828	1200	1360
pH	pH		**7.0-8.7**	0.10	7.14	7.01	7.14	7.12	0.10	7.95	7.96	0.1%	7.95	7.95	7.94
Total Suspended Solids	mg/L	< 25 mg/L above background	**< 5mg/L above background**	-	-	-	-	-	2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0
Turbidity	NTU	<8 NTU above background	**<2 NTU above background**	0.10	0.72	0.47	0.38	0.45	0.10	0.39	0.50	NA	0.42	0.49	0.57
Anions and Nutrients															
Alkalinity, Total (as CaCO3)	mg/L			1.0	59.6	44.5	53.9	54.8	1.0	81.9	84.4	3.0%	78.9	83.0	79.2
Ammonia, Total (as N)	mg/L			0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050
Bromide (Br)	mg/L			-	-	-	-	-	5.0	10.8	11.9	NA	7.7	13.9	12.1
Chloride (Cl)	mg/L			-	-	-	-	-	50	3140	3080	1.9%	2290	3860	3680
Fluoride (F)	mg/L			-	-	-	-	-	1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0
Nitrate (as N)	mg/L	1500	**200**	-	-	-	-	-	0.50	<0.50	<0.50	NA	<0.50	<0.50	<0.50
Nitrite (as N)	mg/L			-	-	-	-	-	0.10	0.12	<0.10	NA	<0.10	<0.10	0.18
Total Kjeldahl Nitrogen	mg/L			0.050	0.098	0.100	0.101	0.124	0.050	0.075	0.101	NA	0.070	0.088	0.085
Sulfate (SO4)	mg/L			-	-	-	-	-	30	438	435	0.7%	319	547	514
Organic / Inorganic Carbon															
Total Organic Carbon	mg/L			0.50	31.8	26.3	28.7	8.36	0.50	1.19	1.10	7.9%	1.21	1.12	1.21
Bacteriological Tests															
Coliform Bacteria - Fecal	CFU/100mL			-	-	-	-	-	-	-	-		-	-	-
Total Metals															
Aluminum (Al)-Total	mg/L			0.0050	0.0282	0.0174	0.0200	0.0222	0.0050	0.0106	0.0093	NA	0.0107	0.0178	0.0217
Antimony (Sb)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	mg/L		**0.0125**	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020
Barium (Ba)-Total	mg/L			0.0010	0.0055	0.0056	0.0059	0.0060	0.0010	0.0050	0.0048	NA	0.0046	0.0054	0.0057
Beryllium (Be)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Boron (B)-Total	mg/L			0.10	1.06	1.27	1.47	1.40	0.10	0.80	0.71	11.9%	0.60	0.95	1.13
Cadmium (Cd)-Total	mg/L		**0.00012**	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Calcium (Ca)-Total	mg/L			0.50	101	125	146	137	0.50	77.7	73.3	5.8%	63.7	88.2	101
Cesium (Cs)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Chromium (Cr)-Total	mg/L		**0.0015 (Cr(VI))**	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	mg/L			0.000050	0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Copper (Cu)-Total	mg/L			0.00050	0.00082	0.00065	<0.00050	0.00054	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Gallium (Ga)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Iron (Fe)-Total	mg/L			0.010	0.035	0.042	0.026	0.028	0.010	0.013	0.011	NA	0.011	0.024	0.031
Lead (Pb)-Total	mg/L			0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	NA	<0.00030	<0.00030	<0.00030
Lithium (Li)-Total	mg/L			0.020	0.046	0.058	0.070	0.065	0.020	0.035	0.032	NA	0.030	0.043	0.050
Magnesium (Mg)-Total	mg/L			1.0	285	357	422	403	1.0	195	180	8.0%	150	229	281
Manganese (Mn)-Total	mg/L			0.00020	0.00127	0.00116	0.00116	0.00124	0.00020	0.00070	0.00076	NA	0.00064	0.00094	0.00113
Mercury (Hg)-Total	mg/L		**0.000016**	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L			0.0020	0.0028	0.0034	0.0038	0.0035	0.0020	0.0022	<0.0020	NA	<0.0020	0.0024	0.0031
Nickel (Ni)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Total	mg/L			1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0
Potassium (K)-Total	mg/L			20	86	110	130	123	20	61	56	NA	46	71	85
Rhenium (Re)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Rubidium (Rb)-Total	mg/L			0.0050	0.0301	0.0376	0.0446	0.0428	0.0050	0.0241	0.0221	NA	0.0182	0.0290	0.0332
Selenium (Se)-Total	mg/L			0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020
Silicon (Si)-Total	mg/L			0.50	<0.50	<0.50	<0.50	<0.50	0.50	<0.50	<0.50	NA	<0.50	<0.50	<0.50
Silver (Ag)-Total	mg/L	0.0075		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	NA	<0.00010	<0.00010	<0.00010
Sodium (Na)-Total	mg/L			20	2320	2990	3570	3330	20	1710	1560	9.2%	1300	2010	2410
Strontium (Sr)-Total	mg/L			0.050	1.69	2.19	2.61	2.44	0.050	1.17	1.07	8.9%	0.896	1.37	1.65
Sulfur (S)-Total	mg/L														
Tellurium (Te)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Thallium (Tl)-Total	mg/L			0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Thorium (Th)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Tin (Sn)-Total	mg/L			0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010
Titanium (Ti)-Total	mg/L			0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050
Tungsten (W)-Total	mg/L			0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010
Uranium (U)-Total	mg/L			0.000050	0.00127	0.00171	0.00148	0.00149	0.000050	0.00158	0.00152	3.9%	0.000929	0.00123	0.00132
Vanadium (V)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Yttrium (Y)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Total	mg/L			0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	<0.0030	<0.0030	NA	<0.0030	<0.0030	<0.0030
Zirconium (Zr)-Total	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	0.00070	<0.00050	NA	<0.00050	<0.00050	<0.00050

Client Sample ID	Lowest Detection Limit	SOURCE	WNW	NORTH	ENE	Lowest Detection Limit	SOURCE	WNW	NORTH	ENE	Lowest Detection Limit	SOURCE	DUP-B (SOURCE)	Relative Percent Difference	WNW	NORTH	ENE	E-BLANK
Date Sampled		31-Aug-2017	31-Aug-2017	31-Aug-2017	31-Aug-2017		5-Sep-2017	5-Sep-2017	5-Sep-2017	5-Sep-2017		10-Sep-2017	10-Sep-2017		10-Sep-2017	10-Sep-2017	10-Sep-2017	12-Sep-2017
Time Sampled		10:54	10:21	10:10	10:33		10:00	9:15	9:30	9:45		11:00	0:00		10:45	10:30	10:15	9:15
ALS Sample ID		L1986378-1	L1986378-2	L1986378-3	L1986378-4		L1987356-4	L1987356-1	L1987356-2	L1987356-3		L1992036-4	L1992036-5		L1992036-1	L1992036-2	L1992036-3	L1992036-6
Parameter		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater		Seawater	Seawater	Seawater	Seawater
Physical Parameters																		
Salinity (calculated by Golder)	-	23.3	23.1	23.4	23.3	-	7.2	6.4	8.6	8.1	-	23.6	23.7		23.3	21.0	24.4	-
Conductivity	2.0	36800	36500	37000	36800	2.0	12500	11300	14800	14000	2.0	37300	37400	0.3%	36900	33600	38400	<2.0
Hardness (as CaCO3)	4.8	4070	4050	4150	3940	4.8	1370	1240	1560	1490	4.8	4060	4100	1.0%	4010	3610	4220	<4.8
pH	0.10	7.90	7.89	7.91	7.90	0.10	8.00	7.99	7.97	8.00	0.10	7.88	7.88	0.0%	7.91	7.86	7.83	**5.32**
Total Suspended Solids	-	-	-	-	-	2.0	<2.0	<2.0	<2.0	<2.0	2.0	**25.5**	14.6	54.4%	3.6	4.6	3.6	<2.0
Turbidity	0.10	0.34	0.27	0.39	0.39	0.10	0.34	0.74	0.44	0.32	0.10	**9.6**	4.82	66.3%	1.08	1.53	1.81	<0.10
Anions and Nutrients																		
Alkalinity, Total (as CaCO3)	1.0	95.5	97.7	95.9	97.3	1.0	95.6	92.3	93.6	93.9	1.0	105	104	1.0%	104	99.3	99.6	<1.0
Ammonia, Total (as N)	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br)	5.0	43.9	43.5	45.7	44.8	5.0	15.0	10.8	16.6	16.1	5.0	47.6	49.5	3.9%	49.9	43.8	51.7	<5.0
Chloride (Cl)	50	12600	12500	13200	12900	50	4550	3820	4960	4860	50	14000	14300	2.1%	14400	12800	14900	<50
Fluoride (F)	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0
Nitrate (as N)	0.50	<0.50	<0.50	<0.50	<0.50	0.50	<0.50	<0.50	<0.50	<0.50	0.50	<0.50	<0.50	NA	<0.50	<0.50	<0.50	<0.50
Nitrite (as N)	0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen	0.050	0.068	0.066	0.061	0.073	0.050	0.104	0.083	0.073	0.065	0.050	0.087	0.097	NA	0.058	0.055	0.061	<0.050
Sulfate (SO4)	30	1790	1770	1870	1830	30	638	533	687	678	30	1980	2030	2.5%	2030	1800	2100	<30
Organic / Inorganic Carbon																		
Total Organic Carbon	0.50	1.08	1.07	1.22	1.17	0.50	21.8	18.5	1.57	15.4	0.50	5.64	8.16	36.5%	2.05	1.20	14.5	<0.50
Bacteriological Tests																		
Coliform Bacteria - Fecal	-	-	-	-	-	1	1	1	1	2	-	-	-	-	-	-	-	-
Total Metals														NC				
Aluminum (Al)-Total	0.0050	0.0111	0.0291	0.0077	0.0077	0.0050	0.0137	0.0081	0.0091	0.0095	0.0050	0.142	0.122	15.2%	0.0330	0.0376	0.0498	<0.0050
Antimony (Sb)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020	<0.0020
Barium (Ba)-Total	0.0010	0.0085	0.0084	0.0084	0.0079	0.0010	0.0053	0.0049	0.0060	0.0054	0.0010	0.0092	0.0091	1.1%	0.0092	0.0085	0.0093	<0.0010
Beryllium (Be)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	0.10	3.24	3.32	3.48	3.20	0.10	1.18	1.02	1.30	1.24	0.10	3.50	3.57	2.0%	3.71	3.29	3.60	<0.10
Cadmium (Cd)-Total	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Calcium (Ca)-Total	1.0	306	309	335	312	1.0	113	105	130	124	1.0	301	317	5.2%	309	279	323	<1.0
Cesium (Cs)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Chromium (Cr)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	0.000154	0.000138	NA	<0.000050	<0.000050	0.000103	<0.000050
Copper (Cu)-Total	0.00050	<0.00050	<0.00050	0.00091	<0.00050	0.00050	0.00054	0.00073	0.00082	0.00064	0.00050	0.00097	0.00081	NA	<0.00050	0.00060	<0.00050	<0.00050
Gallium (Ga)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Total	0.010	<0.010	0.010	<0.010	<0.010	0.010	0.017	0.013	<0.010	0.013	0.010	0.286	0.231	21.3%	0.050	0.051	0.052	<0.010
Lead (Pb)-Total	0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030	0.00035	0.00031	NA	<0.00030	<0.00030	<0.00030	<0.00030
Lithium (Li)-Total	0.020	0.138	0.135	0.147	0.133	0.020	0.038	0.033	0.047	0.043	0.020	0.156	0.162	3.8%	0.164	0.146	0.171	<0.020
Magnesium (Mg)-Total	1.0	825	787	829	826	1.0	258	243	307	285	1.0	813	830	2.1%	824	759	827	<1.0
Manganese (Mn)-Total	0.00020	0.00088	0.00098	0.00091	0.00086	0.00020	0.00091	0.00083	0.00083	0.00095	0.00020	0.00654	0.00531	20.8%	0.00197	0.00220	0.00226	<0.00020
Mercury (Hg)-Total	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	*<0.000030*	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	0.0020	0.0072	0.0079	0.0078	0.0072	0.0020	0.0026	0.0021	0.0028	0.0026	0.0020	0.0088	0.0081	NA	0.0093	0.0075	0.0087	<0.0020
Nickel (Ni)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Total	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total	1.0	234	235	237	228	1.0	76.5	70.3	93.2	84.3	1.0	252	261	3.5%	258	232	275	<1.0
Rhenium (Re)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Rubidium (Rb)-Total	0.0050	0.0866	0.0885	0.0946	0.0901	0.0050	0.0265	0.0225	0.0323	0.0297	0.0050	0.103	0.103	0.0%	0.105	0.0962	0.109	<0.0050
Selenium (Se)-Total	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020	<0.0020
Silicon (Si)-Total	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0
Silver (Ag)-Total	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	NA	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na)-Total	1.0	6340	6450	6800	6430	1.0	2040	1910	2670	2400	1.0	7030	7290	3.6%	7100	6480	7490	<1.0
Strontium (Sr)-Total	0.010	4.27	4.22	4.28	4.54	0.010	1.61	1.47	1.85	1.83	0.010	4.54	4.55	0.2%	4.61	3.94	4.42	<0.010
Sulfur (S)-Total	5.0	615	584	614	615	5.0	189	177	225	219	5.0	641	654	2.0%	655	595	656	<5.0
Tellurium (Te)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (Tl)-Total	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Thorium (Th)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Tin (Sn)-Total	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti)-Total	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	0.0088	0.0073	NA	<0.0050	<0.0050	<0.0050	<0.0050
Tungsten (W)-Total	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010	<0.0010
Uranium (U)-Total	0.000050	0.00239	0.00235	0.00247	0.00246	0.000050	0.00262	0.00172	0.00176	0.00203	0.000050	0.00423	0.00412	2.6%	0.00258	0.00244	0.00307	<0.000050
Vanadium (V)-Total	0.00050	0.00092	0.00085	0.00091	0.00092	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	0.00137	0.00128	NA	0.00096	0.00091	0.00098	<0.00050
Yttrium (Y)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Total	0.0030	0.0030	0.0041	0.0039	0.0043	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	<0.0030	0.0032	NA	0.0035	0.0035	<0.0030	<0.0030
Zirconium (Zr)-Total	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050

APPENDIX B-2
WATER QUALITY SCREENING TABLE

Client Sample ID					SOURCE	WNW	NORTH	ENE		SOURCE	DUP A (SOURCE)		WNW	NORTH	ENE
Date Sampled	Units	CCME Marine WQG for Protection of Aquatic Life		Lowest Detection Limit	8-Aug-2017	8-Aug-2017	8-Aug-2017	8-Aug-2017	Lowest Detection Limit	22-Aug-2017	22-Aug-2017	Relative Percent Difference	22-Aug-2017	22-Aug-2017	22-Aug-2017
Time Sampled					11:59	11:10	11:35	11:00		9:58	10:10		9:22	10:40	10:27
ALS Sample ID					L1974199-1	L1974199-2	L1974199-3	L1974199-4		L1980315-1	L1980315-5		L1980315-2	L1980315-3	L1980315-4
Parameter		Short Term	Long Term		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater		Seawater	Seawater	Seawater
Dissolved Metals															
Dissolved Mercury Filtration Location	-			-	LAB	LAB	LAB	LAB	-	LAB	LAB		LAB	LAB	LAB
Dissolved Metals Filtration Location	-			-	LAB	LAB	LAB	LAB	-	LAB	LAB		LAB	LAB	LAB
Dissolved Metals Filtration Location	-			-	LAB	LAB	LAB	LAB	-	LAB	LAB		LAB	LAB	LAB
Aluminum (Al)-Dissolved	mg/L			0.0050	0.0091	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050
Antimony (Sb)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	mg/L			0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020
Barium (Ba)-Dissolved	mg/L			0.0010	0.0050	0.0057	0.0062	0.0059	0.0010	0.0046	0.0046	NA	0.0042	0.0048	0.0048
Beryllium (Be)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	mg/L			0.10	1.06	1.30	1.60	1.56	0.10	0.78	0.72	8.0%	0.61	0.86	1.00
Cadmium (Cd)-Dissolved	mg/L			0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Calcium (Ca)-Dissolved	mg/L			0.50	98.1	120	141	133	0.50	86.2	77.0	11.3%	68.2	91.8	103
Cesium (Cs)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Chromium (Cr)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	mg/L			0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Copper (Cu)-Dissolved	mg/L			0.00050	0.00091	0.00079	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Gallium (Ga)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L			0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	NA	<0.010	<0.010	<0.010
Lead (Pb)-Dissolved	mg/L			0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	NA	<0.00030	<0.00030	<0.00030
Lithium (Li)-Dissolved	mg/L			0.020	0.049	0.056	0.067	0.073	0.020	0.038	0.032	NA	0.028	0.042	0.045
Magnesium (Mg)-Dissolved	mg/L			1.0	277	344	416	387	1.0	216	186	14.9%	160	236	269
Manganese (Mn)-Dissolved	mg/L			0.00020	0.00089	0.00123	0.00077	0.00057	0.00020	0.00059	0.00058	NA	0.00049	0.00077	0.00059
Mercury (Hg)-Dissolved	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	mg/L			0.0020	0.0026	0.0030	0.0036	0.0042	0.0020	0.0023	0.0021	NA	<0.0020	0.0025	0.0028
Nickel (Ni)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Dissolved	mg/L			1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0
Potassium (K)-Dissolved	mg/L			20	83	106	126	119	20	64	55	NA	47	70	80
Rhenium (Re)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Rubidium (Rb)-Dissolved	mg/L			0.0050	0.0265	0.0343	0.0442	0.0414	0.0050	0.0226	0.0215	NA	0.0168	0.0257	0.0289
Selenium (Se)-Dissolved	mg/L			0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020
Silicon (Si)-Dissolved	mg/L			0.50	<0.50	<0.50	<0.50	<0.50	0.50	<0.50	<0.50	NA	<0.50	<0.50	<0.50
Silver (Ag)-Dissolved	mg/L			0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	NA	<0.00010	<0.00010	<0.00010
Sodium (Na)-Dissolved	mg/L			20	2250	2860	3430	3230	20	1720	1470	15.7%	1250	1890	2170
Strontium (Sr)-Dissolved	mg/L			0.050	1.65	2.10	2.50	2.35	0.050	1.30	1.11	15.8%	0.941	1.41	1.62
Sulfur (S)-Dissolved	mg/L			-	-	-	-	-	-	-	-	NC	-	-	-
Tellurium (Te)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Thallium (Tl)-Dissolved	mg/L			0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Thorium (Th)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Tin (Sn)-Dissolved	mg/L			0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010
Titanium (Ti)-Dissolved	mg/L			0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050
Tungsten (W)-Dissolved	mg/L			0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010
Uranium (U)-Dissolved	mg/L			0.000050	0.00150	0.00185	0.00152	0.00176	0.000050	0.00145	0.00144	0.7%	0.000907	0.00112	0.00118
Vanadium (V)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Yttrium (Y)-Dissolved	mg/L			0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved	mg/L			0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	<0.0030	<0.0030	NA	<0.0030	<0.0030	<0.0030
Zirconium (Zr)-Dissolved	mg/L			0.00050	0.00131	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050
Hydrocarbons												NC			
EPH10-19	mg/L			0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050
EPH19-32	mg/L			0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050
LEPH	mg/L			0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050
HEPH	mg/L			0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050
2-Bromobenzotrifluoride	%			-	80	71.8	86.5	54.4	-	58.3	69.2	NC	62.8	63.9	62.7

Client Sample ID		SOURCE	WNW	NORTH	ENE		SOURCE	WNW	NORTH	ENE		SOURCE	DUP-B (SOURCE)		WNW	NORTH	ENE	E-BLANK
Date Sampled	Lowest Detection Limit	31-Aug-2017	31-Aug-2017	31-Aug-2017	31-Aug-2017	Lowest Detection Limit	5-Sep-2017	5-Sep-2017	5-Sep-2017	5-Sep-2017	Lowest Detection Limit	10-Sep-2017	10-Sep-2017	Relative Percent Difference	10-Sep-2017	10-Sep-2017	10-Sep-2017	12-Sep-2017
Time Sampled		10:54	10:21	10:10	10:33		10:00	9:15	9:30	9:45		11:00	0:00		10:45	10:30	10:15	9:15
ALS Sample ID		L1986378-1	L1986378-2	L1986378-3	L1986378-4		L1987356-4	L1987356-1	L1987356-2	L1987356-3		L1992036-4	L1992036-5		L1992036-1	L1992036-2	L1992036-3	L1992036-6
Parameter		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater		Seawater	Seawater	Seawater	Seawater
Dissolved Metals																		
Dissolved Mercury Filtration Location	-	FIELD	FIELD	FIELD	FIELD	-	FIELD	FIELD	FIELD	FIELD	-	LAB	LAB		LAB	LAB	LAB	LAB
Dissolved Metals Filtration Location	-	FIELD	FIELD	FIELD	FIELD	-	LAB	LAB	LAB	LAB	-	LAB	LAB		LAB	LAB	LAB	LAB
Dissolved Metals Filtration Location	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Aluminum (Al)-Dissolved	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050	<0.0050
Antimony (Sb)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020	<0.0020
Barium (Ba)-Dissolved	0.0010	0.0084	0.0080	0.0081	0.0079	0.0010	0.0051	0.0050	0.0056	0.0051	0.0010	0.0081	0.0084	3.6%	0.0088	0.0078	0.0085	<0.0010
Beryllium (Be)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	0.10	3.27	3.22	3.16	3.18	0.10	1.16	1.04	1.30	1.25	0.10	3.44	3.66	6.2%	3.72	3.30	3.56	<0.10
Cadmium (Cd)-Dissolved	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Calcium (Ca)-Dissolved	1.0	311	302	325	314	1.0	109	98.1	121	122	1.0	307	306	0.3%	298	278	320	<1.0
Cesium (Cs)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Chromium (Cr)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Copper (Cu)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	0.00058	<0.00050	0.00068	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Gallium (Ga)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	NA	<0.010	<0.010	<0.010	<0.010
Lead (Pb)-Dissolved	0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	NA	<0.00030	<0.00030	<0.00030	<0.00030
Lithium (Li)-Dissolved	0.020	0.140	0.136	0.135	0.135	0.020	0.037	0.034	0.045	0.043	0.020	0.149	0.155	3.9%	0.156	0.136	0.166	<0.020
Magnesium (Mg)-Dissolved	1.0	799	799	809	767	1.0	267	242	306	288	1.0	800	810	1.2%	794	710	831	<1.0
Manganese (Mn)-Dissolved	0.00020	<0.00020	0.00040	0.00044	0.00035	0.00020	0.00054	0.00062	0.00053	0.00056	0.00020	0.00056	0.00048	NA	0.00069	0.00071	0.00063	<0.00020
Mercury (Hg)-Dissolved	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0020	0.0074	0.0071	0.0072	0.0073	0.0020	0.0025	0.0022	0.0029	0.0027	0.0020	0.0086	0.0089	NA	0.0089	0.0074	0.0090	<0.0020
Nickel (Ni)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Dissolved	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved	1.0	228	224	244	240	1.0	72.1	66.5	82.8	84.7	20	257	256	0.4%	244	223	265	<20
Rhenium (Re)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Rubidium (Rb)-Dissolved	0.0050	0.0878	0.0868	0.0901	0.0892	0.0050	0.0259	0.0227	0.0312	0.0289	0.0050	0.0992	0.101	1.8%	0.0997	0.0889	0.108	<0.0050
Selenium (Se)-Dissolved	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020	<0.0020
Silicon (Si)-Dissolved	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0
Silver (Ag)-Dissolved	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	NA	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na)-Dissolved	1.0	6410	6160	6460	6510	1.0	1940	1820	2380	2200	20	7150	6940	3.0%	6770	6310	7400	<20
Strontium (Sr)-Dissolved	0.010	4.39	4.32	4.24	4.30	0.010	1.59	1.47	1.86	1.83	0.050	4.34	4.44	2.3%	4.19	3.87	4.55	<0.050
Sulfur (S)-Dissolved	5.0	591	597	607	568	5.0	192	176	225	204	5.0	639	648	1.4%	635	578	672	<5.0
Tellurium (Te)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (Tl)-Dissolved	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Thorium (Th)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Tin (Sn)-Dissolved	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti)-Dissolved	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	NA	<0.0050	<0.0050	<0.0050	<0.0050
Tungsten (W)-Dissolved	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	NA	<0.0010	<0.0010	<0.0010	<0.0010
Uranium (U)-Dissolved	0.000050	0.00236	0.00244	0.00238	0.00238	0.000050	0.00257	0.00179	0.00167	0.00190	0.000050	0.00407	0.00420	3.1%	0.00262	0.00233	0.00315	<0.000050
Vanadium (V)-Dissolved	0.00050	0.00080	0.00083	0.00086	0.00076	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	0.00089	0.00090	NA	0.00083	0.00082	0.00091	<0.00050
Yttrium (Y)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	<0.0030	<0.0030	NA	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium (Zr)-Dissolved	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	NA	<0.00050	<0.00050	<0.00050	<0.00050
Hydrocarbons																		
EPH10-19	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050
EPH19-32	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050
LEPH	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050
HEPH	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050
2-Bromobenzotrifluoride	-	66.7	69.5	73.2	62.4	-	78	83.1	85.6	74.8	-	90.8	94.3	NC	85.5	135.7	114.8	91.6

APPENDIX B-2
WATER QUALITY SCREENING TABLE

Client Sample ID		CCME Marine WQG for Protection of Aquatic Life		Lowest Detection Limit	SOURCE	WNW	NORTH	ENE	Lowest Detection Limit	SOURCE	DUP A (SOURCE)	Relative Percent Difference	WNW	NORTH	ENE
Date Sampled	Units				8-Aug-2017	8-Aug-2017	8-Aug-2017	8-Aug-2017		22-Aug-2017	22-Aug-2017		22-Aug-2017	22-Aug-2017	22-Aug-2017
Time Sampled					11:59	11:10	11:35	11:00		9:58	10:10		9:22	10:40	10:27
ALS Sample ID					L1974199-1	L1974199-2	L1974199-3	L1974199-4		L1980315-1	L1980315-5		L1980315-2	L1980315-3	L1980315-4
Parameter		Short Term	Long Term		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater		Seawater	Seawater	Seawater
Polycyclic Aromatic Hydrocarbons												NC			
Acenaphthene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Acenaphthylene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Acridine	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Anthracene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Benz(a)anthracene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Benzo(a)pyrene	mg/L			0.0000050	<0.000070	<0.000060	<0.0000050	<0.0000050	0.0000050	<0.0000050	<0.0000050	NA	<0.0000050	<0.0000050	<0.0000050
Benzo(b&j)fluoranthene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Benzo(g,h,i)perylene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Benzo(k)fluoranthene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Chrysene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Dibenz(a,h)anthracene	mg/L			0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000050	<0.0000050	<0.0000050	NA	<0.0000050	<0.0000050	<0.0000050
Fluoranthene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Fluorene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Indeno(1,2,3-c,d)pyrene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Naphthalene	mg/L		**0.0014**	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Phenanthrene	mg/L			0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000020	<0.000020	<0.000020	NA	<0.000020	<0.000020	<0.000020
Pyrene	mg/L			0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010
Quinoline	mg/L			0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050
Acridine d9	%			-	100.1	96.6	99.1	98	-	100.4	87.9		91.6	88.6	91.7
Chrysene d12	%			-	109.4	105.6	105.8	104.3	-	123.4	83.5		99.2	92.8	102.4
Naphthalene d8	%			-	75	79.5	79.6	85	-	108.9	99.8		109.6	101.5	112
Phenanthrene d10	%			-	94.7	100.2	94.8	100.5	-	101.6	89.9		99.6	92.9	101.8

Client Sample ID	Lowest Detection Limit	SOURCE	WNW	NORTH	ENE	Lowest Detection Limit	SOURCE	WNW	NORTH	ENE	Lowest Detection Limit	SOURCE	DUP-B (SOURCE)	Relative Percent Difference	WNW	NORTH	ENE	E-BLANK
Date Sampled		31-Aug-2017	31-Aug-2017	31-Aug-2017	31-Aug-2017		5-Sep-2017	5-Sep-2017	5-Sep-2017	5-Sep-2017		10-Sep-2017	10-Sep-2017		10-Sep-2017	10-Sep-2017	10-Sep-2017	12-Sep-2017
Time Sampled		10:54	10:21	10:10	10:33		10:00	9:15	9:30	9:45		11:00	0:00		10:45	10:30	10:15	9:15
ALS Sample ID		L1986378-1	L1986378-2	L1986378-3	L1986378-4		L1987356-4	L1987356-1	L1987356-2	L1987356-3		L1992036-4	L1992036-5		L1992036-1	L1992036-2	L1992036-3	L1992036-6
Parameter		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater	Seawater	Seawater		Seawater	Seawater		Seawater	Seawater	Seawater	Seawater
Polycyclic Aromatic Hydrocarbons																		
Acenaphthene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Acenaphthylene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Acridine	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Anthracene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Benz(a)anthracene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(a)pyrene	0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000050	<0.0000050	<0.0000050	NA	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Benzo(b&j)fluoranthene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(g,h,i)perylene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Benzo(k)fluoranthene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Chrysene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Dibenz(a,h)anthracene	0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000050	<0.0000050	<0.0000050	NA	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Fluoranthene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Fluorene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Indeno(1,2,3-c,d)pyrene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Naphthalene	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Phenanthrene	0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000020	<0.000020	<0.000020	NA	<0.000020	<0.000020	<0.000020	<0.000020
Pyrene	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	NA	<0.000010	<0.000010	<0.000010	<0.000010
Quinoline	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	NA	<0.000050	<0.000050	<0.000050	<0.000050
Acridine d9	-	111.3	109.6	116.1	89.9	-	74.1	73.7	77.3	73.8	-	101	86.5	-	100.8	86.6	94.3	100.4
Chrysene d12	-	110.7	113.3	107.4	90	-	93.7	94.2	98.6	96.1	-	110.9	103.5	-	107.5	93.8	103.3	123.2
Naphthalene d8	-	87.2	88.9	81.8	79.1	-	82.9	79.3	95.5	81.6	-	92.5	81.1	-	96	84.9	87.4	85.8
Phenanthrene d10	-	101.2	102	94.3	91.2	-	87.2	85	91.6	87.7	-	111.4	99.4	-	107.7	95.5	103.6	107.2

Italics = detection limit higher than WQG

RPD = higher than 35%

APPENDIX C

Sediment Quality

GOLDER ASSOCIATES LTD.
ATTN: John Sherrin
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8

Date Received: 18-AUG-17
Report Date: 29-AUG-17 15:10 (MT)
Version: FINAL

Client Phone: 250-881-7372

Certificate of Analysis

Lab Work Order #: L1977406

Project P.O. #: NOT SUBMITTED

Job Reference: 1663724/10000/1003

C of C Numbers:

Legal Site Desc:

Amber Springer

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-1	L1977406-2	L1977406-3	L1977406-4	L1977406-5
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	10-AUG-17	10-AUG-17	10-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	14:55	14:22	13:00	16:30	16:30
	Client ID	SW-3-1	SW-2-2	SW-2-1	SC-4-1	SC-4-2
SOIL						
Physical Tests	Moisture (%)	28.5		27.5	39.5	
	pH (1:2 soil:water) (pH)	8.14	8.12	8.02	8.08	7.92
Particle Size	% Gravel (>2mm) (%)	7.7	<1.0	<1.0	3.0	4.5
	% Sand (2.0mm - 0.063mm) (%)	56.8	68.7	72.1	20.2	25.6
	% Silt (0.063mm - 4um) (%)	30.0	25.2	22.4	33.3	46.5
	% Clay (<4um) (%)	5.6	5.3	4.8	43.5	23.5
	Texture	Sandy loam	Sandy loam / Loamy sand	Loamy sand	Clay loam	Silt loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	1.99	1.43	1.42	1.88	2.67
	Total Carbon by Combustion (%)	4.35	3.44	3.25	3.59	5.26
	Total Organic Carbon (%)	2.36	2.01	1.83	1.71	2.6
Metals	Aluminum (Al) (mg/kg)	4520	3770	3260	14700	8960
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	0.13	0.16
	Arsenic (As) (mg/kg)	3.71	4.38	3.30	5.29	4.65
	Barium (Ba) (mg/kg)	15.5	13.7	12.8	42.9	28.1
	Beryllium (Be) (mg/kg)	0.34	0.26	0.23	0.98	0.62
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	0.23	<0.20
	Boron (B) (mg/kg)	33.4	25.7	22.9	61.2	60.5
	Cadmium (Cd) (mg/kg)	0.038	0.026	0.042	0.080	0.120
	Calcium (Ca) (mg/kg)	79400	51700	56000	44500	73800
	Chromium (Cr) (mg/kg)	17.7	14.8	13.0	63.1	29.7
	Cobalt (Co) (mg/kg)	3.04	2.69	2.27	10.1	5.11
	Copper (Cu) (mg/kg)	6.06	4.56	4.14	23.4	11.6
	Iron (Fe) (mg/kg)	10700	10100	8350	28900	14900
	Lead (Pb) (mg/kg)	4.77	3.68	3.48	15.1	10.5
	Lithium (Li) (mg/kg)	23.8	19.3	16.9	46.0	43.6
	Magnesium (Mg) (mg/kg)	40700	26900	25300	30600	37000
	Manganese (Mn) (mg/kg)	132	106	91.9	235	151
	Mercury (Hg) (mg/kg)	0.0097	0.0076	0.0063	0.0154	0.0237
	Molybdenum (Mo) (mg/kg)	0.36	0.30	0.27	0.95	1.09
	Nickel (Ni) (mg/kg)	9.55	8.34	7.08	34.6	17.2
	Phosphorus (P) (mg/kg)	443	442	403	623	629
	Potassium (K) (mg/kg)	2020	1850	1560	5880	3980
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	0.48
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	0.12	<0.10
	Sodium (Na) (mg/kg)	3970	4170	3690	6500	11200
	Strontium (Sr) (mg/kg)	46.5	35.8	60.5	44.5	62.1

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

	Sample ID	L1977406-6	L1977406-7	L1977406-8	L1977406-9	L1977406-10
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	15:30	15:30	15:30	14:07	14:45
	Client ID	SC-5-1	SC-5-2	DUP-A	SW-5-1	SW-5-2
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	34.1		35.7	32.7	
	pH (1:2 soil:water) (pH)	8.11	8.02	8.19	8.25	8.21
Particle Size	% Gravel (>2mm) (%)	15.4	6.8	31.2	<1.0	10.1
	% Sand (2.0mm - 0.063mm) (%)	36.8	43.9	28.1	42.0	32.4
	% Silt (0.063mm - 4um) (%)	37.5	37.0	31.5	34.8	38.9
	% Clay (<4um) (%)	10.3	12.3	9.1	23.2	18.8
	Texture	Loam	Loam	Loam	Loam	Loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.12	1.74	1.79	2.46	2.29
	Total Carbon by Combustion (%)	4.33	3.63	3.82	4.53	5.03
	Total Organic Carbon (%)	2.21	1.89	2.03	2.07	2.7
Metals	Aluminum (Al) (mg/kg)	6520	6910	6640	6990	6850
	Antimony (Sb) (mg/kg)	0.13	0.15	0.13	0.15	0.15
	Arsenic (As) (mg/kg)	2.42	3.95	2.62	6.52	7.07
	Barium (Ba) (mg/kg)	17.4	18.7	18.9	21.3	21.2
	Beryllium (Be) (mg/kg)	0.45	0.46	0.43	0.46	0.48
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	41.7	46.9	41.5	48.5	49.0
	Cadmium (Cd) (mg/kg)	0.071	0.082	0.068	0.090	0.095
	Calcium (Ca) (mg/kg)	57500	50000	55100	80700	85100
	Chromium (Cr) (mg/kg)	23.5	24.2	23.6	22.8	22.4
	Cobalt (Co) (mg/kg)	3.64	3.79	3.73	4.34	4.27
	Copper (Cu) (mg/kg)	7.60	9.19	7.63	9.57	9.61
	Iron (Fe) (mg/kg)	10700	11500	10800	13700	13900
	Lead (Pb) (mg/kg)	6.70	7.46	6.95	7.49	7.65
	Lithium (Li) (mg/kg)	28.8	29.7	27.9	34.3	34.2
	Magnesium (Mg) (mg/kg)	33900	28100	31000	35200	36900
	Manganese (Mn) (mg/kg)	117	113	116	153	157
	Mercury (Hg) (mg/kg)	0.0130	0.0177	0.0156	0.0163	0.0169
	Molybdenum (Mo) (mg/kg)	0.74	1.04	0.61	0.34	0.35
	Nickel (Ni) (mg/kg)	14.1	14.9	14.1	13.0	12.9
	Phosphorus (P) (mg/kg)	494	528	478	457	499
	Potassium (K) (mg/kg)	2670	2900	2730	3040	3010
	Selenium (Se) (mg/kg)	0.30	0.45	0.32	0.22	0.25
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	5200	7150	5670	5100	5610
	Strontium (Sr) (mg/kg)	41.3	52.5	42.0	55.8	61.3

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-11	L1977406-12	L1977406-13	L1977406-14	L1977406-15
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	13:01	13:26	12:30	12:20	11:10
	Client ID	SN-4-1	SN-4-2	SN-3-2	SN-3-1	SN-2-2
SOIL						
Physical Tests	Moisture (%)	24.8			29.9	
	pH (1:2 soil:water) (pH)	8.29	8.33	8.27	8.22	8.19
Particle Size	% Gravel (>2mm) (%)	15.0	11.4	18.1	10.8	15.4
	% Sand (2.0mm - 0.063mm) (%)	43.6	38.9	25.6	30.2	30.3
	% Silt (0.063mm - 4um) (%)	29.2	35.3	41.4	44.0	42.2
	% Clay (<4um) (%)	12.2	14.4	14.8	15.0	12.1
	Texture	Loam	Loam	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.13	2.23	2.42	2.15	1.98
	Total Carbon by Combustion (%)	4.19	4.74	5.65	5.14	5.09
	Total Organic Carbon (%)	2.06	2.51	3.2	3.0	3.1
Metals	Aluminum (Al) (mg/kg)	5430	5940	6930	6920	6160
	Antimony (Sb) (mg/kg)	0.12	0.14	0.14	0.13	0.12
	Arsenic (As) (mg/kg)	5.83	5.80	6.66	7.72	8.32
	Barium (Ba) (mg/kg)	16.2	18.5	20.4	20.8	19.1
	Beryllium (Be) (mg/kg)	0.37	0.40	0.47	0.45	0.43
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	38.3	42.5	49.1	47.4	44.1
	Cadmium (Cd) (mg/kg)	0.074	0.088	0.074	0.075	0.066
	Calcium (Ca) (mg/kg)	73900	78300	86400	85700	81900
	Chromium (Cr) (mg/kg)	17.7	19.9	22.8	23.1	21.1
	Cobalt (Co) (mg/kg)	3.37	3.84	4.28	4.35	4.05
	Copper (Cu) (mg/kg)	7.56	8.61	9.70	9.72	8.71
	Iron (Fe) (mg/kg)	11300	12400	13900	14300	13700
	Lead (Pb) (mg/kg)	6.05	6.90	7.20	7.18	6.36
	Lithium (Li) (mg/kg)	26.6	30.8	34.1	33.2	30.3
	Magnesium (Mg) (mg/kg)	31200	34800	41900	40500	40100
	Manganese (Mn) (mg/kg)	132	139	157	159	158
	Mercury (Hg) (mg/kg)	0.0127	0.0137	0.0147	0.0143	0.0138
	Molybdenum (Mo) (mg/kg)	0.29	0.33	0.37	0.36	0.34
	Nickel (Ni) (mg/kg)	10.2	11.8	13.3	13.1	12.2
	Phosphorus (P) (mg/kg)	422	436	517	569	589
	Potassium (K) (mg/kg)	2350	2610	3030	3060	2680
	Selenium (Se) (mg/kg)	0.21	<0.20	0.22	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	4210	4670	5560	4840	4460
	Strontium (Sr) (mg/kg)	51.0	52.4	56.6	56.0	52.1

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-16	L1977406-17	L1977406-18	L1977406-19	L1977406-20
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	10:47	10:28	10:14	16:00	16:00
	Client ID	SN-2-1	SN-1-2	SN-1-1	SE-5-1	SE-5-2
SOIL						
Physical Tests	Moisture (%)	28.8		27.8	30.4	
	pH (1:2 soil:water) (pH)	8.24	8.31	8.25	8.18	8.12
Particle Size	% Gravel (>2mm) (%)	15.8	34.9	44.1	6.0	1.5
	% Sand (2.0mm - 0.063mm) (%)	35.6	36.8	27.2	49.3	69.4
	% Silt (0.063mm - 4um) (%)	39.4	23.2	23.7	36.3	20.0
	% Clay (<4um) (%)	9.2	5.1	5.0	8.4	9.0
	Texture	Loam / Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.15	1.85	1.86	1.72	1.42
	Total Carbon by Combustion (%)	4.74	4.17	3.87	3.82	2.49
	Total Organic Carbon (%)	2.59	2.32	2.01	2.10	1.07
Metals	Aluminum (Al) (mg/kg)	5490	3850	5140	5510	3290
	Antimony (Sb) (mg/kg)	0.11	<0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	6.77	3.32	4.81	5.57	5.24
	Barium (Ba) (mg/kg)	17.1	13.5	16.3	15.2	13.0
	Beryllium (Be) (mg/kg)	0.37	0.28	0.33	0.37	0.23
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	39.5	29.7	37.1	39.0	23.7
	Cadmium (Cd) (mg/kg)	0.044	0.049	0.048	0.037	0.029
	Calcium (Ca) (mg/kg)	77800	69200	78800	57200	38100
	Chromium (Cr) (mg/kg)	19.5	14.2	18.4	18.4	12.0
	Cobalt (Co) (mg/kg)	3.52	2.56	3.14	3.28	2.12
	Copper (Cu) (mg/kg)	7.62	5.21	6.48	6.80	4.18
	Iron (Fe) (mg/kg)	12300	9320	11200	11000	7850
	Lead (Pb) (mg/kg)	5.85	4.31	5.23	5.81	3.72
	Lithium (Li) (mg/kg)	27.5	19.8	25.7	26.9	16.3
	Magnesium (Mg) (mg/kg)	36800	30300	40500	31600	19700
	Manganese (Mn) (mg/kg)	140	109	130	117	81.9
	Mercury (Hg) (mg/kg)	0.0133	0.0088	0.0121	0.0121	0.0072
	Molybdenum (Mo) (mg/kg)	0.34	0.27	0.31	0.34	0.23
	Nickel (Ni) (mg/kg)	10.8	7.86	9.87	10.1	6.59
	Phosphorus (P) (mg/kg)	518	354	441	465	430
	Potassium (K) (mg/kg)	2430	1750	2220	2420	1550
	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
	Sodium (Na) (mg/kg)	3990	3170	3880	5580	4320
	Strontium (Sr) (mg/kg)	55.6	50.6	48.5	40.7	34.3

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

APPENDIX C-1
SEDIMENT ANALYTICAL DATA

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-21	L1977406-22	L1977406-23	L1977406-24	L1977406-25
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	16:00	15:24	15:24	15:24	13:51
	Client ID	SE-5-3	SE-4-1	SE-4-2	SE-4-3	SC-2-1
SOIL						
Physical Tests	Moisture (%)		30.5			46.2
	pH (1:2 soil:water) (pH)	8.04	8.18	8.23	8.19	8.01
Particle Size	% Gravel (>2mm) (%)	17.2	37.0	1.4	18.7	5.7
	% Sand (2.0mm - 0.063mm) (%)	54.4	30.3	66.8	50.5	20.5
	% Silt (0.063mm - 4um) (%)	21.4	24.5	24.8	23.2	53.0
	% Clay (<4um) (%)	7.0	8.1	7.0	7.6	20.7
	Texture	Sandy loam	Loam	Sandy loam	Sandy loam	Silt loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	1.53	1.92	1.52	1.66	2.40
	Total Carbon by Combustion (%)	3.10	4.30	2.90	3.27	5.79
	Total Organic Carbon (%)	1.57	2.38	1.38	1.61	3.4
Metals	Aluminum (Al) (mg/kg)	3610	5400	4200	4560	10700
	Antimony (Sb) (mg/kg)	<0.10	0.11	<0.10	<0.10	0.26
	Arsenic (As) (mg/kg)	4.14	5.17	2.08	3.12	6.63
	Barium (Ba) (mg/kg)	12.3	17.8	11.4	12.8	29.6
	Beryllium (Be) (mg/kg)	0.25	0.36	0.28	0.30	0.70
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	24.6	37.8	29.8	33.7	81.3
	Cadmium (Cd) (mg/kg)	0.032	0.050	0.037	0.040	0.114
	Calcium (Ca) (mg/kg)	41100	65400	52400	48700	87500
	Chromium (Cr) (mg/kg)	12.7	19.1	13.5	15.4	34.1
	Cobalt (Co) (mg/kg)	2.26	3.32	2.31	2.49	5.36
	Copper (Cu) (mg/kg)	4.63	6.93	4.84	5.71	13.1
	Iron (Fe) (mg/kg)	8130	11300	7850	8500	17200
	Lead (Pb) (mg/kg)	4.11	6.19	4.44	4.90	10.9
	Lithium (Li) (mg/kg)	17.7	25.1	19.1	21.2	50.6
	Magnesium (Mg) (mg/kg)	20500	30500	25600	26700	50700
	Manganese (Mn) (mg/kg)	88.8	122	90.1	94.0	172
	Mercury (Hg) (mg/kg)	0.0086	0.0142	0.0075	0.0076	0.0201
	Molybdenum (Mo) (mg/kg)	0.26	0.33	0.30	0.37	1.08
	Nickel (Ni) (mg/kg)	7.06	10.7	7.49	8.36	19.2
	Phosphorus (P) (mg/kg)	530	517	340	397	747
	Potassium (K) (mg/kg)	1690	2360	1800	1970	4650
	Selenium (Se) (mg/kg)	<0.20	0.24	<0.20	<0.20	0.63
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	4270	5050	3400	4280	10500
	Strontium (Sr) (mg/kg)	33.6	56.6	36.3	35.1	65.8

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-26	L1977406-27	L1977406-28	L1977406-29	L1977406-30
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	13:51	13:51	12:33	12:33	12:33
	Client ID	SC-2-2	SC-2-3	SC-3-1	SC-3-2	SC-3-3
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)			33.0		
	pH (1:2 soil:water) (pH)	8.09	8.00	8.24	8.17	7.85
Particle Size	% Gravel (>2mm) (%)	3.9	6.5	11.7	13.1	2.5
	% Sand (2.0mm - 0.063mm) (%)	29.7	25.1	25.4	21.9	25.4
	% Silt (0.063mm - 4um) (%)	51.1	50.5	47.9	49.4	52.3
	% Clay (<4um) (%)	15.3	17.9	15.0	15.6	19.9
	Texture	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.40	2.07	2.26	2.18	2.44
	Total Carbon by Combustion (%)	5.31	5.25	4.66	5.44	5.78
	Total Organic Carbon (%)	2.9	3.2	2.40	3.3	3.3
Metals	Aluminum (Al) (mg/kg)	7930	7610	7850	8720	10600
	Antimony (Sb) (mg/kg)	0.16	0.19	0.16	0.19	0.29
	Arsenic (As) (mg/kg)	4.42	4.07	3.69	3.97	5.91
	Barium (Ba) (mg/kg)	25.8	19.7	20.4	27.5	25.9
	Beryllium (Be) (mg/kg)	0.51	0.50	0.51	0.55	0.65
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	54.4	55.0	54.7	61.8	73.6
	Cadmium (Cd) (mg/kg)	0.069	0.179	0.088	0.085	0.170
	Calcium (Ca) (mg/kg)	80100	69400	73800	85100	72100
	Chromium (Cr) (mg/kg)	25.7	25.5	23.9	26.6	32.4
	Cobalt (Co) (mg/kg)	4.38	4.05	3.76	4.28	4.65
	Copper (Cu) (mg/kg)	9.29	9.57	8.14	9.26	13.0
	Iron (Fe) (mg/kg)	13300	12300	12000	13200	14000
	Lead (Pb) (mg/kg)	8.27	8.16	8.08	9.00	10.2
	Lithium (Li) (mg/kg)	35.4	35.9	35.6	39.6	46.2
	Magnesium (Mg) (mg/kg)	45700	41900	42000	46700	45800
	Manganese (Mn) (mg/kg)	154	132	135	147	146
	Mercury (Hg) (mg/kg)	0.0157	0.0148	0.0174	0.0185	0.0199
	Molybdenum (Mo) (mg/kg)	0.48	1.02	0.69	0.75	2.78
	Nickel (Ni) (mg/kg)	14.4	14.5	13.0	14.6	17.7
	Phosphorus (P) (mg/kg)	569	523	499	556	532
	Potassium (K) (mg/kg)	3390	3310	3300	3640	4480
	Selenium (Se) (mg/kg)	0.29	0.37	0.34	0.36	0.63
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	6920	7040	5780	7680	10100
	Strontium (Sr) (mg/kg)	56.3	50.3	51.2	69.1	51.9

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-31	L1977406-32	L1977406-33	L1977406-34	L1977406-35
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	11:36	11:09	10:43	10:09	09:50
	Client ID	SC-4-3	SC-5-3	SN-5-3	SN-4-3	SN-3-3
SOIL						
Physical Tests	Moisture (%)					
	pH (1:2 soil:water) (pH)	8.08	8.16	8.26	8.32	8.35
Particle Size	% Gravel (>2mm) (%)	15.6	11.7	14.4	12.0	3.8
	% Sand (2.0mm - 0.063mm) (%)	33.6	40.5	34.2	29.4	27.9
	% Silt (0.063mm - 4um) (%)	35.9	32.5	33.8	40.3	47.2
	% Clay (<4um) (%)	14.8	15.2	17.7	18.4	21.1
	Texture	Loam	Loam	Loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.17	1.79	2.41	2.55	2.32
	Total Carbon by Combustion (%)	4.65	3.54	4.95	5.57	5.28
	Total Organic Carbon (%)	2.48	1.75	2.54	3.0	3.0
Metals	Aluminum (Al) (mg/kg)	9910	8590	8630	8450	8500
	Antimony (Sb) (mg/kg)	0.17	0.13	0.16	0.17	0.17
	Arsenic (As) (mg/kg)	4.05	3.85	6.67	7.16	4.43
	Barium (Ba) (mg/kg)	36.4	23.1	23.9	23.4	22.2
	Beryllium (Be) (mg/kg)	0.60	0.53	0.53	0.56	0.55
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	64.6	51.0	58.8	61.3	59.3
	Cadmium (Cd) (mg/kg)	0.120	0.075	0.099	0.106	0.104
	Calcium (Ca) (mg/kg)	75600	53200	87700	98800	89800
	Chromium (Cr) (mg/kg)	30.0	31.5	24.2	26.1	27.7
	Cobalt (Co) (mg/kg)	4.76	4.57	4.59	4.84	4.76
	Copper (Cu) (mg/kg)	9.96	9.88	10.3	10.7	11.0
	Iron (Fe) (mg/kg)	13600	13600	14400	15600	14500
	Lead (Pb) (mg/kg)	9.27	8.37	8.32	8.78	8.34
	Lithium (Li) (mg/kg)	40.6	31.3	37.0	40.5	40.7
	Magnesium (Mg) (mg/kg)	38700	29400	39300	44500	43900
	Manganese (Mn) (mg/kg)	146	133	176	173	152
	Mercury (Hg) (mg/kg)	0.0243	0.0148	0.0180	0.0154	0.0141
	Molybdenum (Mo) (mg/kg)	0.74	0.66	0.39	0.39	0.41
	Nickel (Ni) (mg/kg)	17.8	18.5	13.8	14.8	15.5
	Phosphorus (P) (mg/kg)	526	534	478	513	460
	Potassium (K) (mg/kg)	4060	3520	3600	3590	3530
	Selenium (Se) (mg/kg)	0.59	0.28	0.25	0.24	0.26
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	8670	8490	5440	5160	5310
	Strontium (Sr) (mg/kg)	65.2	68.4	62.3	68.8	59.1

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

	Sample ID	L1977406-36	L1977406-37	L1977406-38	L1977406-39	L1977406-40
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	09:30	09:11	16:10	16:10	16:10
	Client ID	SN-2-3	SN-1-3	SW-5-1	SW-5-2	SW-5-3
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)			28.7		
	pH (1:2 soil:water) (pH)	8.27	8.48	8.26	8.20	8.18
Particle Size	% Gravel (>2mm) (%)	20.0	13.7	1.1	<1.0	1.0
	% Sand (2.0mm - 0.063mm) (%)	37.9	44.7	66.8	61.8	54.9
	% Silt (0.063mm - 4um) (%)	32.5	32.8	28.1	32.8	37.9
	% Clay (<4um) (%)	9.6	8.9	4.0	4.6	6.2
	Texture	Loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.03	1.87	1.65	1.68	1.57
	Total Carbon by Combustion (%)	4.41	4.71	4.44	4.43	4.42
	Total Organic Carbon (%)	2.38	2.84	2.79	2.75	2.85
Metals	Aluminum (Al) (mg/kg)	6330	5440	3980	4250	5590
	Antimony (Sb) (mg/kg)	0.12	0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	6.79	2.31	2.72	3.74	7.03
	Barium (Ba) (mg/kg)	17.5	15.0	13.3	14.8	22.0
	Beryllium (Be) (mg/kg)	0.44	0.35	0.27	0.32	0.38
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	46.6	39.3	30.3	31.5	42.2
	Cadmium (Cd) (mg/kg)	0.051	0.080	0.033	<0.020	0.033
	Calcium (Ca) (mg/kg)	75000	73800	68600	75100	88100
	Chromium (Cr) (mg/kg)	20.0	18.1	15.2	16.9	21.3
	Cobalt (Co) (mg/kg)	3.73	3.12	3.04	3.11	3.95
	Copper (Cu) (mg/kg)	8.06	6.66	5.96	6.45	8.16
	Iron (Fe) (mg/kg)	12500	10200	10700	11600	15600
	Lead (Pb) (mg/kg)	6.23	5.19	3.57	3.82	5.01
	Lithium (Li) (mg/kg)	31.1	25.7	22.0	23.7	29.7
	Magnesium (Mg) (mg/kg)	37500	35200	36100	39700	45900
	Manganese (Mn) (mg/kg)	143	113	137	135	166
	Mercury (Hg) (mg/kg)	0.0121	0.0087	0.0056	0.0059	0.0085
	Molybdenum (Mo) (mg/kg)	0.39	0.33	0.29	0.29	0.35
	Nickel (Ni) (mg/kg)	11.3	9.97	8.36	9.14	11.7
	Phosphorus (P) (mg/kg)	518	344	466	504	1050
	Potassium (K) (mg/kg)	2710	2290	1930	1960	2540
	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
	Sodium (Na) (mg/kg)	4520	3330	4900	3580	5180
	Strontium (Sr) (mg/kg)	51.8	48.6	41.8	43.3	67.1

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-41	L1977406-42	L1977406-43	L1977406-44	L1977406-45
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	15:22	15:22	15:22	14:30	14:30
	Client ID	SW-1-1	SW-1-2	SW-1-3	SW-3-2	SW-3-3
SOIL						
Physical Tests	Moisture (%)	13.3				
	pH (1:2 soil:water) (pH)	8.43	8.67	8.49	8.28	8.26
Particle Size	% Gravel (>2mm) (%)	25.1	48.5	51.5	5.1	19.9
	% Sand (2.0mm - 0.063mm) (%)	73.2	50.4	46.8	56.0	41.8
	% Silt (0.063mm - 4um) (%)	1.1	<1.0	1.3	30.9	31.3
	% Clay (<4um) (%)	<1.0	<1.0	<1.0	8.1	7.0
	Texture	Sand	Sand	Sand	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	0.869	1.05	0.828	2.06	1.73
	Total Carbon by Combustion (%)	1.48	1.38	1.25	4.40	4.63
	Total Organic Carbon (%)	0.61	0.33	0.42	2.34	2.90
Metals	Aluminum (Al) (mg/kg)	797	810	1100	5160	6070
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	<0.10	0.11
	Arsenic (As) (mg/kg)	0.44	0.45	0.47	4.93	5.39
	Barium (Ba) (mg/kg)	1.90	2.24	3.90	17.6	20.4
	Beryllium (Be) (mg/kg)	<0.10	<0.10	<0.10	0.34	0.42
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	7.8	7.3	7.7	35.6	42.9
	Cadmium (Cd) (mg/kg)	<0.020	<0.020	<0.020	0.035	0.039
	Calcium (Ca) (mg/kg)	37500	26000	20900	72900	86600
	Chromium (Cr) (mg/kg)	2.56	3.06	3.65	19.3	22.1
	Cobalt (Co) (mg/kg)	0.58	0.59	0.76	3.26	3.86
	Copper (Cu) (mg/kg)	1.21	1.13	1.56	6.19	7.50
	Iron (Fe) (mg/kg)	1970	3200	4040	11600	13300
	Lead (Pb) (mg/kg)	1.14	1.20	0.94	4.97	5.78
	Lithium (Li) (mg/kg)	4.9	4.5	5.9	24.5	28.8
	Magnesium (Mg) (mg/kg)	15400	12200	10600	38700	46900
	Manganese (Mn) (mg/kg)	31.7	31.9	35.9	128	153
	Mercury (Hg) (mg/kg)	<0.0050	<0.0050	<0.0050	0.0089	0.0100
	Molybdenum (Mo) (mg/kg)	0.12	0.10	0.12	0.30	0.39
	Nickel (Ni) (mg/kg)	1.87	1.48	2.14	10.3	11.8
	Phosphorus (P) (mg/kg)	87	77	95	533	563
	Potassium (K) (mg/kg)	330	360	490	2410	2740
	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
	Sodium (Na) (mg/kg)	1480	1410	1600	3990	5030
	Strontium (Sr) (mg/kg)	25.5	16.0	12.8	50.0	56.2

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

Grouping	Analyte	L1977406-46	L1977406-47	L1977406-48	L1977406-49	L1977406-50
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	14:30	13:33	13:33	13:33	13:33
	Client ID	DUP F	SE-1-1	SE-1-2	SE-1-3	DUP E
SOIL						
Physical Tests	Moisture (%)	24.3	22.7			21.1
	pH (1:2 soil:water) (pH)	8.33	8.34	8.31	8.18	8.25
Particle Size	% Gravel (>2mm) (%)	11.1	9.3	22.4	45.9	49.7
	% Sand (2.0mm - 0.063mm) (%)	49.1	54.4	44.2	33.8	30.2
	% Silt (0.063mm - 4um) (%)	31.8	28.6	26.6	16.3	16.0
	% Clay (<4um) (%)	7.9	7.7	6.8	4.0	4.1
	Texture	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	1.54	2.00	1.86	1.80	1.74
	Total Carbon by Combustion (%)	4.17	4.68	4.33	3.98	3.95
	Total Organic Carbon (%)	2.63	2.68	2.47	2.18	2.21
Metals	Aluminum (Al) (mg/kg)	5060	4850	4770	3990	4800
	Antimony (Sb) (mg/kg)	0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	4.24	3.75	4.96	4.06	3.89
	Barium (Ba) (mg/kg)	15.3	15.3	15.4	13.2	14.6
	Beryllium (Be) (mg/kg)	0.34	0.31	0.34	0.30	0.33
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	36.8	35.6	35.6	30.0	34.6
	Cadmium (Cd) (mg/kg)	0.034	0.048	0.040	0.039	0.041
	Calcium (Ca) (mg/kg)	72800	71000	72200	62300	74200
	Chromium (Cr) (mg/kg)	18.2	16.5	16.2	14.8	17.1
	Cobalt (Co) (mg/kg)	3.02	2.96	3.01	2.74	2.81
	Copper (Cu) (mg/kg)	5.84	6.21	6.16	8.16	5.80
	Iron (Fe) (mg/kg)	10700	12100	11400	11600	11200
	Lead (Pb) (mg/kg)	4.77	4.97	4.92	4.18	4.78
	Lithium (Li) (mg/kg)	23.7	23.6	24.1	19.9	23.5
	Magnesium (Mg) (mg/kg)	39900	34800	35300	30900	31800
	Manganese (Mn) (mg/kg)	119	127	131	126	118
	Mercury (Hg) (mg/kg)	0.0079	0.0104	0.0092	0.0084	0.0113
	Molybdenum (Mo) (mg/kg)	0.30	0.32	0.33	0.35	0.30
	Nickel (Ni) (mg/kg)	9.66	9.10	9.12	8.43	9.06
	Phosphorus (P) (mg/kg)	483	376	441	365	394
	Potassium (K) (mg/kg)	2280	2150	2090	1770	2090
	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
	Sodium (Na) (mg/kg)	4060	4000	3790	4520	3480
	Strontium (Sr) (mg/kg)	44.8	48.0	50.1	43.9	50.8

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

	Sample ID	L1977406-51	L1977406-52	L1977406-53	L1977406-54	L1977406-55
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	12:00	12:00	12:00	12:00	10:11
	Client ID	SE-2-1	SE-2-2	SE-2-3	DUP D	SE-3-1
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	23.0			20.4	31.9
	pH (1:2 soil:water) (pH)	8.11	8.35	8.35	8.38	8.23
Particle Size	% Gravel (>2mm) (%)	82.3	39.8	10.5	22.9	7.8
	% Sand (2.0mm - 0.063mm) (%)	13.0	42.5	47.6	59.5	63.6
	% Silt (0.063mm - 4um) (%)	3.6	13.4	32.5	13.1	21.1
	% Clay (<4um) (%)	1.1	4.4	9.5	4.5	7.6
	Texture	Loamy sand	Sandy loam	Sandy loam	Loamy sand	Sandy loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	1.66	1.83	1.92	1.39	1.83
	Total Carbon by Combustion (%)	3.59	3.18	4.30	2.54	3.36
	Total Organic Carbon (%)	1.93	1.35	2.38	1.15	1.53
Metals	Aluminum (Al) (mg/kg)	3800	4140	5310	2960	4140
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	3.79	4.04	2.95	4.05	3.28
	Barium (Ba) (mg/kg)	12.5	14.6	15.6	10.5	12.9
	Beryllium (Be) (mg/kg)	0.25	0.29	0.37	0.23	0.28
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	27.2	31.5	36.5	23.8	32.2
	Cadmium (Cd) (mg/kg)	0.038	0.046	0.052	0.030	0.043
	Calcium (Ca) (mg/kg)	55000	61400	74900	56700	56700
	Chromium (Cr) (mg/kg)	12.8	13.7	17.3	10.2	13.2
	Cobalt (Co) (mg/kg)	2.26	2.56	3.03	1.88	2.34
	Copper (Cu) (mg/kg)	4.29	4.96	6.66	3.80	5.03
	Iron (Fe) (mg/kg)	9610	10500	10100	7660	8740
	Lead (Pb) (mg/kg)	3.91	4.49	5.31	3.42	4.69
	Lithium (Li) (mg/kg)	17.7	20.0	25.5	15.7	20.4
	Magnesium (Mg) (mg/kg)	24100	29300	38000	23800	26200
	Manganese (Mn) (mg/kg)	92.2	109	127	80.2	88.1
	Mercury (Hg) (mg/kg)	0.0076	0.0077	0.0097	0.0071	0.0094
	Molybdenum (Mo) (mg/kg)	0.41	0.32	0.30	0.26	0.52
	Nickel (Ni) (mg/kg)	6.99	8.83	9.63	5.91	7.71
	Phosphorus (P) (mg/kg)	385	403	594	378	388
	Potassium (K) (mg/kg)	1760	1840	2330	1350	1890
	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
	Sodium (Na) (mg/kg)	3690	3640	4130	3090	4800
	Strontium (Sr) (mg/kg)	55.0	44.8	50.3	43.0	43.0

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

	Sample ID	L1977406-56	L1977406-57	L1977406-58	L1977406-59	L1977406-60
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	10:11	10:11	10:11	15:15	15:15
	Client ID	SE-3-2	SE-3-3	DUP C	SW-4-1	SW-4-2
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)			25.5	24.3	
	pH (1:2 soil:water) (pH)	8.27	8.23	8.14	8.18	8.17
Particle Size	% Gravel (>2mm) (%)	30.8	32.0	50.0	9.2	3.2
	% Sand (2.0mm - 0.063mm) (%)	47.6	46.4	34.7	55.1	61.9
	% Silt (0.063mm - 4um) (%)	15.6	16.0	11.7	29.3	29.0
	% Clay (<4um) (%)	5.9	5.6	3.5	6.5	5.9
	Texture	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Inorganic Carbon (%)	1.71	1.77	1.56	1.70	1.67
	Total Carbon by Combustion (%)	3.50	3.09	3.16	3.69	3.85
	Total Organic Carbon (%)	1.79	1.32	1.60	1.99	2.18
Metals	Aluminum (Al) (mg/kg)	4440	4500	4380	4940	4140
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	3.23	3.50	3.25	6.53	6.54
	Barium (Ba) (mg/kg)	14.3	14.8	13.7	16.9	14.9
	Beryllium (Be) (mg/kg)	0.31	0.28	0.30	0.33	0.29
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	30.8	30.6	31.6	37.8	31.9
	Cadmium (Cd) (mg/kg)	0.042	0.031	0.055	0.056	<0.020
	Calcium (Ca) (mg/kg)	55000	52900	57900	70800	73400
	Chromium (Cr) (mg/kg)	14.5	15.1	13.9	18.0	16.0
	Cobalt (Co) (mg/kg)	2.50	2.54	2.34	3.19	2.78
	Copper (Cu) (mg/kg)	5.40	4.76	4.81	6.07	5.15
	Iron (Fe) (mg/kg)	9700	9970	9390	12300	10700
	Lead (Pb) (mg/kg)	4.50	4.43	4.45	4.60	4.02
	Lithium (Li) (mg/kg)	20.5	20.0	20.0	23.7	22.1
	Magnesium (Mg) (mg/kg)	27000	26600	25300	35200	34300
	Manganese (Mn) (mg/kg)	98.4	96.9	91.9	136	118
	Mercury (Hg) (mg/kg)	0.0123	0.0087	0.0103	0.0090	0.0073
	Molybdenum (Mo) (mg/kg)	0.36	0.32	0.29	0.32	0.26
	Nickel (Ni) (mg/kg)	8.09	7.83	7.68	9.90	8.66
	Phosphorus (P) (mg/kg)	366	400	379	599	548
	Potassium (K) (mg/kg)	2050	2000	1970	2350	2040
	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
	Sodium (Na) (mg/kg)	3580	3710	4580	4400	4050
	Strontium (Sr) (mg/kg)	40.2	43.0	45.5	54.2	47.2

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

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	Sample ID	L1977406-61	L1977406-62	L1977406-63		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17		
	Sampled Time	12:33	14:25	15:15		
	Client ID	DUP B	SW2-3	SW-4-3		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	41.6				
	pH (1:2 soil:water) (pH)	8.02	8.20	8.19		
Particle Size	% Gravel (>2mm) (%)	5.1	13.0	4.4		
	% Sand (2.0mm - 0.063mm) (%)	22.4	81.7	48.1		
	% Silt (0.063mm - 4um) (%)	49.5	4.0	39.3		
	% Clay (<4um) (%)	23.0	1.3	8.2		
	Texture	Silt loam	Sand	Sandy loam		
Organic / Inorganic Carbon	Inorganic Carbon (%)	2.38	0.840	1.51		
	Total Carbon by Combustion (%)	5.85	1.58	4.54		
	Total Organic Carbon (%)	3.5	0.74	3.03		
Metals	Aluminum (Al) (mg/kg)	8520	917	6090		
	Antimony (Sb) (mg/kg)	0.21	<0.10	0.10		
	Arsenic (As) (mg/kg)	4.10	0.72	10.3		
	Barium (Ba) (mg/kg)	23.2	2.80	22.9		
	Beryllium (Be) (mg/kg)	0.57	<0.10	0.41		
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20		
	Boron (B) (mg/kg)	61.4	8.4	45.1		
	Cadmium (Cd) (mg/kg)	0.097	<0.020	0.042		
	Calcium (Ca) (mg/kg)	80500	19500	94500		
	Chromium (Cr) (mg/kg)	27.5	4.58	22.6		
	Cobalt (Co) (mg/kg)	4.39	0.70	4.06		
	Copper (Cu) (mg/kg)	10.1	1.30	8.08		
	Iron (Fe) (mg/kg)	13500	5410	15200		
	Lead (Pb) (mg/kg)	9.66	1.19	5.95		
	Lithium (Li) (mg/kg)	41.8	5.5	30.9		
	Magnesium (Mg) (mg/kg)	45300	8950	47000		
	Manganese (Mn) (mg/kg)	146	36.1	194		
	Mercury (Hg) (mg/kg)	0.0208	<0.0050	0.0097		
	Molybdenum (Mo) (mg/kg)	1.19	0.18	0.42		
	Nickel (Ni) (mg/kg)	15.8	2.06	12.5		
	Phosphorus (P) (mg/kg)	538	110	929		
	Potassium (K) (mg/kg)	3630	430	2810		
	Selenium (Se) (mg/kg)	0.40	<0.20	<0.20		
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		
	Sodium (Na) (mg/kg)	7420	1350	5020		
	Strontium (Sr) (mg/kg)	56.4	15.1	66.6		

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

Grouping	Analyte	L1977406-1	L1977406-2	L1977406-3	L1977406-4	L1977406-5
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	10-AUG-17	10-AUG-17	10-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	14:55	14:22	13:00	16:30	16:30
	Client ID	SW-3-1	SW-2-2	SW-2-1	SC-4-1	SC-4-2
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	<1000	2000	2100
	Thallium (Tl) (mg/kg)	0.092	0.094	0.076	0.285	0.190
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	253	247	211	747	339
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.762	0.651	0.634	2.87	1.54
	Vanadium (V) (mg/kg)	18.6	15.9	13.8	47.2	32.6
	Zinc (Zn) (mg/kg)	14.0	13.3	12.1	42.6	27.9
	Zirconium (Zr) (mg/kg)	5.2	3.7	3.5	22.7	8.8
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) (%)	93.1		93.5	99.2	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	90.4		87.6	96.5	
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10		<10	<10	
	F1-BTEX (mg/kg)	<10		<10	<10	
	F2 (C10-C16) (mg/kg)	<30		<30	<30	
	F3 (C16-C34) (mg/kg)	<50		<50	<50	
	F4 (C34-C50) (mg/kg)	<50		<50	<50	
	Chrom. to baseline at nC50	YES		YES	YES	
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	99.4		90.6	90.7	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	91.0		109.1	115.5	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Acenaphthylene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Anthracene (mg/kg)	<0.0040		<0.0040	<0.0040	
	Benz(a)anthracene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(a)pyrene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(b&j)fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015		<0.015	<0.015	

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

	Sample ID	L1977406-6	L1977406-7	L1977406-8	L1977406-9	L1977406-10
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	15:30	15:30	15:30	14:07	14:45
	Client ID	SC-5-1	SC-5-2	DUP-A	SW-5-1	SW-5-2
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	1000	1600	1100	<1000	<1000
	Thallium (Tl) (mg/kg)	0.129	0.137	0.124	0.127	0.124
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	313	299	304	256	249
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	1.26	1.39	1.23	0.972	0.954
	Vanadium (V) (mg/kg)	21.9	25.2	22.0	29.4	29.8
	Zinc (Zn) (mg/kg)	21.1	22.2	21.0	21.9	21.9
	Zirconium (Zr) (mg/kg)	5.5	5.0	5.3	7.3	6.9
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) (%)	89.6		97.2	92.7	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	87.0		97.1	91.3	
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10		<10	<10	
	F1-BTEX (mg/kg)	<10		<10	<10	
	F2 (C10-C16) (mg/kg)	<30		<30	<30	
	F3 (C16-C34) (mg/kg)	<50		<50	<50	
	F4 (C34-C50) (mg/kg)	<50		<50	<50	
	Chrom. to baseline at nC50	YES		YES	YES	
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	88.7		90.5	91.3	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	94.1		95.5	102.7	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Acenaphthylene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Anthracene (mg/kg)	<0.0040		<0.0040	<0.0040	
	Benz(a)anthracene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(a)pyrene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(b&j)fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015		<0.015	<0.015	

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

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	Sample ID	L1977406-11	L1977406-12	L1977406-13	L1977406-14	L1977406-15
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	13:01	13:26	12:30	12:20	11:10
	Client ID	SN-4-1	SN-4-2	SN-3-2	SN-3-1	SN-2-2
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	1000	<1000	<1000
	Thallium (Tl) (mg/kg)	0.101	0.111	0.127	0.127	0.110
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	209	229	281	288	284
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.768	0.915	0.949	0.954	0.975
	Vanadium (V) (mg/kg)	24.2	26.6	29.2	29.7	26.6
	Zinc (Zn) (mg/kg)	16.8	19.2	20.4	20.5	18.3
	Zirconium (Zr) (mg/kg)	5.6	6.1	7.1	7.3	6.4
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) (%)	98.0			88.9	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	96.6			85.3	
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10			<10	
	F1-BTEX (mg/kg)	<10			<10	
	F2 (C10-C16) (mg/kg)	<30			<30	
	F3 (C16-C34) (mg/kg)	<50			<50	
	F4 (C34-C50) (mg/kg)	<50			<50	
	Chrom. to baseline at nC50	YES			YES	
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	87.7			92.5	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	92.3			101.6	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050			<0.0050	
	Acenaphthylene (mg/kg)	<0.0050			<0.0050	
	Anthracene (mg/kg)	<0.0040			<0.0040	
	Benz(a)anthracene (mg/kg)	<0.010			<0.010	
	Benzo(a)pyrene (mg/kg)	<0.010			<0.010	
	Benzo(b&j)fluoranthene (mg/kg)	<0.010			<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015			<0.015	

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

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	Sample ID	L1977406-16	L1977406-17	L1977406-18	L1977406-19	L1977406-20
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	10:47	10:28	10:14	16:00	16:00
	Client ID	SN-2-1	SN-1-2	SN-1-1	SE-5-1	SE-5-2
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)	0.101	0.079	0.100	0.103	0.066
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	237	204	236	243	171
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.790	0.671	0.802	0.783	0.495
	Vanadium (V) (mg/kg)	23.2	16.3	20.6	23.1	15.1
	Zinc (Zn) (mg/kg)	16.5	12.1	15.2	16.3	10.9
	Zirconium (Zr) (mg/kg)	5.5	4.8	5.9	5.8	3.3
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) (%)	86.8		93.2	90.6	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	88.5		94.3	92.0	
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10		<10	<10	
	F1-BTEX (mg/kg)	<10		<10	<10	
	F2 (C10-C16) (mg/kg)	<30		<30	<30	
	F3 (C16-C34) (mg/kg)	<50		<50	<50	
	F4 (C34-C50) (mg/kg)	<50		<50	<50	
	Chrom. to baseline at nC50	YES		YES	YES	
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	84.1		88.5	82.5	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	97.5		108.2	98.4	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Acenaphthylene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Anthracene (mg/kg)	<0.0040		<0.0040	<0.0040	
	Benz(a)anthracene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(a)pyrene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(b&j)fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015		<0.015	<0.015	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-21	L1977406-22	L1977406-23	L1977406-24	L1977406-25
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	16:00	15:24	15:24	15:24	13:51
	Client ID	SE-5-3	SE-4-1	SE-4-2	SE-4-3	SC-2-1
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	1100	<1000	<1000	1900
	Thallium (Tl) (mg/kg)	0.077	0.107	0.115	0.096	0.207
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	178	257	196	198	385
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.567	0.904	0.714	0.725	1.66
	Vanadium (V) (mg/kg)	16.0	22.4	16.3	18.5	42.6
	Zinc (Zn) (mg/kg)	11.6	16.6	12.7	13.6	31.7
	Zirconium (Zr) (mg/kg)	3.7	5.2	4.7	4.9	9.1
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) (%)		93.2			91.3
	Surrogate: 1,4-Difluorobenzene (SS) (%)		93.1			84.9
Hydrocarbons	F1 (C6-C10) (mg/kg)		<10			<10
	F1-BTEX (mg/kg)		<10			<10
	F2 (C10-C16) (mg/kg)		<30			<30
	F3 (C16-C34) (mg/kg)		<50			<50
	F4 (C34-C50) (mg/kg)		<50			<50
	Chrom. to baseline at nC50		YES			YES
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)		87.1			77.0
	Surrogate: 3,4-Dichlorotoluene (SS) (%)		97.9			103.6
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)		<0.0050			<0.0050
	Acenaphthylene (mg/kg)		<0.0050			<0.0050
	Anthracene (mg/kg)		<0.0040			<0.0040
	Benz(a)anthracene (mg/kg)		<0.010			<0.010
	Benzo(a)pyrene (mg/kg)		<0.010			<0.010
	Benzo(b&j)fluoranthene (mg/kg)		<0.010			<0.010
	Benzo(b+j+k)fluoranthene (mg/kg)		<0.015			<0.015

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-26	L1977406-27	L1977406-28	L1977406-29	L1977406-30
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	13:51	13:51	12:33	12:33	12:33
	Client ID	SC-2-2	SC-2-3	SC-3-1	SC-3-2	SC-3-3
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	1200	1400	<1000	1300	3100
	Thallium (Tl) (mg/kg)	0.142	0.146	0.138	0.155	0.206
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	321	283	277	299	341
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	1.16	1.38	1.25	1.39	1.96
	Vanadium (V) (mg/kg)	28.5	30.3	27.7	30.3	43.0
	Zinc (Zn) (mg/kg)	23.7	22.3	21.9	23.9	27.7
	Zirconium (Zr) (mg/kg)	7.3	7.0	6.7	7.3	9.0
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) (%)			92.0		
	Surrogate: 1,4-Difluorobenzene (SS) (%)			85.2		
Hydrocarbons	F1 (C6-C10) (mg/kg)			<10		
	F1-BTEX (mg/kg)			<10		
	F2 (C10-C16) (mg/kg)			<30		
	F3 (C16-C34) (mg/kg)			<50		
	F4 (C34-C50) (mg/kg)			<50		
	Chrom. to baseline at nC50			YES		
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)			77.3		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)			103.3		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)			<0.0050		
	Acenaphthylene (mg/kg)			<0.0050		
	Anthracene (mg/kg)			<0.0040		
	Benz(a)anthracene (mg/kg)			<0.010		
	Benzo(a)pyrene (mg/kg)			<0.010		
	Benzo(b&j)fluoranthene (mg/kg)			<0.010		
	Benzo(b+j+k)fluoranthene (mg/kg)			<0.015		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-31	L1977406-32	L1977406-33	L1977406-34	L1977406-35
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	11:36	11:09	10:43	10:09	09:50
	Client ID	SC-4-3	SC-5-3	SN-5-3	SN-4-3	SN-3-3
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	1400	1300	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)	0.172	0.149	0.145	0.151	0.154
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	336	381	283	298	309
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	1.45	1.55	1.10	1.18	1.29
	Vanadium (V) (mg/kg)	32.1	27.4	32.7	35.5	32.7
	Zinc (Zn) (mg/kg)	27.2	23.5	23.6	24.5	23.9
	Zirconium (Zr) (mg/kg)	8.1	8.9	7.8	8.8	9.7
Volatile Organic Compounds	VOC Sample Container					
	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Methyl t-butyl ether (MTBE) (mg/kg)					
	Styrene (mg/kg)					
	Toluene (mg/kg)					
	ortho-Xylene (mg/kg)					
	meta- & para-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (SS) (%)					
	Surrogate: 1,4-Difluorobenzene (SS) (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)					
	F3 (C16-C34) (mg/kg)					
	F4 (C34-C50) (mg/kg)					
	Chrom. to baseline at nC50					
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)					
	Surrogate: 3,4-Dichlorotoluene (SS) (%)					
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)					
	Acenaphthylene (mg/kg)					
	Anthracene (mg/kg)					
	Benz(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(b+j+k)fluoranthene (mg/kg)					

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

	Sample ID	L1977406-36	L1977406-37	L1977406-38	L1977406-39	L1977406-40
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	09:30	09:11	16:10	16:10	16:10
	Client ID	SN-2-3	SN-1-3	SW-5-1	SW-5-2	SW-5-3
Grouping	**Analyte**					
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	1000	<1000	1200
	Thallium (Tl) (mg/kg)	0.113	0.097	0.090	0.080	0.116
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	250	238	251	250	317
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.886	0.850	0.654	0.748	0.930
	Vanadium (V) (mg/kg)	24.8	20.4	14.3	15.7	20.1
	Zinc (Zn) (mg/kg)	18.2	15.4	12.3	12.2	17.4
	Zirconium (Zr) (mg/kg)	6.9	7.3	5.7	6.0	7.2
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) (%)			96.4		
	Surrogate: 1,4-Difluorobenzene (SS) (%)			91.7		
Hydrocarbons	F1 (C6-C10) (mg/kg)			<10		
	F1-BTEX (mg/kg)			<10		
	F2 (C10-C16) (mg/kg)			<30		
	F3 (C16-C34) (mg/kg)			<50		
	F4 (C34-C50) (mg/kg)			<50		
	Chrom. to baseline at nC50			YES		
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)			83.2		
	Surrogate: 3,4-Dichlorotoluene (SS) (%)			106.3		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)			<0.0050		
	Acenaphthylene (mg/kg)			<0.0050		
	Anthracene (mg/kg)			<0.0040		
	Benz(a)anthracene (mg/kg)			<0.010		
	Benzo(a)pyrene (mg/kg)			<0.010		
	Benzo(b&j)fluoranthene (mg/kg)			<0.010		
	Benzo(b+j+k)fluoranthene (mg/kg)			<0.015		

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

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Grouping	Analyte	L1977406-41	L1977406-42	L1977406-43	L1977406-44	L1977406-45
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	15:22	15:22	15:22	14:30	14:30
	Client ID	SW-1-1	SW-1-2	SW-1-3	SW-3-2	SW-3-3
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	0.107	0.116
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	32.8	36.4	57.2	290	334
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.216	0.217	0.213	0.869	0.894
	Vanadium (V) (mg/kg)	3.08	3.34	3.79	20.6	23.4
	Zinc (Zn) (mg/kg)	2.2	2.4	3.4	15.8	17.8
	Zirconium (Zr) (mg/kg)	1.3	1.4	1.6	5.6	6.6
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) (%)	106.7				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	96.3				
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10				
	F1-BTEX (mg/kg)	<10				
	F2 (C10-C16) (mg/kg)	<30				
	F3 (C16-C34) (mg/kg)	<50				
	F4 (C34-C50) (mg/kg)	<50				
	Chrom. to baseline at nC50	YES				
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	80.3				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	109.4				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050				
	Acenaphthylene (mg/kg)	<0.0050				
	Anthracene (mg/kg)	<0.0040				
	Benz(a)anthracene (mg/kg)	<0.010				
	Benzo(a)pyrene (mg/kg)	<0.010				
	Benzo(b&j)fluoranthene (mg/kg)	<0.010				
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015				

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

Grouping	Analyte	L1977406-46	L1977406-47	L1977406-48	L1977406-49	L1977406-50
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	14:30	13:33	13:33	13:33	13:33
	Client ID	DUP F	SE-1-1	SE-1-2	SE-1-3	DUP E
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)	0.092	0.093	0.089	0.080	0.097
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	266	235	224	211	215
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.749	0.798	0.755	0.722	0.827
	Vanadium (V) (mg/kg)	20.6	19.1	18.9	17.1	18.3
	Zinc (Zn) (mg/kg)	14.4	14.7	14.0	13.9	13.4
	Zirconium (Zr) (mg/kg)	6.2	5.9	5.7	4.4	6.0
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) (%)	94.3	105.8			99.0
	Surrogate: 1,4-Difluorobenzene (SS) (%)	87.3	97.8			90.5
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10	<10			<10
	F1-BTEX (mg/kg)	<10	<10			<10
	F2 (C10-C16) (mg/kg)	<30	<30			<30
	F3 (C16-C34) (mg/kg)	<50	<50			<50
	F4 (C34-C50) (mg/kg)	<50	<50			<50
	Chrom. to baseline at nC50	YES	YES			YES
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	89.0	80.7			84.6
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	104.8	105.6			SMI Not Reportable
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050	<0.0050			<0.0050
	Acenaphthylene (mg/kg)	<0.0050	<0.0050			<0.0050
	Anthracene (mg/kg)	<0.0040	<0.0040			<0.0040
	Benz(a)anthracene (mg/kg)	<0.010	<0.010			<0.010
	Benzo(a)pyrene (mg/kg)	<0.010	<0.010			<0.010
	Benzo(b&j)fluoranthene (mg/kg)	<0.010	<0.010			<0.010
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015	<0.015			<0.015

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

Grouping	Analyte	L1977406-51	L1977406-52	L1977406-53	L1977406-54	L1977406-55
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	12:00	12:00	12:00	12:00	10:11
	Client ID	SE-2-1	SE-2-2	SE-2-3	DUP D	SE-3-1
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)	0.078	0.082	0.100	0.061	0.082
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	198	202	241	145	201
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.651	0.746	0.845	0.545	0.806
	Vanadium (V) (mg/kg)	15.8	19.1	21.1	13.2	17.3
	Zinc (Zn) (mg/kg)	11.4	13.2	14.7	9.3	12.3
	Zirconium (Zr) (mg/kg)	4.6	4.5	6.9	3.5	3.9
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) (%)	81.3			90.4	88.5
	Surrogate: 1,4-Difluorobenzene (SS) (%)	82.5			87.7	87.3
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10			<10	<10
	F1-BTEX (mg/kg)	<10			<10	<10
	F2 (C10-C16) (mg/kg)	<30			<30	<30
	F3 (C16-C34) (mg/kg)	<50			<50	<50
	F4 (C34-C50) (mg/kg)	<50			<50	<50
	Chrom. to baseline at nC50	YES			YES	YES
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	78.5			88.4	78.1
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	98.0			128.9	91.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050			<0.0050	<0.0050
	Acenaphthylene (mg/kg)	<0.0050			<0.0050	<0.0050
	Anthracene (mg/kg)	<0.0040			<0.0040	<0.0040
	Benz(a)anthracene (mg/kg)	<0.010			<0.010	<0.010
	Benzo(a)pyrene (mg/kg)	<0.010			<0.010	<0.010
	Benzo(b&j)fluoranthene (mg/kg)	<0.010			<0.010	<0.010
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015			<0.015	<0.015

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

APPENDIX C-1
SEDIMENT ANALYTICAL DATA

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-56	L1977406-57	L1977406-58	L1977406-59	L1977406-60
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	10:11	10:11	10:11	15:15	15:15
	Client ID	SE-3-2	SE-3-3	DUP C	SW-4-1	SW-4-2
SOIL						
Metals	Sulfur (S) (mg/kg)	<1000	<1000	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)	0.077	0.083	0.078	0.101	0.088
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	198	218	193	277	243
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.682	0.734	0.674	0.694	0.669
	Vanadium (V) (mg/kg)	17.4	17.5	17.7	20.3	17.0
	Zinc (Zn) (mg/kg)	12.6	12.9	12.0	13.9	12.1
	Zirconium (Zr) (mg/kg)	4.7	4.6	4.7	6.0	5.6
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) (%)			71.6	82.5	
	Surrogate: 1,4-Difluorobenzene (SS) (%)			70.7	87.5	
Hydrocarbons	F1 (C6-C10) (mg/kg)			<10	<10	
	F1-BTEX (mg/kg)			<10	<10	
	F2 (C10-C16) (mg/kg)			<30	<30	
	F3 (C16-C34) (mg/kg)			<50	<50	
	F4 (C34-C50) (mg/kg)			<50	<50	
	Chrom. to baseline at nC50			YES	YES	
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)			80.3	79.4	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)			71.6	66.9 SURR-ND	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)			<0.0050	<0.0050	
	Acenaphthylene (mg/kg)			<0.0050	<0.0050	
	Anthracene (mg/kg)			<0.0040	<0.0040	
	Benz(a)anthracene (mg/kg)			<0.010	<0.010	
	Benzo(a)pyrene (mg/kg)			<0.010	<0.010	
	Benzo(b&j)fluoranthene (mg/kg)			<0.010	<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)			<0.015	<0.015	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-61	L1977406-62	L1977406-63		
	Description	Sediment	Sediment	Sediment		
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17		
	Sampled Time	12:33	14:25	15:15		
	Client ID	DUP B	SW2-3	SW-4-3		
SOIL						
Metals	Sulfur (S) (mg/kg)	1400	<1000	<1000		
	Thallium (Tl) (mg/kg)	0.170	<0.050	0.126		
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
	Titanium (Ti) (mg/kg)	308	53.7	312		
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50		
	Uranium (U) (mg/kg)	1.59	0.293	0.961		
	Vanadium (V) (mg/kg)	33.1	4.40	23.8		
	Zinc (Zn) (mg/kg)	24.0	3.4	16.9		
	Zirconium (Zr) (mg/kg)	7.8	1.4	7.5		
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) (%)	81.0				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	80.5				
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10				
	F1-BTEX (mg/kg)	<10				
	F2 (C10-C16) (mg/kg)	<30				
	F3 (C16-C34) (mg/kg)	<50				
	F4 (C34-C50) (mg/kg)	<50				
	Chrom. to baseline at nC50	YES				
	Surrogate: 2-Bromobenzotrifluoride, F2-F4 (%)	76.9				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	89.6				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050				
	Acenaphthylene (mg/kg)	<0.0050				
	Anthracene (mg/kg)	<0.0040				
	Benz(a)anthracene (mg/kg)	<0.010				
	Benzo(a)pyrene (mg/kg)	<0.010				
	Benzo(b&j)fluoranthene (mg/kg)	<0.010				
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015				

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

APPENDIX C-1
SEDIMENT ANALYTICAL DATA

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-1	L1977406-2	L1977406-3	L1977406-4	L1977406-5
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	10-AUG-17	10-AUG-17	10-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	14:55	14:22	13:00	16:30	16:30
	Client ID	SW-3-1	SW-2-2	SW-2-1	SC-4-1	SC-4-2
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(k)fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Chrysene (mg/kg)	<0.010		<0.010	<0.010	
	Dibenz(a,h)anthracene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Fluorene (mg/kg)	<0.010		<0.010	<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010		<0.010	<0.010	
	2-Methylnaphthalene (mg/kg)	<0.010		<0.010	<0.010	
	Naphthalene (mg/kg)	<0.010		<0.010	<0.010	
	Phenanthrene (mg/kg)	<0.010		<0.010	<0.010	
	Pyrene (mg/kg)	<0.010		<0.010	<0.010	
	Surrogate: Acenaphthene d10 (%)	96.1		98.4	96.5	
	Surrogate: Chrysene d12 (%)	102.1		104.0	108.4	
	Surrogate: Naphthalene d8 (%)	94.9		100.7	93.7	
	Surrogate: Phenanthrene d10 (%)	98.6		106.0	107.8	
	B(a)P Total Potency Equivalent (mg/kg)	<0.020		<0.020	<0.020	
	IACR (CCME) (mg/kg)	<0.15		<0.15	<0.15	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-6	L1977406-7	L1977406-8	L1977406-9	L1977406-10
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	15:30	15:30	15:30	14:07	14:45
	Client ID	SC-5-1	SC-5-2	DUP-A	SW-5-1	SW-5-2
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(k)fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Chrysene (mg/kg)	<0.010		<0.010	<0.010	
	Dibenz(a,h)anthracene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Fluorene (mg/kg)	<0.010		<0.010	<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010		<0.010	<0.010	
	2-Methylnaphthalene (mg/kg)	<0.010		<0.010	<0.010	
	Naphthalene (mg/kg)	<0.010		<0.010	<0.010	
	Phenanthrene (mg/kg)	<0.010		<0.010	<0.010	
	Pyrene (mg/kg)	<0.010		<0.010	<0.010	
	Surrogate: Acenaphthene d10 (%)	93.9		81.5	83.9	
	Surrogate: Chrysene d12 (%)	97.4		80.1	94.8	
	Surrogate: Naphthalene d8 (%)	80.5		78.6	74.4	
	Surrogate: Phenanthrene d10 (%)	101.8		91.3	95.9	
	B(a)P Total Potency Equivalent (mg/kg)	<0.020		<0.020	<0.020	
	IACR (CCME) (mg/kg)	<0.15		<0.15	<0.15	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-11	L1977406-12	L1977406-13	L1977406-14	L1977406-15
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17	11-AUG-17
	Sampled Time	13:01	13:26	12:30	12:20	11:10
	Client ID	SN-4-1	SN-4-2	SN-3-2	SN-3-1	SN-2-2
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010			<0.010	
	Benzo(k)fluoranthene (mg/kg)	<0.010			<0.010	
	Chrysene (mg/kg)	<0.010			<0.010	
	Dibenz(a,h)anthracene (mg/kg)	<0.0050			<0.0050	
	Fluoranthene (mg/kg)	<0.010			<0.010	
	Fluorene (mg/kg)	<0.010			<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010			<0.010	
	2-Methylnaphthalene (mg/kg)	<0.010			<0.010	
	Naphthalene (mg/kg)	<0.010			<0.010	
	Phenanthrene (mg/kg)	<0.010			<0.010	
	Pyrene (mg/kg)	<0.010			<0.010	
	Surrogate: Acenaphthene d10 (%)	95.0			94.9	
	Surrogate: Chrysene d12 (%)	105.9			107.6	
	Surrogate: Naphthalene d8 (%)	83.6			86.0	
	Surrogate: Phenanthrene d10 (%)	99.8			96.3	
	B(a)P Total Potency Equivalent (mg/kg)	<0.020			<0.020	
	IACR (CCME) (mg/kg)	<0.15			<0.15	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1977406-16	L1977406-17	L1977406-18	L1977406-19	L1977406-20
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	11-AUG-17	11-AUG-17	11-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	10:47	10:28	10:14	16:00	16:00
	Client ID	SN-2-1	SN-1-2	SN-1-1	SE-5-1	SE-5-2
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010		<0.010	<0.010	
	Benzo(k)fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Chrysene (mg/kg)	<0.010		<0.010	<0.010	
	Dibenz(a,h)anthracene (mg/kg)	<0.0050		<0.0050	<0.0050	
	Fluoranthene (mg/kg)	<0.010		<0.010	<0.010	
	Fluorene (mg/kg)	<0.010		<0.010	<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010		<0.010	<0.010	
	2-Methylnaphthalene (mg/kg)	<0.010		<0.010	<0.010	
	Naphthalene (mg/kg)	<0.010		<0.010	<0.010	
	Phenanthrene (mg/kg)	<0.010		<0.010	<0.010	
	Pyrene (mg/kg)	<0.010		<0.010	<0.010	
	Surrogate: Acenaphthene d10 (%)	96.1		101.9	97.2	
	Surrogate: Chrysene d12 (%)	104.9		104.3	108.7	
	Surrogate: Naphthalene d8 (%)	95.3		89.2	95.8	
	Surrogate: Phenanthrene d10 (%)	105.5		108.2	107.4	
	B(a)P Total Potency Equivalent (mg/kg)	<0.020		<0.020	<0.020	
	IACR (CCME) (mg/kg)	<0.15		<0.15	<0.15	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-21	L1977406-22	L1977406-23	L1977406-24	L1977406-25
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	16:00	15:24	15:24	15:24	13:51
	Client ID	SE-5-3	SE-4-1	SE-4-2	SE-4-3	SC-2-1
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)		<0.010			<0.010
	Benzo(k)fluoranthene (mg/kg)		<0.010			<0.010
	Chrysene (mg/kg)		<0.010			<0.010
	Dibenz(a,h)anthracene (mg/kg)		<0.0050			<0.0050
	Fluoranthene (mg/kg)		<0.010			<0.010
	Fluorene (mg/kg)		<0.010			<0.010
	Indeno(1,2,3-c,d)pyrene (mg/kg)		<0.010			<0.010
	2-Methylnaphthalene (mg/kg)		<0.010			<0.010
	Naphthalene (mg/kg)		<0.010			<0.010
	Phenanthrene (mg/kg)		<0.010			<0.010
	Pyrene (mg/kg)		<0.010			<0.010
	Surrogate: Acenaphthene d10 (%)		100.3			82.2
	Surrogate: Chrysene d12 (%)		111.9			97.8
	Surrogate: Naphthalene d8 (%)		85.3			75.2
	Surrogate: Phenanthrene d10 (%)		110.2			93.0
	B(a)P Total Potency Equivalent (mg/kg)		<0.020			<0.020
	IACR (CCME) (mg/kg)		<0.15			<0.15

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L1977406-26 Sediment 12-AUG-17 13:51 SC-2-2	L1977406-27 Sediment 12-AUG-17 13:51 SC-2-3	L1977406-28 Sediment 12-AUG-17 12:33 SC-3-1	L1977406-29 Sediment 12-AUG-17 12:33 SC-3-2	L1977406-30 Sediment 12-AUG-17 12:33 SC-3-3
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)			<0.010		
	Benzo(k)fluoranthene (mg/kg)			<0.010		
	Chrysene (mg/kg)			<0.010		
	Dibenz(a,h)anthracene (mg/kg)			<0.0050		
	Fluoranthene (mg/kg)			<0.010		
	Fluorene (mg/kg)			<0.010		
	Indeno(1,2,3-c,d)pyrene (mg/kg)			<0.010		
	2-Methylnaphthalene (mg/kg)			<0.010		
	Naphthalene (mg/kg)			<0.010		
	Phenanthrene (mg/kg)			<0.010		
	Pyrene (mg/kg)			<0.010		
	Surrogate: Acenaphthene d10 (%)			98.7		
	Surrogate: Chrysene d12 (%)			107.6		
	Surrogate: Naphthalene d8 (%)			87.2		
	Surrogate: Phenanthrene d10 (%)			99.3		
	B(a)P Total Potency Equivalent (mg/kg)			<0.020		
	IACR (CCME) (mg/kg)			<0.15		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-31	L1977406-32	L1977406-33	L1977406-34	L1977406-35
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17	12-AUG-17
	Sampled Time	11:36	11:09	10:43	10:09	09:50
	Client ID	SC-4-3	SC-5-3	SN-5-3	SN-4-3	SN-3-3
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Chrysene (mg/kg)					
	Dibenz(a,h)anthracene (mg/kg)					
	Fluoranthene (mg/kg)					
	Fluorene (mg/kg)					
	Indeno(1,2,3-c,d)pyrene (mg/kg)					
	2-Methylnaphthalene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Surrogate: Acenaphthene d10 (%)					
	Surrogate: Chrysene d12 (%)					
	Surrogate: Naphthalene d8 (%)					
	Surrogate: Phenanthrene d10 (%)					
	B(a)P Total Potency Equivalent (mg/kg)					
	IACR (CCME) (mg/kg)					

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-36	L1977406-37	L1977406-38	L1977406-39	L1977406-40
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	12-AUG-17	12-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	09:30	09:11	16:10	16:10	16:10
	Client ID	SN-2-3	SN-1-3	SW-5-1	SW-5-2	SW-5-3
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)			<0.010		
	Benzo(k)fluoranthene (mg/kg)			<0.010		
	Chrysene (mg/kg)			<0.010		
	Dibenz(a,h)anthracene (mg/kg)			<0.0050		
	Fluoranthene (mg/kg)			<0.010		
	Fluorene (mg/kg)			<0.010		
	Indeno(1,2,3-c,d)pyrene (mg/kg)			<0.010		
	2-Methylnaphthalene (mg/kg)			<0.010		
	Naphthalene (mg/kg)			<0.010		
	Phenanthrene (mg/kg)			<0.010		
	Pyrene (mg/kg)			<0.010		
	Surrogate: Acenaphthene d10 (%)			79.4		
	Surrogate: Chrysene d12 (%)			93.7		
	Surrogate: Naphthalene d8 (%)			76.2		
	Surrogate: Phenanthrene d10 (%)			89.6		
	B(a)P Total Potency Equivalent (mg/kg)			<0.020		
	IACR (CCME) (mg/kg)			<0.15		

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

	Sample ID	L1977406-41	L1977406-42	L1977406-43	L1977406-44	L1977406-45
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	15:22	15:22	15:22	14:30	14:30
	Client ID	SW-1-1	SW-1-2	SW-1-3	SW-3-2	SW-3-3
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010				
	Benzo(k)fluoranthene (mg/kg)	<0.010				
	Chrysene (mg/kg)	<0.010				
	Dibenz(a,h)anthracene (mg/kg)	<0.0050				
	Fluoranthene (mg/kg)	<0.010				
	Fluorene (mg/kg)	<0.010				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010				
	2-Methylnaphthalene (mg/kg)	<0.010				
	Naphthalene (mg/kg)	<0.010				
	Phenanthrene (mg/kg)	<0.010				
	Pyrene (mg/kg)	<0.010				
	Surrogate: Acenaphthene d10 (%)	79.7				
	Surrogate: Chrysene d12 (%)	94.4				
	Surrogate: Naphthalene d8 (%)	75.9				
	Surrogate: Phenanthrene d10 (%)	83.1				
	B(a)P Total Potency Equivalent (mg/kg)	<0.020				
	IACR (CCME) (mg/kg)	<0.15				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1977406-46 Sediment 13-AUG-17 14:30 DUP F	L1977406-47 Sediment 13-AUG-17 13:33 SE-1-1	L1977406-48 Sediment 13-AUG-17 13:33 SE-1-2	L1977406-49 Sediment 13-AUG-17 13:33 SE-1-3	L1977406-50 Sediment 13-AUG-17 13:33 DUP E
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010	<0.010			<0.010
	Benzo(k)fluoranthene (mg/kg)	<0.010	<0.010			<0.010
	Chrysene (mg/kg)	<0.010	<0.010			<0.010
	Dibenz(a,h)anthracene (mg/kg)	<0.0050	<0.0050			<0.0050
	Fluoranthene (mg/kg)	<0.010	<0.010			<0.010
	Fluorene (mg/kg)	<0.010	<0.010			<0.010
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010	<0.010			<0.010
	2-Methylnaphthalene (mg/kg)	<0.010	<0.010			<0.010
	Naphthalene (mg/kg)	<0.010	<0.010			<0.010
	Phenanthrene (mg/kg)	<0.010	<0.010			<0.010
	Pyrene (mg/kg)	<0.010	<0.010			<0.010
	Surrogate: Acenaphthene d10 (%)	78.2	75.3			101.2
	Surrogate: Chrysene d12 (%)	91.5	82.4			111.2
	Surrogate: Naphthalene d8 (%)	74.2	68.7			91.6
	Surrogate: Phenanthrene d10 (%)	89.4	80.4			106.5
	B(a)P Total Potency Equivalent (mg/kg)	<0.020	<0.020			<0.020
	IACR (CCME) (mg/kg)	<0.15	<0.15			<0.15

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1977406-51	L1977406-52	L1977406-53	L1977406-54	L1977406-55
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	12:00	12:00	12:00	12:00	10:11
	Client ID	SE-2-1	SE-2-2	SE-2-3	DUP D	SE-3-1
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010			<0.010	<0.010
	Benzo(k)fluoranthene (mg/kg)	<0.010			<0.010	<0.010
	Chrysene (mg/kg)	<0.010			<0.010	<0.010
	Dibenz(a,h)anthracene (mg/kg)	<0.0050			<0.0050	<0.0050
	Fluoranthene (mg/kg)	<0.010			<0.010	<0.010
	Fluorene (mg/kg)	<0.010			<0.010	<0.010
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010			<0.010	<0.010
	2-Methylnaphthalene (mg/kg)	<0.010			<0.010	<0.010
	Naphthalene (mg/kg)	<0.010			<0.010	<0.010
	Phenanthrene (mg/kg)	<0.010			<0.010	<0.010
	Pyrene (mg/kg)	<0.010			<0.010	<0.010
	Surrogate: Acenaphthene d10 (%)	76.8			80.7	82.9
	Surrogate: Chrysene d12 (%)	91.3			95.2	92.7
	Surrogate: Naphthalene d8 (%)	71.7			76.1	78.3
	Surrogate: Phenanthrene d10 (%)	85.2			89.4	91.9
	B(a)P Total Potency Equivalent (mg/kg)	<0.020			<0.020	<0.020
	IACR (CCME) (mg/kg)	<0.15			<0.15	<0.15

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

	Sample ID	L1977406-56	L1977406-57	L1977406-58	L1977406-59	L1977406-60
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17	13-AUG-17
	Sampled Time	10:11	10:11	10:11	15:15	15:15
	Client ID	SE-3-2	SE-3-3	DUP C	SW-4-1	SW-4-2
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)			<0.010	<0.010	
	Benzo(k)fluoranthene (mg/kg)			<0.010	<0.010	
	Chrysene (mg/kg)			<0.010	<0.010	
	Dibenz(a,h)anthracene (mg/kg)			<0.0050	<0.0050	
	Fluoranthene (mg/kg)			<0.010	<0.010	
	Fluorene (mg/kg)			<0.010	<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)			<0.010	<0.010	
	2-Methylnaphthalene (mg/kg)			<0.010	<0.010	
	Naphthalene (mg/kg)			<0.010	<0.010	
	Phenanthrene (mg/kg)			<0.010	<0.010	
	Pyrene (mg/kg)			<0.010	<0.010	
	Surrogate: Acenaphthene d10 (%)			79.4	77.4	
	Surrogate: Chrysene d12 (%)			98.7	86.8	
	Surrogate: Naphthalene d8 (%)			80.3	74.7	
	Surrogate: Phenanthrene d10 (%)			90.6	88.9	
	B(a)P Total Potency Equivalent (mg/kg)			<0.020	<0.020	
	IACR (CCME) (mg/kg)			<0.15	<0.15	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L1977406-61 Sediment 13-AUG-17 12:33 DUP B	L1977406-62 Sediment 13-AUG-17 14:25 SW2-3	L1977406-63 Sediment 13-AUG-17 15:15 SW-4-3		
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(g,h,i)perylene (mg/kg)	<0.010				
	Benzo(k)fluoranthene (mg/kg)	<0.010				
	Chrysene (mg/kg)	<0.010				
	Dibenz(a,h)anthracene (mg/kg)	<0.0050				
	Fluoranthene (mg/kg)	<0.010				
	Fluorene (mg/kg)	<0.010				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010				
	2-Methylnaphthalene (mg/kg)	<0.010				
	Naphthalene (mg/kg)	<0.010				
	Phenanthrene (mg/kg)	<0.010				
	Pyrene (mg/kg)	<0.010				
	Surrogate: Acenaphthene d10 (%)	74.6				
	Surrogate: Chrysene d12 (%)	89.0				
	Surrogate: Naphthalene d8 (%)	72.0				
	Surrogate: Phenanthrene d10 (%)	84.2				
	B(a)P Total Potency Equivalent (mg/kg)	<0.020				
	IACR (CCME) (mg/kg)	<0.15				

* 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	Strontium (Sr)	DUP-H	L1977406-1, -10, -11, -12, -13, -14, -15, -16, -17, -2, -20, -21, -22, -3, -4, -5, -6, -7, -8, -9
Duplicate	Strontium (Sr)	DUP-H	L1977406-50, -51, -52, -53, -54, -55, -56, -57, -58, -59, -60, -61, -62, -63

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
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**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

F1-BTX-CALC-VA	Soil	F1-Total BTX	CCME CWS PHC TIER 1 (2001)

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." For F1 (C6-C10) and F1-BTEX, a subsample of the sediment/soil is extracted with methanol and analysed by purge & trap GC/FID. The F1-BTEX result is then calculated as follows:

F1-BTEX: F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).

F1-HSFID-VA	Soil	CCME F1 by headspace GCMS	CCME CWS PHC (Pub# 1310)

The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. The F1 fraction concentration is measured using flame ionization detection.

F2F4-TUMB-H/A-FID-VA	Soil	CWS F2-F4 Hydrocarbons by Tumbler GCFID	CCME PETROLEUM HYDROCARBONS

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." For C10 to C50 hydrocarbons (F2, F3, F4) and gravimetric heavy hydrocarbons (F4G-sg), a subsample of the sediment/soil is extracted with 1:1 hexane:acetone using a rotary extractor. The extract undergoes a silica-gel clean-up to remove polar compounds. F2, F3 & F4 are analyzed by on-column GC/FID, and F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where F4 (C34-C50) and F4G-sg results are reported for a sample, the larger of the reported values is used for comparison against the relevant CCME standard for F4.
7. The gravimetric heavy hydrocarbon results (F4G-sg), cannot be added to the C6 to C50 hydrocarbon results.
8. This method is validated for use.
9. Data from analysis of quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram.

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.

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
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

Reference Information

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.

PSA-PIPET+GRAVEL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

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
XYLENES-CALC-VA	Soil	Sum of Xylene Isomer Concentrations	EPA 8260B & 524.2

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1977406   Report Date: 29-AUG-17

Client: GOLDER ASSOCIATES LTD.
3795 Carey Road, Second Floor
Victoria BC V8Z 6T8
Contact: John Sherrin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TIC-PCT-SK	**Soil**							
Batch R3812315								
WG2599082-2 LCS								
Inorganic Carbon			91.5		%		80-120	26-AUG-17
WG2599082-3 MB								
Inorganic Carbon			<0.050		%		0.05	26-AUG-17
Batch R3813078								
WG2597950-4 DUP		**L1977406-8**						
Inorganic Carbon		1.79	1.79		%	0.3	20	28-AUG-17
WG2597950-5 LCS								
Inorganic Carbon			95.0		%		80-120	28-AUG-17
WG2597950-6 MB								
Inorganic Carbon			<0.050		%		0.05	28-AUG-17
Batch R3813223								
WG2598326-1 DUP		**L1977406-29**						
Inorganic Carbon		2.18	2.25		%	3.0	20	28-AUG-17
WG2598326-2 LCS								
Inorganic Carbon			96.2		%		80-120	28-AUG-17
WG2598326-3 MB								
Inorganic Carbon			<0.050		%		0.05	28-AUG-17
Batch R3813314								
WG2598328-1 DUP		**L1977406-47**						
Inorganic Carbon		2.00	2.03		%	1.8	20	28-AUG-17
WG2598328-2 LCS								
Inorganic Carbon			102.0		%		80-120	28-AUG-17
WG2598328-3 MB								
Inorganic Carbon			<0.050		%		0.05	28-AUG-17
C-TOT-LECO-SK	**Soil**							
Batch R3812416								
WG2598021-1 DUP		**L1977406-10**						
Total Carbon by Combustion		5.03	5.00		%	0.6	20	25-AUG-17
WG2598021-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			102.7		%		80-120	25-AUG-17
WG2598021-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	25-AUG-17
Batch R3812417								
WG2598027-1 DUP		**L1977406-30**						
Total Carbon by Combustion		5.78	5.91		%	2.3	20	25-AUG-17
WG2598027-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			99.2		%		80-120	25-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TOT-LECO-SK	**Soil**							
Batch R3812417								
WG2598027-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	25-AUG-17
Batch R3812420								
WG2598031-1 DUP		**L1977406-50**						
Total Carbon by Combustion		3.95	3.92		%	1.0	20	25-AUG-17
WG2598031-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			103.6		%		80-120	25-AUG-17
WG2598031-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	25-AUG-17
Batch R3812472								
WG2596487-3 IRM		**08-109_SOIL**						
Total Carbon by Combustion			100.2		%		80-120	25-AUG-17
WG2596487-4 MB								
Total Carbon by Combustion			<0.05		%		0.05	25-AUG-17
F1-HSFID-VA	**Soil**							
Batch R3800793								
WG2599060-3 DUP		**L1977406-47**						
F1 (C6-C10)		<10	<10	RPD-NA	mg/kg	N/A	40	23-AUG-17
WG2599060-2 LCS								
F1 (C6-C10)			108.3		%		70-130	23-AUG-17
WG2599060-1 MB								
F1 (C6-C10)			<10		mg/kg		10	23-AUG-17
Batch R3810563								
WG2600550-2 LCS								
F1 (C6-C10)			106.6		%		70-130	24-AUG-17
WG2600550-1 MB								
F1 (C6-C10)			<10		mg/kg		10	24-AUG-17
F2F4-TUMB-H/A-FID-VA	**Soil**							
Batch R3812791								
WG2598728-4 DUP		**L1977406-1**						
F2 (C10-C16)		<30	<30	RPD-NA	mg/kg	N/A	40	28-AUG-17
F3 (C16-C34)		<50	<50	RPD-NA	mg/kg	N/A	40	28-AUG-17
F4 (C34-C50)		<50	<50	RPD-NA	mg/kg	N/A	40	28-AUG-17
WG2598814-4 DUP		**L1977406-25**						
F2 (C10-C16)		<30	<30	RPD-NA	mg/kg	N/A	40	28-AUG-17
F3 (C16-C34)		<50	<50	RPD-NA	mg/kg	N/A	40	28-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2F4-TUMB-H/A-FID-VA	**Soil**							
Batch **R3812791**								
WG2598814-4 **DUP**		**L1977406-25**						
F4 (C34-C50)		<50	<50	RPD-NA	mg/kg	N/A	40	28-AUG-17
WG2598728-3 **IRM**		**ALS PHC2 RM**						
F2 (C10-C16)			120.7		%		70-130	28-AUG-17
F3 (C16-C34)			125.2		%		70-130	28-AUG-17
F4 (C34-C50)			129.0		%		70-130	28-AUG-17
WG2598814-3 **IRM**		**ALS PHC2 RM**						
F2 (C10-C16)			106.2		%		70-130	28-AUG-17
F3 (C16-C34)			107.8		%		70-130	28-AUG-17
F4 (C34-C50)			109.2		%		70-130	28-AUG-17
WG2598728-2 **LCS**								
F2 (C10-C16)			116.2		%		70-130	28-AUG-17
F3 (C16-C34)			111.9		%		70-130	28-AUG-17
F4 (C34-C50)			114.6		%		70-130	28-AUG-17
WG2598814-2 **LCS**								
F2 (C10-C16)			104.7		%		70-130	28-AUG-17
F3 (C16-C34)			98.7		%		70-130	28-AUG-17
F4 (C34-C50)			100.3		%		70-130	28-AUG-17
WG2598728-1 **MB**								
F2 (C10-C16)			<30		mg/kg		30	28-AUG-17
F3 (C16-C34)			<50		mg/kg		50	28-AUG-17
F4 (C34-C50)			<50		mg/kg		50	28-AUG-17
Surrogate: 2-Bromobenzotrifluoride, F2-F4			98.7		%		50-150	28-AUG-17
WG2598814-1 **MB**								
F2 (C10-C16)			<30		mg/kg		30	28-AUG-17
F3 (C16-C34)			<50		mg/kg		50	28-AUG-17
F4 (C34-C50)			<50		mg/kg		50	28-AUG-17
Surrogate: 2-Bromobenzotrifluoride, F2-F4			88.9		%		50-150	28-AUG-17
HG-200.2-CVAF-VA	**Soil**							
Batch **R3807837**								
WG2597686-4 **CRM**		**VA-CANMET-TILL1**						
Mercury (Hg)			99.8		%		70-130	23-AUG-17
WG2597686-3 **LCS**								
Mercury (Hg)			103.1		%		70-130	23-AUG-17
WG2597686-1 **MB**								
Mercury (Hg)			<0.0050		mg/kg		0.005	23-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAF-VA	**Soil**							
Batch R3809045								
WG2598774-4 CRM		**VA-CANMET-TILL1**						
Mercury (Hg)			91.2		%		70-130	24-AUG-17
WG2598774-2 DUP		**L1977406-48**						
Mercury (Hg)		0.0092	0.0097		mg/kg	4.6	40	24-AUG-17
WG2598774-3 LCS								
Mercury (Hg)			100.5		%		70-130	24-AUG-17
WG2598774-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	24-AUG-17
Batch R3810278								
WG2598697-4 CRM		**VA-CANMET-TILL1**						
Mercury (Hg)			91.5		%		70-130	25-AUG-17
WG2598697-2 DUP		**L1977406-6**						
Mercury (Hg)		0.0130	0.0131		mg/kg	0.6	40	25-AUG-17
WG2598697-3 LCS								
Mercury (Hg)			98.6		%		70-130	25-AUG-17
WG2598697-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	25-AUG-17
Batch R3812180								
WG2598742-4 CRM		**VA-CANMET-TILL1**						
Mercury (Hg)			103.7		%		70-130	25-AUG-17
WG2598796-4 CRM		**VA-CANMET-TILL1**						
Mercury (Hg)			100.5		%		70-130	25-AUG-17
WG2598742-2 DUP		**L1977406-18**						
Mercury (Hg)		0.0121	0.0122		mg/kg	1.1	40	25-AUG-17
WG2598796-2 DUP		**L1977406-57**						
Mercury (Hg)		0.0087	0.0111		mg/kg	24	40	25-AUG-17
WG2598742-3 LCS								
Mercury (Hg)			112.5		%		70-130	25-AUG-17
WG2598796-3 LCS								
Mercury (Hg)			109.8		%		70-130	25-AUG-17
WG2598742-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	25-AUG-17
WG2598796-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	25-AUG-17
MET-200.2-CCMS-VA	**Soil**							

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3807844								
WG2597686-4 CRM		**VA-CANMET-TILL1**						
Aluminum (Al)			107.6		%		70-130	22-AUG-17
Antimony (Sb)			105.9		%		70-130	22-AUG-17
Arsenic (As)			104.8		%		70-130	22-AUG-17
Barium (Ba)			102.2		%		70-130	22-AUG-17
Beryllium (Be)			0.58		mg/kg		0.34-0.74	22-AUG-17
Bismuth (Bi)			103.0		%		70-130	22-AUG-17
Boron (B)			3.4		mg/kg		0-8.2	22-AUG-17
Cadmium (Cd)			102.1		%		70-130	22-AUG-17
Calcium (Ca)			119.5		%		70-130	22-AUG-17
Chromium (Cr)			107.3		%		70-130	22-AUG-17
Cobalt (Co)			106.3		%		70-130	22-AUG-17
Copper (Cu)			105.9		%		70-130	22-AUG-17
Iron (Fe)			109.8		%		70-130	22-AUG-17
Lead (Pb)			105.2		%		70-130	22-AUG-17
Lithium (Li)			116.9		%		70-130	22-AUG-17
Magnesium (Mg)			110.9		%		70-130	22-AUG-17
Manganese (Mn)			106.5		%		70-130	22-AUG-17
Nickel (Ni)			107.3		%		70-130	22-AUG-17
Potassium (K)			115.5		%		70-130	22-AUG-17
Selenium (Se)			0.35		mg/kg		0.11-0.51	22-AUG-17
Silver (Ag)			0.23		mg/kg		0.13-0.33	22-AUG-17
Sodium (Na)			118.4		%		70-130	22-AUG-17
Strontium (Sr)			112.5		%		70-130	22-AUG-17
Thallium (Tl)			0.134		mg/kg		0.077-0.18	22-AUG-17
Tin (Sn)			1.1		mg/kg		0-3	22-AUG-17
Titanium (Ti)			120.0		%		70-130	22-AUG-17
Tungsten (W)			0.19		mg/kg		0-0.66	22-AUG-17
Uranium (U)			115.5		%		70-130	22-AUG-17
Vanadium (V)			111.5		%		70-130	22-AUG-17
Zinc (Zn)			107.8		%		70-130	22-AUG-17
Zirconium (Zr)			1.0		mg/kg		0-1.8	22-AUG-17
WG2597686-3 LCS								
Aluminum (Al)			97.8		%		80-120	22-AUG-17
Antimony (Sb)			107.8		%		80-120	22-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3807844								
WG2597686-3 LCS								
Arsenic (As)			102.5		%		80-120	22-AUG-17
Barium (Ba)			100.1		%		80-120	22-AUG-17
Beryllium (Be)			101.7		%		80-120	22-AUG-17
Bismuth (Bi)			102.1		%		80-120	22-AUG-17
Boron (B)			96.6		%		80-120	22-AUG-17
Cadmium (Cd)			100.9		%		80-120	22-AUG-17
Calcium (Ca)			101.8		%		80-120	22-AUG-17
Chromium (Cr)			101.4		%		80-120	22-AUG-17
Cobalt (Co)			99.8		%		80-120	22-AUG-17
Copper (Cu)			100.6		%		80-120	22-AUG-17
Iron (Fe)			99.8		%		80-120	22-AUG-17
Lead (Pb)			101.3		%		80-120	22-AUG-17
Lithium (Li)			101.1		%		80-120	22-AUG-17
Magnesium (Mg)			103.4		%		80-120	22-AUG-17
Manganese (Mn)			100.5		%		80-120	22-AUG-17
Molybdenum (Mo)			97.8		%		80-120	22-AUG-17
Nickel (Ni)			100.1		%		80-120	22-AUG-17
Phosphorus (P)			104.3		%		80-120	22-AUG-17
Potassium (K)			101.7		%		80-120	22-AUG-17
Selenium (Se)			105.6		%		80-120	22-AUG-17
Silver (Ag)			97.7		%		80-120	22-AUG-17
Sodium (Na)			103.1		%		80-120	22-AUG-17
Strontium (Sr)			100.4		%		80-120	22-AUG-17
Sulfur (S)			100.3		%		80-120	22-AUG-17
Thallium (Tl)			102.4		%		80-120	22-AUG-17
Tin (Sn)			102.6		%		80-120	22-AUG-17
Titanium (Ti)			90.8		%		80-120	22-AUG-17
Tungsten (W)			100.8		%		80-120	22-AUG-17
Uranium (U)			101.5		%		80-120	22-AUG-17
Vanadium (V)			103.3		%		80-120	22-AUG-17
Zinc (Zn)			95.8		%		80-120	22-AUG-17
Zirconium (Zr)			99.8		%		70-130	22-AUG-17
WG2597686-1 MB								
Aluminum (Al)			<50		mg/kg		50	22-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3807844								
WG2597686-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	22-AUG-17
Arsenic (As)			<0.10		mg/kg		0.1	22-AUG-17
Barium (Ba)			<0.50		mg/kg		0.5	22-AUG-17
Beryllium (Be)			<0.10		mg/kg		0.1	22-AUG-17
Bismuth (Bi)			<0.20		mg/kg		0.2	22-AUG-17
Boron (B)			<5.0		mg/kg		5	22-AUG-17
Cadmium (Cd)			<0.020		mg/kg		0.02	22-AUG-17
Calcium (Ca)			<50		mg/kg		50	22-AUG-17
Chromium (Cr)			<0.50		mg/kg		0.5	22-AUG-17
Cobalt (Co)			<0.10		mg/kg		0.1	22-AUG-17
Copper (Cu)			<0.50		mg/kg		0.5	22-AUG-17
Iron (Fe)			<50		mg/kg		50	22-AUG-17
Lead (Pb)			<0.50		mg/kg		0.5	22-AUG-17
Lithium (Li)			<2.0		mg/kg		2	22-AUG-17
Magnesium (Mg)			<20		mg/kg		20	22-AUG-17
Manganese (Mn)			<1.0		mg/kg		1	22-AUG-17
Molybdenum (Mo)			<0.10		mg/kg		0.1	22-AUG-17
Nickel (Ni)			<0.50		mg/kg		0.5	22-AUG-17
Phosphorus (P)			<50		mg/kg		50	22-AUG-17
Potassium (K)			<100		mg/kg		100	22-AUG-17
Selenium (Se)			<0.20		mg/kg		0.2	22-AUG-17
Silver (Ag)			<0.10		mg/kg		0.1	22-AUG-17
Sodium (Na)			<50		mg/kg		50	22-AUG-17
Strontium (Sr)			<0.50		mg/kg		0.5	22-AUG-17
Sulfur (S)			<1000		mg/kg		1000	22-AUG-17
Thallium (Tl)			<0.050		mg/kg		0.05	22-AUG-17
Tin (Sn)			<2.0		mg/kg		2	22-AUG-17
Titanium (Ti)			<1.0		mg/kg		1	22-AUG-17
Tungsten (W)			<0.50		mg/kg		0.5	22-AUG-17
Uranium (U)			<0.050		mg/kg		0.05	22-AUG-17
Vanadium (V)			<0.20		mg/kg		0.2	22-AUG-17
Zinc (Zn)			<2.0		mg/kg		2	22-AUG-17
Zirconium (Zr)			<1.0		mg/kg		1	22-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3809178								
WG2598774-4 CRM		**VA-CANMET-TILL1**						
Aluminum (Al)			96.4		%		70-130	24-AUG-17
Antimony (Sb)			110.1		%		70-130	24-AUG-17
Arsenic (As)			99.0		%		70-130	24-AUG-17
Barium (Ba)			93.8		%		70-130	24-AUG-17
Beryllium (Be)			0.54		mg/kg		0.34-0.74	24-AUG-17
Bismuth (Bi)			96.9		%		70-130	24-AUG-17
Boron (B)			3.0		mg/kg		0-8.2	24-AUG-17
Cadmium (Cd)			98.4		%		70-130	24-AUG-17
Calcium (Ca)			102.2		%		70-130	24-AUG-17
Chromium (Cr)			103.6		%		70-130	24-AUG-17
Cobalt (Co)			100.3		%		70-130	24-AUG-17
Copper (Cu)			102.7		%		70-130	24-AUG-17
Iron (Fe)			101.7		%		70-130	24-AUG-17
Lead (Pb)			97.6		%		70-130	24-AUG-17
Lithium (Li)			106.5		%		70-130	24-AUG-17
Magnesium (Mg)			98.5		%		70-130	24-AUG-17
Manganese (Mn)			96.4		%		70-130	24-AUG-17
Nickel (Ni)			102.6		%		70-130	24-AUG-17
Potassium (K)			101.4		%		70-130	24-AUG-17
Selenium (Se)			0.30		mg/kg		0.11-0.51	24-AUG-17
Silver (Ag)			0.25		mg/kg		0.13-0.33	24-AUG-17
Sodium (Na)			102.7		%		70-130	24-AUG-17
Strontium (Sr)			102.7		%		70-130	24-AUG-17
Thallium (Tl)			0.120		mg/kg		0.077-0.18	24-AUG-17
Tin (Sn)			1.1		mg/kg		0-3	24-AUG-17
Titanium (Ti)			105.5		%		70-130	24-AUG-17
Tungsten (W)			0.16		mg/kg		0-0.66	24-AUG-17
Uranium (U)			101.6		%		70-130	24-AUG-17
Vanadium (V)			99.7		%		70-130	24-AUG-17
Zinc (Zn)			104.7		%		70-130	24-AUG-17
Zirconium (Zr)			0.7		mg/kg		0-1.8	24-AUG-17
WG2598774-3 LCS								
Aluminum (Al)			98.3		%		80-120	24-AUG-17
Antimony (Sb)			105.2		%		80-120	24-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3809178								
WG2598774-3 LCS								
Arsenic (As)			100.9		%		80-120	24-AUG-17
Barium (Ba)			99.1		%		80-120	24-AUG-17
Beryllium (Be)			99.2		%		80-120	24-AUG-17
Bismuth (Bi)			96.7		%		80-120	24-AUG-17
Boron (B)			97.2		%		80-120	24-AUG-17
Cadmium (Cd)			101.2		%		80-120	24-AUG-17
Calcium (Ca)			97.4		%		80-120	24-AUG-17
Chromium (Cr)			102.0		%		80-120	24-AUG-17
Cobalt (Co)			99.7		%		80-120	24-AUG-17
Copper (Cu)			100.0		%		80-120	24-AUG-17
Iron (Fe)			97.3		%		80-120	24-AUG-17
Lead (Pb)			96.1		%		80-120	24-AUG-17
Lithium (Li)			96.9		%		80-120	24-AUG-17
Magnesium (Mg)			98.4		%		80-120	24-AUG-17
Manganese (Mn)			100.1		%		80-120	24-AUG-17
Molybdenum (Mo)			97.6		%		80-120	24-AUG-17
Nickel (Ni)			99.9		%		80-120	24-AUG-17
Phosphorus (P)			106.6		%		80-120	24-AUG-17
Potassium (K)			100.5		%		80-120	24-AUG-17
Selenium (Se)			101.9		%		80-120	24-AUG-17
Silver (Ag)			101.9		%		80-120	24-AUG-17
Sodium (Na)			101.9		%		80-120	24-AUG-17
Strontium (Sr)			98.8		%		80-120	24-AUG-17
Sulfur (S)			98.8		%		80-120	24-AUG-17
Thallium (Tl)			95.6		%		80-120	24-AUG-17
Tin (Sn)			101.9		%		80-120	24-AUG-17
Titanium (Ti)			94.2		%		80-120	24-AUG-17
Tungsten (W)			98.2		%		80-120	24-AUG-17
Uranium (U)			98.1		%		80-120	24-AUG-17
Vanadium (V)			100.7		%		80-120	24-AUG-17
Zinc (Zn)			97.6		%		80-120	24-AUG-17
Zirconium (Zr)			99.0		%		70-130	24-AUG-17
WG2598774-1 MB								
Aluminum (Al)			<50		mg/kg		50	24-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3809178								
WG2598774-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	24-AUG-17
Arsenic (As)			<0.10		mg/kg		0.1	24-AUG-17
Barium (Ba)			<0.50		mg/kg		0.5	24-AUG-17
Beryllium (Be)			<0.10		mg/kg		0.1	24-AUG-17
Bismuth (Bi)			<0.20		mg/kg		0.2	24-AUG-17
Boron (B)			<5.0		mg/kg		5	24-AUG-17
Cadmium (Cd)			<0.020		mg/kg		0.02	24-AUG-17
Calcium (Ca)			<50		mg/kg		50	24-AUG-17
Chromium (Cr)			<0.50		mg/kg		0.5	24-AUG-17
Cobalt (Co)			<0.10		mg/kg		0.1	24-AUG-17
Copper (Cu)			<0.50		mg/kg		0.5	24-AUG-17
Iron (Fe)			<50		mg/kg		50	24-AUG-17
Lead (Pb)			<0.50		mg/kg		0.5	24-AUG-17
Lithium (Li)			<2.0		mg/kg		2	24-AUG-17
Magnesium (Mg)			<20		mg/kg		20	24-AUG-17
Manganese (Mn)			<1.0		mg/kg		1	24-AUG-17
Molybdenum (Mo)			<0.10		mg/kg		0.1	24-AUG-17
Nickel (Ni)			<0.50		mg/kg		0.5	24-AUG-17
Phosphorus (P)			<50		mg/kg		50	24-AUG-17
Potassium (K)			<100		mg/kg		100	24-AUG-17
Selenium (Se)			<0.20		mg/kg		0.2	24-AUG-17
Silver (Ag)			<0.10		mg/kg		0.1	24-AUG-17
Sodium (Na)			<50		mg/kg		50	24-AUG-17
Strontium (Sr)			<0.50		mg/kg		0.5	24-AUG-17
Sulfur (S)			<1000		mg/kg		1000	24-AUG-17
Thallium (Tl)			<0.050		mg/kg		0.05	24-AUG-17
Tin (Sn)			<2.0		mg/kg		2	24-AUG-17
Titanium (Ti)			<1.0		mg/kg		1	24-AUG-17
Tungsten (W)			<0.50		mg/kg		0.5	24-AUG-17
Uranium (U)			<0.050		mg/kg		0.05	24-AUG-17
Vanadium (V)			<0.20		mg/kg		0.2	24-AUG-17
Zinc (Zn)			<2.0		mg/kg		2	24-AUG-17
Zirconium (Zr)			<1.0		mg/kg		1	24-AUG-17

ALS Environmental

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3811687								
WG2598697-4 CRM		**VA-CANMET-TILL1**						
Aluminum (Al)			93.7		%		70-130	24-AUG-17
Antimony (Sb)			105.9		%		70-130	24-AUG-17
Arsenic (As)			101.2		%		70-130	24-AUG-17
Barium (Ba)			94.3		%		70-130	24-AUG-17
Beryllium (Be)			0.53		mg/kg		0.34-0.74	24-AUG-17
Bismuth (Bi)			103.0		%		70-130	24-AUG-17
Boron (B)			2.5		mg/kg		0-8.2	24-AUG-17
Cadmium (Cd)			99.0		%		70-130	24-AUG-17
Calcium (Ca)			99.3		%		70-130	24-AUG-17
Chromium (Cr)			100.9		%		70-130	24-AUG-17
Cobalt (Co)			101.7		%		70-130	24-AUG-17
Copper (Cu)			101.8		%		70-130	24-AUG-17
Iron (Fe)			101.4		%		70-130	24-AUG-17
Lead (Pb)			101.1		%		70-130	24-AUG-17
Lithium (Li)			103.9		%		70-130	24-AUG-17
Magnesium (Mg)			97.5		%		70-130	24-AUG-17
Manganese (Mn)			96.0		%		70-130	24-AUG-17
Nickel (Ni)			100.7		%		70-130	24-AUG-17
Potassium (K)			102.1		%		70-130	24-AUG-17
Selenium (Se)			0.31		mg/kg		0.11-0.51	24-AUG-17
Silver (Ag)			0.24		mg/kg		0.13-0.33	24-AUG-17
Sodium (Na)			101.2		%		70-130	24-AUG-17
Strontium (Sr)			96.6		%		70-130	24-AUG-17
Thallium (Tl)			0.128		mg/kg		0.077-0.18	24-AUG-17
Tin (Sn)			1.0		mg/kg		0-3	24-AUG-17
Titanium (Ti)			98.5		%		70-130	24-AUG-17
Tungsten (W)			0.17		mg/kg		0-0.66	24-AUG-17
Uranium (U)			105.1		%		70-130	24-AUG-17
Vanadium (V)			98.0		%		70-130	24-AUG-17
Zinc (Zn)			100.2		%		70-130	24-AUG-17
Zirconium (Zr)			0.9		mg/kg		0-1.8	24-AUG-17
WG2598697-2 DUP		**L1977406-6**						
Aluminum (Al)		6520	6380		mg/kg	2.2	40	24-AUG-17
Antimony (Sb)		0.13	0.13		mg/kg	0.7	30	24-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3811687								
WG2598697-2 DUP		**L1977406-6**						
Arsenic (As)		2.42	2.36		mg/kg	2.5	30	24-AUG-17
Barium (Ba)		17.4	16.7		mg/kg	4.1	40	24-AUG-17
Beryllium (Be)		0.45	0.44		mg/kg	3.2	30	24-AUG-17
Bismuth (Bi)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	24-AUG-17
Boron (B)		41.7	40.4		mg/kg	3.3	30	24-AUG-17
Cadmium (Cd)		0.071	0.056		mg/kg	23	30	24-AUG-17
Calcium (Ca)		57500	61400		mg/kg	6.5	30	24-AUG-17
Chromium (Cr)		23.5	23.2		mg/kg	1.3	30	24-AUG-17
Cobalt (Co)		3.64	3.58		mg/kg	1.8	30	24-AUG-17
Copper (Cu)		7.60	7.32		mg/kg	3.7	30	24-AUG-17
Iron (Fe)		10700	10500		mg/kg	1.8	30	24-AUG-17
Lead (Pb)		6.70	6.75		mg/kg	0.8	40	24-AUG-17
Lithium (Li)		28.8	28.2		mg/kg	2.2	30	24-AUG-17
Magnesium (Mg)		33900	32700		mg/kg	3.5	30	24-AUG-17
Manganese (Mn)		117	115		mg/kg	1.7	30	24-AUG-17
Molybdenum (Mo)		0.74	0.58		mg/kg	24	40	24-AUG-17
Nickel (Ni)		14.1	13.8		mg/kg	1.8	30	24-AUG-17
Phosphorus (P)		494	483		mg/kg	2.3	30	24-AUG-17
Potassium (K)		2670	2600		mg/kg	2.9	40	24-AUG-17
Selenium (Se)		0.30	0.28		mg/kg	7.2	30	24-AUG-17
Silver (Ag)		<0.10	<0.10	RPD-NA	mg/kg	N/A	40	24-AUG-17
Sodium (Na)		5200	4950		mg/kg	4.8	40	24-AUG-17
Strontium (Sr)		41.3	64.8	DUP-H	mg/kg	44	40	24-AUG-17
Sulfur (S)		1000	1000		mg/kg	0.7	30	24-AUG-17
Thallium (Tl)		0.129	0.125		mg/kg	3.2	30	24-AUG-17
Tin (Sn)		<2.0	<2.0	RPD-NA	mg/kg	N/A	40	24-AUG-17
Titanium (Ti)		313	301		mg/kg	3.7	40	24-AUG-17
Tungsten (W)		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	24-AUG-17
Uranium (U)		1.26	1.22		mg/kg	3.4	30	24-AUG-17
Vanadium (V)		21.9	21.5		mg/kg	2.1	30	24-AUG-17
Zinc (Zn)		21.1	20.2		mg/kg	4.2	30	24-AUG-17
Zirconium (Zr)		5.5	5.1		mg/kg	7.8	30	24-AUG-17
WG2598697-3 LCS								
Aluminum (Al)			98.1		%		80-120	24-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3811687								
WG2598697-3 LCS								
Antimony (Sb)			105.1		%		80-120	24-AUG-17
Arsenic (As)			102.2		%		80-120	24-AUG-17
Barium (Ba)			101.3		%		80-120	24-AUG-17
Beryllium (Be)			97.2		%		80-120	24-AUG-17
Bismuth (Bi)			96.9		%		80-120	24-AUG-17
Boron (B)			93.6		%		80-120	24-AUG-17
Cadmium (Cd)			100.7		%		80-120	24-AUG-17
Calcium (Ca)			99.4		%		80-120	24-AUG-17
Chromium (Cr)			101.6		%		80-120	24-AUG-17
Cobalt (Co)			100.3		%		80-120	24-AUG-17
Copper (Cu)			99.3		%		80-120	24-AUG-17
Iron (Fe)			102.6		%		80-120	24-AUG-17
Lead (Pb)			97.6		%		80-120	24-AUG-17
Lithium (Li)			95.7		%		80-120	24-AUG-17
Magnesium (Mg)			99.1		%		80-120	24-AUG-17
Manganese (Mn)			99.0		%		80-120	24-AUG-17
Molybdenum (Mo)			96.7		%		80-120	24-AUG-17
Nickel (Ni)			99.5		%		80-120	24-AUG-17
Phosphorus (P)			107.0		%		80-120	24-AUG-17
Potassium (K)			101.1		%		80-120	24-AUG-17
Selenium (Se)			100.8		%		80-120	24-AUG-17
Silver (Ag)			97.9		%		80-120	24-AUG-17
Sodium (Na)			99.98		%		80-120	24-AUG-17
Strontium (Sr)			96.7		%		80-120	24-AUG-17
Sulfur (S)			103.8		%		80-120	24-AUG-17
Thallium (Tl)			96.8		%		80-120	24-AUG-17
Tin (Sn)			101.0		%		80-120	24-AUG-17
Titanium (Ti)			102.0		%		80-120	24-AUG-17
Tungsten (W)			97.9		%		80-120	24-AUG-17
Uranium (U)			99.3		%		80-120	24-AUG-17
Vanadium (V)			100.5		%		80-120	24-AUG-17
Zinc (Zn)			96.9		%		80-120	24-AUG-17
Zirconium (Zr)			98.0		%		70-130	24-AUG-17
WG2598697-1 MB								

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3811687								
WG2598697-1 MB								
Aluminum (Al)			<50		mg/kg		50	24-AUG-17
Antimony (Sb)			<0.10		mg/kg		0.1	24-AUG-17
Arsenic (As)			<0.10		mg/kg		0.1	24-AUG-17
Barium (Ba)			<0.50		mg/kg		0.5	24-AUG-17
Beryllium (Be)			<0.10		mg/kg		0.1	24-AUG-17
Bismuth (Bi)			<0.20		mg/kg		0.2	24-AUG-17
Boron (B)			<5.0		mg/kg		5	24-AUG-17
Cadmium (Cd)			<0.020		mg/kg		0.02	24-AUG-17
Calcium (Ca)			<50		mg/kg		50	24-AUG-17
Chromium (Cr)			<0.50		mg/kg		0.5	24-AUG-17
Cobalt (Co)			<0.10		mg/kg		0.1	24-AUG-17
Copper (Cu)			<0.50		mg/kg		0.5	24-AUG-17
Iron (Fe)			<50		mg/kg		50	24-AUG-17
Lead (Pb)			<0.50		mg/kg		0.5	24-AUG-17
Lithium (Li)			<2.0		mg/kg		2	24-AUG-17
Magnesium (Mg)			<20		mg/kg		20	24-AUG-17
Manganese (Mn)			<1.0		mg/kg		1	24-AUG-17
Molybdenum (Mo)			<0.10		mg/kg		0.1	24-AUG-17
Nickel (Ni)			<0.50		mg/kg		0.5	24-AUG-17
Phosphorus (P)			<50		mg/kg		50	24-AUG-17
Potassium (K)			<100		mg/kg		100	24-AUG-17
Selenium (Se)			<0.20		mg/kg		0.2	24-AUG-17
Silver (Ag)			<0.10		mg/kg		0.1	24-AUG-17
Sodium (Na)			<50		mg/kg		50	24-AUG-17
Strontium (Sr)			<0.50		mg/kg		0.5	24-AUG-17
Sulfur (S)			<1000		mg/kg		1000	24-AUG-17
Thallium (Tl)			<0.050		mg/kg		0.05	24-AUG-17
Tin (Sn)			<2.0		mg/kg		2	24-AUG-17
Titanium (Ti)			<1.0		mg/kg		1	24-AUG-17
Tungsten (W)			<0.50		mg/kg		0.5	24-AUG-17
Uranium (U)			<0.050		mg/kg		0.05	24-AUG-17
Vanadium (V)			<0.20		mg/kg		0.2	24-AUG-17
Zinc (Zn)			<2.0		mg/kg		2	24-AUG-17
Zirconium (Zr)			<1.0		mg/kg		1	24-AUG-17

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3812207								
WG2598796-4 CRM		**VA-CANMET-TILL1**						
Aluminum (Al)			99.4		%		70-130	25-AUG-17
Antimony (Sb)			111.9		%		70-130	25-AUG-17
Arsenic (As)			98.4		%		70-130	25-AUG-17
Barium (Ba)			99.6		%		70-130	25-AUG-17
Beryllium (Be)			0.54		mg/kg		0.34-0.74	25-AUG-17
Bismuth (Bi)			101.2		%		70-130	25-AUG-17
Boron (B)			3.2		mg/kg		0-8.2	25-AUG-17
Cadmium (Cd)			103.1		%		70-130	25-AUG-17
Calcium (Ca)			108.3		%		70-130	25-AUG-17
Chromium (Cr)			103.5		%		70-130	25-AUG-17
Cobalt (Co)			101.9		%		70-130	25-AUG-17
Copper (Cu)			99.3		%		70-130	25-AUG-17
Iron (Fe)			101.6		%		70-130	25-AUG-17
Lead (Pb)			102.9		%		70-130	25-AUG-17
Lithium (Li)			107.5		%		70-130	25-AUG-17
Magnesium (Mg)			101.7		%		70-130	25-AUG-17
Manganese (Mn)			97.1		%		70-130	25-AUG-17
Nickel (Ni)			102.4		%		70-130	25-AUG-17
Potassium (K)			105.8		%		70-130	25-AUG-17
Selenium (Se)			0.31		mg/kg		0.11-0.51	25-AUG-17
Silver (Ag)			0.25		mg/kg		0.13-0.33	25-AUG-17
Sodium (Na)			104.7		%		70-130	25-AUG-17
Strontium (Sr)			107.2		%		70-130	25-AUG-17
Thallium (Tl)			0.131		mg/kg		0.077-0.18	25-AUG-17
Tin (Sn)			1.1		mg/kg		0-3	25-AUG-17
Titanium (Ti)			107.3		%		70-130	25-AUG-17
Tungsten (W)			0.17		mg/kg		0-0.66	25-AUG-17
Uranium (U)			104.6		%		70-130	25-AUG-17
Vanadium (V)			102.9		%		70-130	25-AUG-17
Zinc (Zn)			102.3		%		70-130	25-AUG-17
Zirconium (Zr)			0.8		mg/kg		0-1.8	25-AUG-17
WG2598774-2 DUP		**L1977406-48**						
Aluminum (Al)		4770	4490		mg/kg	6.0	40	25-AUG-17
Antimony (Sb)		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	25-AUG-17

ALS Environmental

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3812207								
WG2598774-2 DUP		**L1977406-48**						
Arsenic (As)		4.96	4.63		mg/kg	6.9	30	25-AUG-17
Barium (Ba)		15.4	14.5		mg/kg	6.5	40	25-AUG-17
Beryllium (Be)		0.34	0.33		mg/kg	1.8	30	25-AUG-17
Bismuth (Bi)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	25-AUG-17
Boron (B)		35.6	33.8		mg/kg	5.3	30	25-AUG-17
Cadmium (Cd)		0.040	0.041		mg/kg	1.9	30	25-AUG-17
Calcium (Ca)		72200	72900		mg/kg	0.9	30	25-AUG-17
Chromium (Cr)		16.2	15.9		mg/kg	2.1	30	25-AUG-17
Cobalt (Co)		3.01	2.96		mg/kg	1.8	30	25-AUG-17
Copper (Cu)		6.16	6.12		mg/kg	0.7	30	25-AUG-17
Iron (Fe)		11400	11000		mg/kg	3.6	30	25-AUG-17
Lead (Pb)		4.92	4.87		mg/kg	1.2	40	25-AUG-17
Lithium (Li)		24.1	23.5		mg/kg	2.7	30	25-AUG-17
Magnesium (Mg)		35300	35600		mg/kg	1.0	30	25-AUG-17
Manganese (Mn)		131	125		mg/kg	4.7	30	25-AUG-17
Molybdenum (Mo)		0.33	0.32		mg/kg	2.1	40	25-AUG-17
Nickel (Ni)		9.12	8.96		mg/kg	1.8	30	25-AUG-17
Phosphorus (P)		441	463		mg/kg	4.9	30	25-AUG-17
Potassium (K)		2090	1940		mg/kg	7.8	40	25-AUG-17
Selenium (Se)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	25-AUG-17
Silver (Ag)		<0.10	<0.10	RPD-NA	mg/kg	N/A	40	25-AUG-17
Sodium (Na)		3790	3190		mg/kg	17	40	25-AUG-17
Strontium (Sr)		50.1	44.5		mg/kg	12	40	25-AUG-17
Sulfur (S)		<1000	<1000	RPD-NA	mg/kg	N/A	30	25-AUG-17
Thallium (Tl)		0.089	0.088		mg/kg	0.4	30	25-AUG-17
Tin (Sn)		<2.0	<2.0	RPD-NA	mg/kg	N/A	40	25-AUG-17
Titanium (Ti)		224	222		mg/kg	1.0	40	25-AUG-17
Tungsten (W)		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	25-AUG-17
Uranium (U)		0.755	0.755		mg/kg	0.0	30	25-AUG-17
Vanadium (V)		18.9	18.6		mg/kg	1.2	30	25-AUG-17
Zinc (Zn)		14.0	13.8		mg/kg	1.5	30	25-AUG-17
Zirconium (Zr)		5.7	5.3		mg/kg	6.7	30	25-AUG-17
WG2598796-2 DUP		**L1977406-57**						
Aluminum (Al)		4500	4890		mg/kg	8.3	40	25-AUG-17

Quality Control Report

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3812207								
WG2598796-2 DUP		**L1977406-57**						
Antimony (Sb)		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	25-AUG-17
Arsenic (As)		3.50	3.78		mg/kg	7.8	30	25-AUG-17
Barium (Ba)		14.8	15.8		mg/kg	6.5	40	25-AUG-17
Beryllium (Be)		0.28	0.32		mg/kg	13	30	25-AUG-17
Bismuth (Bi)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	25-AUG-17
Boron (B)		30.6	32.7		mg/kg	6.6	30	25-AUG-17
Cadmium (Cd)		0.031	0.054	J	mg/kg	0.023	0.04	25-AUG-17
Calcium (Ca)		52900	59500		mg/kg	12	30	25-AUG-17
Chromium (Cr)		15.1	15.3		mg/kg	1.4	30	25-AUG-17
Cobalt (Co)		2.54	2.68		mg/kg	5.2	30	25-AUG-17
Copper (Cu)		4.76	5.02		mg/kg	5.2	30	25-AUG-17
Iron (Fe)		9970	10300		mg/kg	2.9	30	25-AUG-17
Lead (Pb)		4.43	4.63		mg/kg	4.3	40	25-AUG-17
Lithium (Li)		20.0	21.5		mg/kg	6.8	30	25-AUG-17
Magnesium (Mg)		26600	27400		mg/kg	3.3	30	25-AUG-17
Manganese (Mn)		96.9	106		mg/kg	9.3	30	25-AUG-17
Molybdenum (Mo)		0.32	0.33		mg/kg	2.3	40	25-AUG-17
Nickel (Ni)		7.83	8.61		mg/kg	9.5	30	25-AUG-17
Phosphorus (P)		400	414		mg/kg	3.5	30	25-AUG-17
Potassium (K)		2000	2370		mg/kg	17	40	25-AUG-17
Selenium (Se)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	25-AUG-17
Silver (Ag)		<0.10	<0.10	RPD-NA	mg/kg	N/A	40	25-AUG-17
Sodium (Na)		3710	3500		mg/kg	6.0	40	25-AUG-17
Strontium (Sr)		43.0	66.9	DUP-H	mg/kg	44	40	25-AUG-17
Sulfur (S)		<1000	<1000	RPD-NA	mg/kg	N/A	30	25-AUG-17
Thallium (Tl)		0.083	0.096		mg/kg	15	30	25-AUG-17
Tin (Sn)		<2.0	<2.0	RPD-NA	mg/kg	N/A	40	25-AUG-17
Titanium (Ti)		218	249		mg/kg	13	40	25-AUG-17
Tungsten (W)		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	25-AUG-17
Uranium (U)		0.734	0.751		mg/kg	2.4	30	25-AUG-17
Vanadium (V)		17.5	18.5		mg/kg	5.5	30	25-AUG-17
Zinc (Zn)		12.9	14.3		mg/kg	9.9	30	25-AUG-17
Zirconium (Zr)		4.6	5.2		mg/kg	10	30	25-AUG-17
WG2598796-3 LCS								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3812207								
WG2598796-3 LCS								
Aluminum (Al)			98.0		%		80-120	25-AUG-17
Antimony (Sb)			110.8		%		80-120	25-AUG-17
Arsenic (As)			99.0		%		80-120	25-AUG-17
Barium (Ba)			102.0		%		80-120	25-AUG-17
Beryllium (Be)			101.7		%		80-120	25-AUG-17
Bismuth (Bi)			105.6		%		80-120	25-AUG-17
Boron (B)			97.3		%		80-120	25-AUG-17
Cadmium (Cd)			99.7		%		80-120	25-AUG-17
Calcium (Ca)			101.1		%		80-120	25-AUG-17
Chromium (Cr)			99.4		%		80-120	25-AUG-17
Cobalt (Co)			97.2		%		80-120	25-AUG-17
Copper (Cu)			96.0		%		80-120	25-AUG-17
Iron (Fe)			96.2		%		80-120	25-AUG-17
Lead (Pb)			104.0		%		80-120	25-AUG-17
Lithium (Li)			96.1		%		80-120	25-AUG-17
Magnesium (Mg)			97.8		%		80-120	25-AUG-17
Manganese (Mn)			97.7		%		80-120	25-AUG-17
Molybdenum (Mo)			102.5		%		80-120	25-AUG-17
Nickel (Ni)			97.8		%		80-120	25-AUG-17
Phosphorus (P)			102.2		%		80-120	25-AUG-17
Potassium (K)			99.5		%		80-120	25-AUG-17
Selenium (Se)			102.4		%		80-120	25-AUG-17
Silver (Ag)			103.5		%		80-120	25-AUG-17
Sodium (Na)			98.5		%		80-120	25-AUG-17
Strontium (Sr)			103.4		%		80-120	25-AUG-17
Sulfur (S)			96.3		%		80-120	25-AUG-17
Thallium (Tl)			103.2		%		80-120	25-AUG-17
Tin (Sn)			101.1		%		80-120	25-AUG-17
Titanium (Ti)			90.3		%		80-120	25-AUG-17
Tungsten (W)			107.0		%		80-120	25-AUG-17
Uranium (U)			107.3		%		80-120	25-AUG-17
Vanadium (V)			100.2		%		80-120	25-AUG-17
Zinc (Zn)			93.5		%		80-120	25-AUG-17
Zirconium (Zr)			103.2		%		70-130	25-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3812207								
WG2598796-1 MB								
Aluminum (Al)			<50		mg/kg		50	25-AUG-17
Antimony (Sb)			<0.10		mg/kg		0.1	25-AUG-17
Arsenic (As)			<0.10		mg/kg		0.1	25-AUG-17
Barium (Ba)			<0.50		mg/kg		0.5	25-AUG-17
Beryllium (Be)			<0.10		mg/kg		0.1	25-AUG-17
Bismuth (Bi)			<0.20		mg/kg		0.2	25-AUG-17
Boron (B)			<5.0		mg/kg		5	25-AUG-17
Cadmium (Cd)			<0.020		mg/kg		0.02	25-AUG-17
Calcium (Ca)			<50		mg/kg		50	25-AUG-17
Chromium (Cr)			<0.50		mg/kg		0.5	25-AUG-17
Cobalt (Co)			<0.10		mg/kg		0.1	25-AUG-17
Copper (Cu)			<0.50		mg/kg		0.5	25-AUG-17
Iron (Fe)			<50		mg/kg		50	25-AUG-17
Lead (Pb)			<0.50		mg/kg		0.5	25-AUG-17
Lithium (Li)			<2.0		mg/kg		2	25-AUG-17
Magnesium (Mg)			<20		mg/kg		20	25-AUG-17
Manganese (Mn)			<1.0		mg/kg		1	25-AUG-17
Molybdenum (Mo)			<0.10		mg/kg		0.1	25-AUG-17
Nickel (Ni)			<0.50		mg/kg		0.5	25-AUG-17
Phosphorus (P)			<50		mg/kg		50	25-AUG-17
Potassium (K)			<100		mg/kg		100	25-AUG-17
Selenium (Se)			<0.20		mg/kg		0.2	25-AUG-17
Silver (Ag)			<0.10		mg/kg		0.1	25-AUG-17
Sodium (Na)			<50		mg/kg		50	25-AUG-17
Strontium (Sr)			<0.50		mg/kg		0.5	25-AUG-17
Sulfur (S)			<1000		mg/kg		1000	25-AUG-17
Thallium (Tl)			<0.050		mg/kg		0.05	25-AUG-17
Tin (Sn)			<2.0		mg/kg		2	25-AUG-17
Titanium (Ti)			<1.0		mg/kg		1	25-AUG-17
Tungsten (W)			<0.50		mg/kg		0.5	25-AUG-17
Uranium (U)			<0.050		mg/kg		0.05	25-AUG-17
Vanadium (V)			<0.20		mg/kg		0.2	25-AUG-17
Zinc (Zn)			<2.0		mg/kg		2	25-AUG-17
Zirconium (Zr)			<1.0		mg/kg		1	25-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3813339								
WG2598742-4 CRM		**VA-CANMET-TILL1**						
Aluminum (Al)			102.4		%		70-130	25-AUG-17
Antimony (Sb)			103.6		%		70-130	25-AUG-17
Arsenic (As)			101.0		%		70-130	25-AUG-17
Barium (Ba)			97.1		%		70-130	25-AUG-17
Beryllium (Be)			0.51		mg/kg		0.34-0.74	25-AUG-17
Bismuth (Bi)			93.7		%		70-130	25-AUG-17
Boron (B)			3.0		mg/kg		0-8.2	25-AUG-17
Cadmium (Cd)			101.6		%		70-130	25-AUG-17
Calcium (Ca)			104.5		%		70-130	25-AUG-17
Chromium (Cr)			104.7		%		70-130	25-AUG-17
Cobalt (Co)			102.8		%		70-130	25-AUG-17
Copper (Cu)			102.1		%		70-130	25-AUG-17
Iron (Fe)			102.0		%		70-130	25-AUG-17
Lead (Pb)			97.0		%		70-130	25-AUG-17
Lithium (Li)			102.4		%		70-130	25-AUG-17
Magnesium (Mg)			103.7		%		70-130	25-AUG-17
Manganese (Mn)			100.3		%		70-130	25-AUG-17
Nickel (Ni)			101.8		%		70-130	25-AUG-17
Potassium (K)			112.0		%		70-130	25-AUG-17
Selenium (Se)			0.31		mg/kg		0.11-0.51	25-AUG-17
Silver (Ag)			0.23		mg/kg		0.13-0.33	25-AUG-17
Sodium (Na)			109.5		%		70-130	25-AUG-17
Strontium (Sr)			103.3		%		70-130	25-AUG-17
Thallium (Tl)			0.124		mg/kg		0.077-0.18	25-AUG-17
Tin (Sn)			1.1		mg/kg		0-3	25-AUG-17
Titanium (Ti)			108.3		%		70-130	25-AUG-17
Tungsten (W)			0.16		mg/kg		0-0.66	25-AUG-17
Uranium (U)			103.1		%		70-130	25-AUG-17
Vanadium (V)			103.0		%		70-130	25-AUG-17
Zinc (Zn)			103.8		%		70-130	25-AUG-17
Zirconium (Zr)			0.7		mg/kg		0-1.8	25-AUG-17
WG2598742-2 DUP		**L1977406-18**						
Aluminum (Al)		5140	4940		mg/kg	3.9	40	25-AUG-17
Antimony (Sb)		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	25-AUG-17

ALS Environmental

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3813339								
WG2598742-2 DUP		**L1977406-18**						
Arsenic (As)		4.81	4.86		mg/kg	1.0	30	25-AUG-17
Barium (Ba)		16.3	15.4		mg/kg	5.8	40	25-AUG-17
Beryllium (Be)		0.33	0.34		mg/kg	1.0	30	25-AUG-17
Bismuth (Bi)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	25-AUG-17
Boron (B)		37.1	35.8		mg/kg	3.6	30	25-AUG-17
Cadmium (Cd)		0.048	0.050		mg/kg	3.8	30	25-AUG-17
Calcium (Ca)		78800	74800		mg/kg	5.1	30	25-AUG-17
Chromium (Cr)		18.4	17.7		mg/kg	3.9	30	25-AUG-17
Cobalt (Co)		3.14	3.10		mg/kg	1.3	30	25-AUG-17
Copper (Cu)		6.48	6.48		mg/kg	0.0	30	25-AUG-17
Iron (Fe)		11200	11200		mg/kg	0.2	30	25-AUG-17
Lead (Pb)		5.23	4.96		mg/kg	5.3	40	25-AUG-17
Lithium (Li)		25.7	25.4		mg/kg	1.0	30	25-AUG-17
Magnesium (Mg)		40500	39100		mg/kg	3.5	30	25-AUG-17
Manganese (Mn)		130	129		mg/kg	0.8	30	25-AUG-17
Molybdenum (Mo)		0.31	0.30		mg/kg	5.7	40	25-AUG-17
Nickel (Ni)		9.87	9.65		mg/kg	2.2	30	25-AUG-17
Phosphorus (P)		441	424		mg/kg	3.8	30	25-AUG-17
Potassium (K)		2220	2130		mg/kg	4.3	40	25-AUG-17
Selenium (Se)		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	25-AUG-17
Silver (Ag)		<0.10	<0.10	RPD-NA	mg/kg	N/A	40	25-AUG-17
Sodium (Na)		3880	3700		mg/kg	4.7	40	25-AUG-17
Strontium (Sr)		48.5	44.2		mg/kg	9.2	40	25-AUG-17
Sulfur (S)		<1000	<1000	RPD-NA	mg/kg	N/A	30	25-AUG-17
Thallium (Tl)		0.100	0.091		mg/kg	9.1	30	25-AUG-17
Tin (Sn)		<2.0	<2.0	RPD-NA	mg/kg	N/A	40	25-AUG-17
Titanium (Ti)		236	229		mg/kg	3.1	40	25-AUG-17
Tungsten (W)		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	25-AUG-17
Uranium (U)		0.802	0.750		mg/kg	6.7	30	25-AUG-17
Vanadium (V)		20.6	20.0		mg/kg	2.8	30	25-AUG-17
Zinc (Zn)		15.2	14.5		mg/kg	5.1	30	25-AUG-17
Zirconium (Zr)		5.9	5.5		mg/kg	6.8	30	25-AUG-17
WG2598742-3 LCS								
Aluminum (Al)			99.96		%		80-120	25-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3813339								
WG2598742-3 LCS								
Antimony (Sb)			103.4		%		80-120	25-AUG-17
Arsenic (As)			99.7		%		80-120	25-AUG-17
Barium (Ba)			99.5		%		80-120	25-AUG-17
Beryllium (Be)			97.5		%		80-120	25-AUG-17
Bismuth (Bi)			95.9		%		80-120	25-AUG-17
Boron (B)			92.8		%		80-120	25-AUG-17
Cadmium (Cd)			97.8		%		80-120	25-AUG-17
Calcium (Ca)			98.3		%		80-120	25-AUG-17
Chromium (Cr)			97.7		%		80-120	25-AUG-17
Cobalt (Co)			97.0		%		80-120	25-AUG-17
Copper (Cu)			96.2		%		80-120	25-AUG-17
Iron (Fe)			94.9		%		80-120	25-AUG-17
Lead (Pb)			97.5		%		80-120	25-AUG-17
Lithium (Li)			94.7		%		80-120	25-AUG-17
Magnesium (Mg)			98.3		%		80-120	25-AUG-17
Manganese (Mn)			99.6		%		80-120	25-AUG-17
Molybdenum (Mo)			96.8		%		80-120	25-AUG-17
Nickel (Ni)			95.7		%		80-120	25-AUG-17
Phosphorus (P)			101.4		%		80-120	25-AUG-17
Potassium (K)			99.8		%		80-120	25-AUG-17
Selenium (Se)			100.6		%		80-120	25-AUG-17
Silver (Ag)			98.5		%		80-120	25-AUG-17
Sodium (Na)			98.9		%		80-120	25-AUG-17
Strontium (Sr)			98.0		%		80-120	25-AUG-17
Sulfur (S)			100.8		%		80-120	25-AUG-17
Thallium (Tl)			97.5		%		80-120	25-AUG-17
Tin (Sn)			98.8		%		80-120	25-AUG-17
Titanium (Ti)			91.0		%		80-120	25-AUG-17
Tungsten (W)			98.1		%		80-120	25-AUG-17
Uranium (U)			98.4		%		80-120	25-AUG-17
Vanadium (V)			98.4		%		80-120	25-AUG-17
Zinc (Zn)			95.4		%		80-120	25-AUG-17
Zirconium (Zr)			94.0		%		70-130	25-AUG-17
WG2598742-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-VA	**Soil**							
Batch R3813339								
WG2598742-1 MB								
Aluminum (Al)			<50		mg/kg		50	25-AUG-17
Antimony (Sb)			<0.10		mg/kg		0.1	25-AUG-17
Arsenic (As)			<0.10		mg/kg		0.1	25-AUG-17
Barium (Ba)			<0.50		mg/kg		0.5	25-AUG-17
Beryllium (Be)			<0.10		mg/kg		0.1	25-AUG-17
Bismuth (Bi)			<0.20		mg/kg		0.2	25-AUG-17
Boron (B)			<5.0		mg/kg		5	25-AUG-17
Cadmium (Cd)			<0.020		mg/kg		0.02	25-AUG-17
Calcium (Ca)			<50		mg/kg		50	25-AUG-17
Chromium (Cr)			<0.50		mg/kg		0.5	25-AUG-17
Cobalt (Co)			<0.10		mg/kg		0.1	25-AUG-17
Copper (Cu)			<0.50		mg/kg		0.5	25-AUG-17
Iron (Fe)			<50		mg/kg		50	25-AUG-17
Lead (Pb)			<0.50		mg/kg		0.5	25-AUG-17
Lithium (Li)			<2.0		mg/kg		2	25-AUG-17
Magnesium (Mg)			<20		mg/kg		20	25-AUG-17
Manganese (Mn)			<1.0		mg/kg		1	25-AUG-17
Molybdenum (Mo)			<0.10		mg/kg		0.1	25-AUG-17
Nickel (Ni)			<0.50		mg/kg		0.5	25-AUG-17
Phosphorus (P)			<50		mg/kg		50	25-AUG-17
Potassium (K)			<100		mg/kg		100	25-AUG-17
Selenium (Se)			<0.20		mg/kg		0.2	25-AUG-17
Silver (Ag)			<0.10		mg/kg		0.1	25-AUG-17
Sodium (Na)			<50		mg/kg		50	25-AUG-17
Strontium (Sr)			<0.50		mg/kg		0.5	25-AUG-17
Sulfur (S)			<1000		mg/kg		1000	25-AUG-17
Thallium (Tl)			<0.050		mg/kg		0.05	25-AUG-17
Tin (Sn)			<2.0		mg/kg		2	25-AUG-17
Titanium (Ti)			<1.0		mg/kg		1	25-AUG-17
Tungsten (W)			<0.50		mg/kg		0.5	25-AUG-17
Uranium (U)			<0.050		mg/kg		0.05	25-AUG-17
Vanadium (V)			<0.20		mg/kg		0.2	25-AUG-17
Zinc (Zn)			<2.0		mg/kg		2	25-AUG-17
Zirconium (Zr)			<1.0		mg/kg		1	25-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-VA	**Soil**							
Batch R3807566								
WG2598797-2 LCS								
Moisture			99.8		%		90-110	22-AUG-17
WG2598797-6 LCS								
Moisture			100.2		%		90-110	22-AUG-17
WG2598797-1 MB								
Moisture			<0.25		%		0.25	22-AUG-17
WG2598797-5 MB								
Moisture			<0.25		%		0.25	22-AUG-17
Batch R3807632								
WG2598741-1 DUP		**L1977406-1**						
Moisture		28.5	27.7		%	2.9	20	22-AUG-17
WG2598741-3 LCS								
Moisture			100.1		%		90-110	22-AUG-17
WG2598741-2 MB								
Moisture			<0.25		%		0.25	22-AUG-17
PAH-TMB-H/A-MS-VA	**Soil**							
Batch R3808128								
WG2598735-2 LCS								
Acenaphthene			88.5		%		60-130	23-AUG-17
Acenaphthylene			89.4		%		60-130	23-AUG-17
Anthracene			90.2		%		60-130	23-AUG-17
Benz(a)anthracene			94.8		%		60-130	23-AUG-17
Benzo(a)pyrene			99.9		%		60-130	23-AUG-17
Benzo(b&j)fluoranthene			97.7		%		50-150	23-AUG-17
Benzo(g,h,i)perylene			93.8		%		60-130	23-AUG-17
Benzo(k)fluoranthene			100.3		%		60-130	23-AUG-17
Chrysene			102.4		%		60-130	23-AUG-17
Dibenz(a,h)anthracene			94.7		%		60-130	23-AUG-17
Fluoranthene			96.5		%		60-130	23-AUG-17
Fluorene			90.4		%		60-130	23-AUG-17
Indeno(1,2,3-c,d)pyrene			96.2		%		60-130	23-AUG-17
2-Methylnaphthalene			90.3		%		60-130	23-AUG-17
Naphthalene			90.1		%		50-130	23-AUG-17
Phenanthrene			92.6		%		60-130	23-AUG-17
Pyrene			96.5		%		60-130	23-AUG-17
WG2598735-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	23-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-VA	**Soil**							
Batch R3808128								
WG2598735-1 MB								
Acenaphthylene			<0.0050		mg/kg		0.005	23-AUG-17
Anthracene			<0.0040		mg/kg		0.004	23-AUG-17
Benz(a)anthracene			<0.010		mg/kg		0.01	23-AUG-17
Benzo(a)pyrene			<0.010		mg/kg		0.01	23-AUG-17
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	23-AUG-17
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	23-AUG-17
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	23-AUG-17
Chrysene			<0.010		mg/kg		0.01	23-AUG-17
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	23-AUG-17
Fluoranthene			<0.010		mg/kg		0.01	23-AUG-17
Fluorene			<0.010		mg/kg		0.01	23-AUG-17
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	23-AUG-17
2-Methylnaphthalene			<0.010		mg/kg		0.01	23-AUG-17
Naphthalene			<0.010		mg/kg		0.01	23-AUG-17
Phenanthrene			<0.010		mg/kg		0.01	23-AUG-17
Pyrene			<0.010		mg/kg		0.01	23-AUG-17
Surrogate: Naphthalene d8			89.2		%		50-130	23-AUG-17
Surrogate: Acenaphthene d10			89.3		%		60-130	23-AUG-17
Surrogate: Phenanthrene d10			87.3		%		60-130	23-AUG-17
Surrogate: Chrysene d12			92.9		%		60-130	23-AUG-17
Batch R3809186								
WG2598800-2 LCS								
Acenaphthene			85.6		%		60-130	24-AUG-17
Acenaphthylene			86.3		%		60-130	24-AUG-17
Anthracene			86.2		%		60-130	24-AUG-17
Benz(a)anthracene			99.9		%		60-130	24-AUG-17
Benzo(a)pyrene			94.2		%		60-130	24-AUG-17
Benzo(b&j)fluoranthene			91.8		%		50-150	24-AUG-17
Benzo(g,h,i)perylene			95.3		%		60-130	24-AUG-17
Benzo(k)fluoranthene			98.2		%		60-130	24-AUG-17
Chrysene			99.8		%		60-130	24-AUG-17
Dibenz(a,h)anthracene			92.7		%		60-130	24-AUG-17
Fluoranthene			95.7		%		60-130	24-AUG-17
Fluorene			87.2		%		60-130	24-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-VA	**Soil**							
Batch R3809186								
WG2598800-2 LCS								
Indeno(1,2,3-c,d)pyrene			95.3		%		60-130	24-AUG-17
2-Methylnaphthalene			89.1		%		60-130	24-AUG-17
Naphthalene			89.6		%		50-130	24-AUG-17
Phenanthrene			89.2		%		60-130	24-AUG-17
Pyrene			96.2		%		60-130	24-AUG-17
WG2598800-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	24-AUG-17
Acenaphthylene			<0.0050		mg/kg		0.005	24-AUG-17
Anthracene			<0.0040		mg/kg		0.004	24-AUG-17
Benz(a)anthracene			<0.010		mg/kg		0.01	24-AUG-17
Benzo(a)pyrene			<0.010		mg/kg		0.01	24-AUG-17
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	24-AUG-17
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	24-AUG-17
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	24-AUG-17
Chrysene			<0.010		mg/kg		0.01	24-AUG-17
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	24-AUG-17
Fluoranthene			<0.010		mg/kg		0.01	24-AUG-17
Fluorene			<0.010		mg/kg		0.01	24-AUG-17
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	24-AUG-17
2-Methylnaphthalene			<0.010		mg/kg		0.01	24-AUG-17
Naphthalene			<0.010		mg/kg		0.01	24-AUG-17
Phenanthrene			<0.010		mg/kg		0.01	24-AUG-17
Pyrene			<0.010		mg/kg		0.01	24-AUG-17
Surrogate: Naphthalene d8			75.0		%		50-130	24-AUG-17
Surrogate: Acenaphthene d10			76.3		%		60-130	24-AUG-17
Surrogate: Phenanthrene d10			74.0		%		60-130	24-AUG-17
Surrogate: Chrysene d12			83.1		%		60-130	24-AUG-17
Batch R3812798								
WG2601907-2 LCS								
Acenaphthene			91.0		%		60-130	27-AUG-17
Acenaphthylene			93.1		%		60-130	27-AUG-17
Anthracene			92.2		%		60-130	27-AUG-17
Benz(a)anthracene			105.0		%		60-130	27-AUG-17
Benzo(a)pyrene			96.6		%		60-130	27-AUG-17
Benzo(b&j)fluoranthene			97.3		%		50-150	27-AUG-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-VA	**Soil**							
Batch R3812798								
WG2601907-2 LCS								
Benzo(g,h,i)perylene			95.2		%		60-130	27-AUG-17
Benzo(k)fluoranthene			103.7		%		60-130	27-AUG-17
Chrysene			108.5		%		60-130	27-AUG-17
Dibenz(a,h)anthracene			97.1		%		60-130	27-AUG-17
Fluoranthene			101.7		%		60-130	27-AUG-17
Fluorene			91.0		%		60-130	27-AUG-17
Indeno(1,2,3-c,d)pyrene			99.1		%		60-130	27-AUG-17
2-Methylnaphthalene			95.1		%		60-130	27-AUG-17
Naphthalene			94.7		%		50-130	27-AUG-17
Phenanthrene			95.5		%		60-130	27-AUG-17
Pyrene			103.3		%		60-130	27-AUG-17
WG2601907-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	27-AUG-17
Acenaphthylene			<0.0050		mg/kg		0.005	27-AUG-17
Anthracene			<0.0040		mg/kg		0.004	27-AUG-17
Benz(a)anthracene			<0.010		mg/kg		0.01	27-AUG-17
Benzo(a)pyrene			<0.010		mg/kg		0.01	27-AUG-17
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	27-AUG-17
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	27-AUG-17
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	27-AUG-17
Chrysene			<0.010		mg/kg		0.01	27-AUG-17
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	27-AUG-17
Fluoranthene			<0.010		mg/kg		0.01	27-AUG-17
Fluorene			<0.010		mg/kg		0.01	27-AUG-17
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	27-AUG-17
2-Methylnaphthalene			<0.010		mg/kg		0.01	27-AUG-17
Naphthalene			<0.010		mg/kg		0.01	27-AUG-17
Phenanthrene			<0.010		mg/kg		0.01	27-AUG-17
Pyrene			<0.010		mg/kg		0.01	27-AUG-17
Surrogate: Naphthalene d8			98.7		%		50-130	27-AUG-17
Surrogate: Acenaphthene d10			100.1		%		60-130	27-AUG-17
Surrogate: Phenanthrene d10			97.9		%		60-130	27-AUG-17
Surrogate: Chrysene d12			97.4		%		60-130	27-AUG-17
PH-1:2-VA	**Soil**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-1:2-VA	**Soil**							
Batch R3807930								
WG2597686-5 IRM		**VA-ALP-SRS1507**						
pH (1:2 soil:water)			6.34		pH		6.2-6.8	23-AUG-17
Batch R3812185								
WG2598742-2 DUP		**L1977406-18**						
pH (1:2 soil:water)		8.25	8.23	J	pH	0.02	0.2	25-AUG-17
WG2598742-5 IRM		**VA-ALP-SRS1507**						
pH (1:2 soil:water)			6.41		pH		6.2-6.8	25-AUG-17
Batch R3812746								
WG2598697-2 DUP		**L1977406-6**						
pH (1:2 soil:water)		8.11	8.17	J	pH	0.06	0.2	27-AUG-17
WG2598697-5 IRM		**VA-ALP-SRS1507**						
pH (1:2 soil:water)			6.36		pH		6.2-6.8	27-AUG-17
Batch R3812754								
WG2598774-2 DUP		**L1977406-48**						
pH (1:2 soil:water)		8.31	8.34	J	pH	0.03	0.2	27-AUG-17
WG2598774-5 IRM		**VA-ALP-SRS1507**						
pH (1:2 soil:water)			6.39		pH		6.2-6.8	27-AUG-17
Batch R3812781								
WG2598796-2 DUP		**L1977406-57**						
pH (1:2 soil:water)		8.23	8.16	J	pH	0.07	0.2	27-AUG-17
WG2598796-5 IRM		**VA-ALP-SRS1507**						
pH (1:2 soil:water)			6.41		pH		6.2-6.8	27-AUG-17
PSA-PIPET+GRAVEL-SK	**Soil**							
Batch R3812501								
WG2598555-1 DUP		**L1977406-10**						
% Gravel (>2mm)		10.1	10.1		%	0.0	25	25-AUG-17
% Sand (2.0mm - 0.063mm)		32.4	31.6	J	%	0.7	5	25-AUG-17
% Silt (0.063mm - 4um)		38.9	39.5	J	%	0.6	5	25-AUG-17
% Clay (<4um)		18.8	18.9	J	%	0.1	5	25-AUG-17
WG2598555-2 IRM		**2017-PSA**						
% Sand (2.0mm - 0.063mm)			42.3		%		39.1-49.1	25-AUG-17
% Silt (0.063mm - 4um)			39.6		%		32.5-42.5	25-AUG-17
% Clay (<4um)			18.1		%		13.4-23.4	25-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-PIPET+GRAVEL-SK	**Soil**							
Batch R3813395								
WG2598585-2	**IRM**	**2017-PSA**						
% Sand (2.0mm - 0.063mm)			43.6		%		39.1-49.1	28-AUG-17
% Silt (0.063mm - 4um)			38.4		%		32.5-42.5	28-AUG-17
% Clay (<4um)			18.1		%		13.4-23.4	28-AUG-17
Batch R3813440								
WG2598557-1	**DUP**	**L1977406-27**						
% Gravel (>2mm)		6.5	6.5		%	0.0	25	28-AUG-17
% Sand (2.0mm - 0.063mm)		25.1	26.2	J	%	1.1	5	28-AUG-17
% Silt (0.063mm - 4um)		50.5	51.4	J	%	0.9	5	28-AUG-17
% Clay (<4um)		17.9	16.0	J	%	1.9	5	28-AUG-17
WG2598557-2	**IRM**	**2017-PSA**						
% Sand (2.0mm - 0.063mm)			45.5		%		39.1-49.1	28-AUG-17
% Silt (0.063mm - 4um)			36.3		%		32.5-42.5	28-AUG-17
% Clay (<4um)			18.3		%		13.4-23.4	28-AUG-17
Batch R3813444								
WG2598579-1	**DUP**	**L1977406-48**						
% Gravel (>2mm)		22.4	22.4		%	0.0	25	28-AUG-17
% Sand (2.0mm - 0.063mm)		44.2	44.4	J	%	0.1	5	28-AUG-17
% Silt (0.063mm - 4um)		26.6	26.5	J	%	0.2	5	28-AUG-17
% Clay (<4um)		6.8	6.8	J	%	0.0	5	28-AUG-17
WG2598579-2	**IRM**	**2017-PSA**						
% Sand (2.0mm - 0.063mm)			44.5		%		39.1-49.1	28-AUG-17
% Silt (0.063mm - 4um)			37.4		%		32.5-42.5	28-AUG-17
% Clay (<4um)			18.2		%		13.4-23.4	28-AUG-17
VOC7-L-HSMS-VA	**Soil**							
Batch R3800693								
WG2599060-3	**DUP**	**L1977406-47**						
Benzene		<0.0050	<0.0050	RPD-NA	mg/kg	N/A	40	23-AUG-17
Ethylbenzene		<0.015	<0.015	RPD-NA	mg/kg	N/A	40	23-AUG-17
Methyl t-butyl ether (MTBE)		<0.20	<0.20	RPD-NA	mg/kg	N/A	40	23-AUG-17
Styrene		<0.050	<0.050	RPD-NA	mg/kg	N/A	40	23-AUG-17
Toluene		<0.050	<0.050	RPD-NA	mg/kg	N/A	40	23-AUG-17
meta- & para-Xylene		<0.050	<0.050	RPD-NA	mg/kg	N/A	40	23-AUG-17
ortho-Xylene		<0.050	<0.050	RPD-NA	mg/kg	N/A	40	23-AUG-17
WG2599060-2	**LCS**							
Benzene			97.3		%		70-130	23-AUG-17

Quality Control Report

Workorder: L1977406 Report Date: 29-AUG-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC7-L-HSMS-VA	**Soil**							
Batch R3800693								
WG2599060-2 LCS								
Ethylbenzene			88.2		%		70-130	23-AUG-17
Methyl t-butyl ether (MTBE)			101.1		%		70-130	23-AUG-17
Styrene			92.0		%		70-130	23-AUG-17
Toluene			85.7		%		70-130	23-AUG-17
meta- & para-Xylene			96.6		%		70-130	23-AUG-17
ortho-Xylene			93.1		%		70-130	23-AUG-17
WG2599060-1 MB								
Benzene			<0.0050		mg/kg		0.005	23-AUG-17
Ethylbenzene			<0.015		mg/kg		0.015	23-AUG-17
Methyl t-butyl ether (MTBE)			<0.20		mg/kg		0.2	23-AUG-17
Styrene			<0.050		mg/kg		0.05	23-AUG-17
Toluene			<0.050		mg/kg		0.05	23-AUG-17
meta- & para-Xylene			<0.050		mg/kg		0.05	23-AUG-17
ortho-Xylene			<0.050		mg/kg		0.05	23-AUG-17
Batch R3812184								
WG2600550-2 LCS								
Benzene			91.6		%		70-130	23-AUG-17
Ethylbenzene			103.5		%		70-130	23-AUG-17
Methyl t-butyl ether (MTBE)			101.1		%		70-130	23-AUG-17
Styrene			101.4		%		70-130	23-AUG-17
Toluene			99.0		%		70-130	23-AUG-17
meta- & para-Xylene			105.9		%		70-130	23-AUG-17
ortho-Xylene			106.1		%		70-130	23-AUG-17
WG2600550-1 MB								
Benzene			<0.0050		mg/kg		0.005	23-AUG-17
Ethylbenzene			<0.015		mg/kg		0.015	23-AUG-17
Methyl t-butyl ether (MTBE)			<0.20		mg/kg		0.2	23-AUG-17
Styrene			<0.050		mg/kg		0.05	23-AUG-17
Toluene			<0.050		mg/kg		0.05	23-AUG-17
meta- & para-Xylene			<0.050		mg/kg		0.05	23-AUG-17
ortho-Xylene			<0.050		mg/kg		0.05	23-AUG-17

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

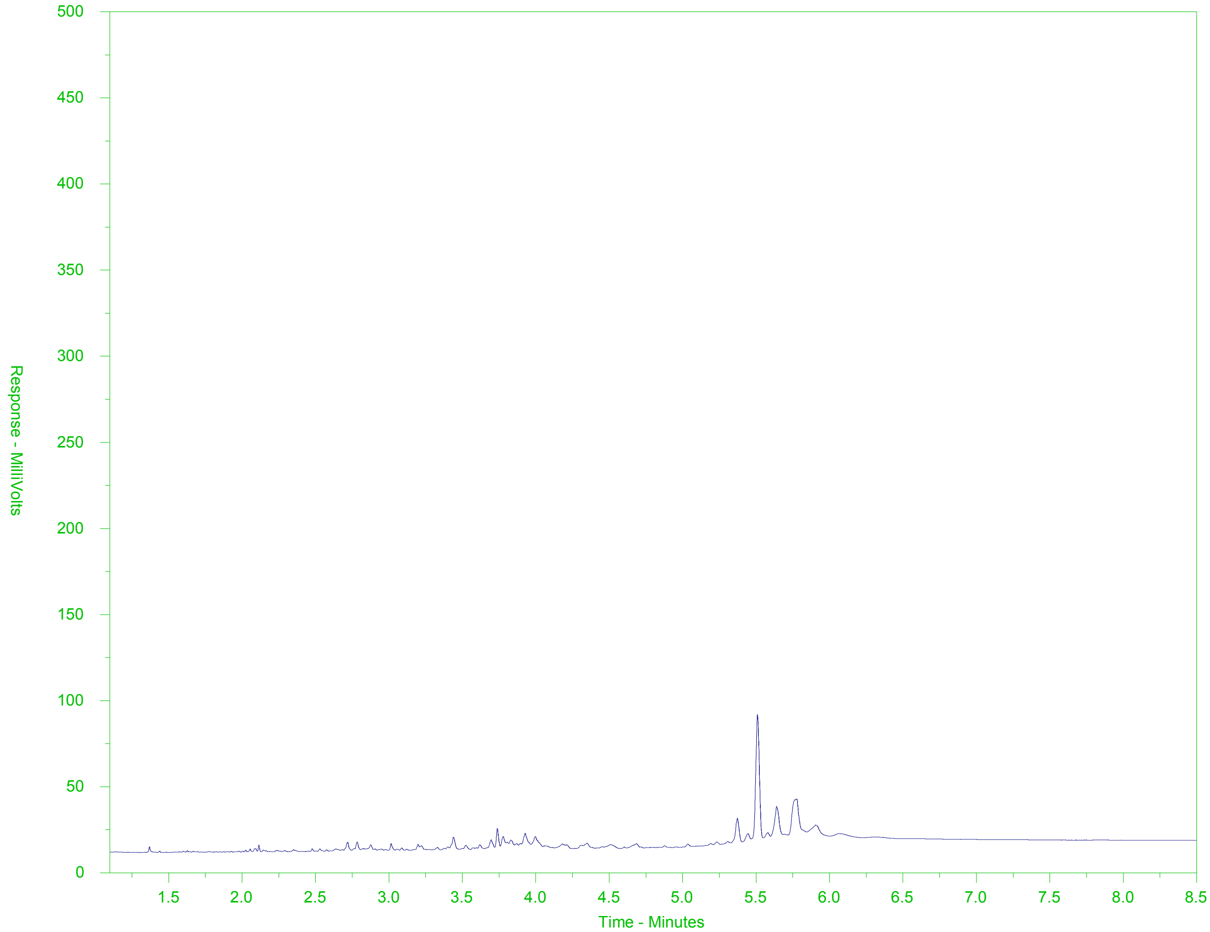
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-1
Client Sample ID: SW-3-1



← F2 →← F3 →← F4 →			
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

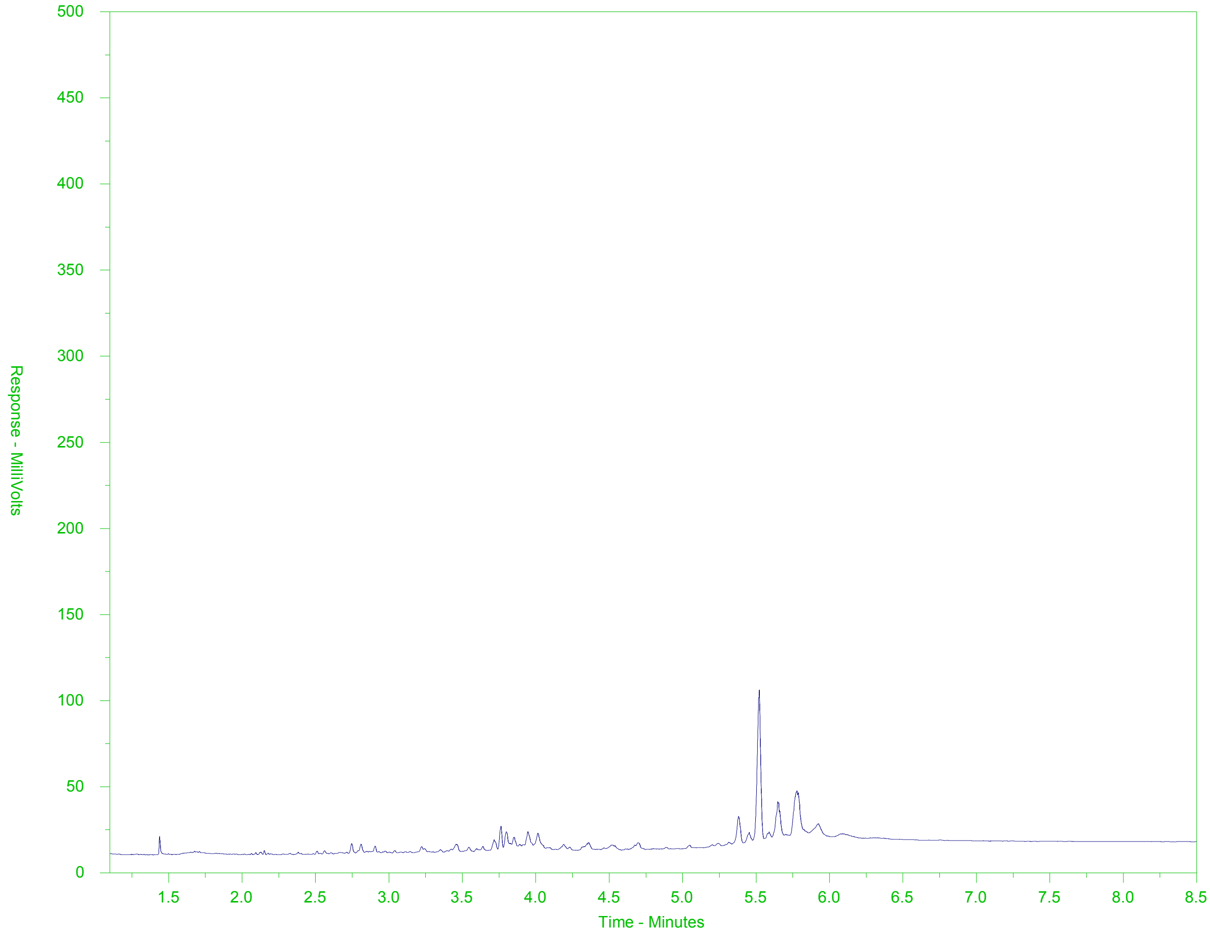
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG2598728-C-4#L1977406-C-1
Client Sample ID: SW-3-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

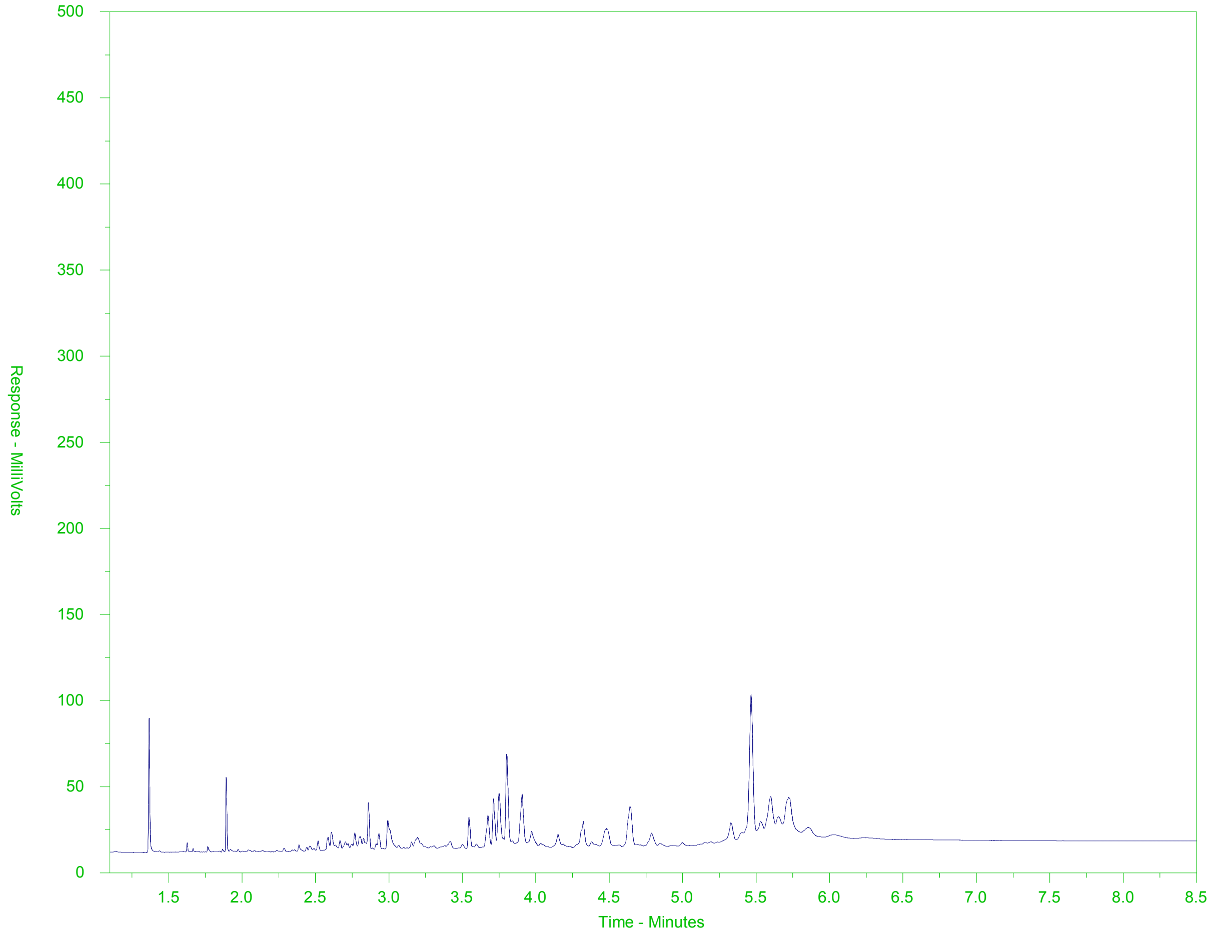
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-3
Client Sample ID: SW-2-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

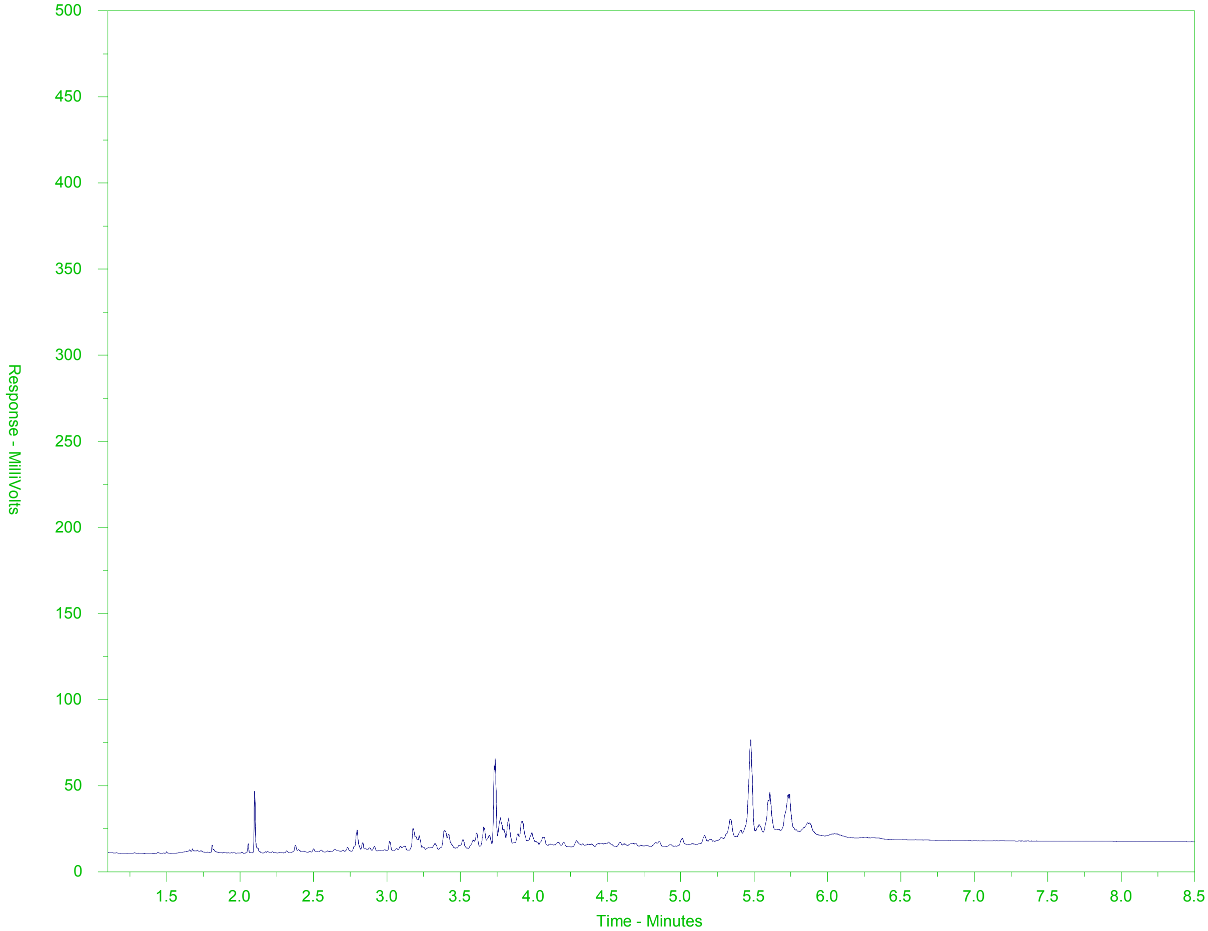
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-4
Client Sample ID: SC-4-1



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

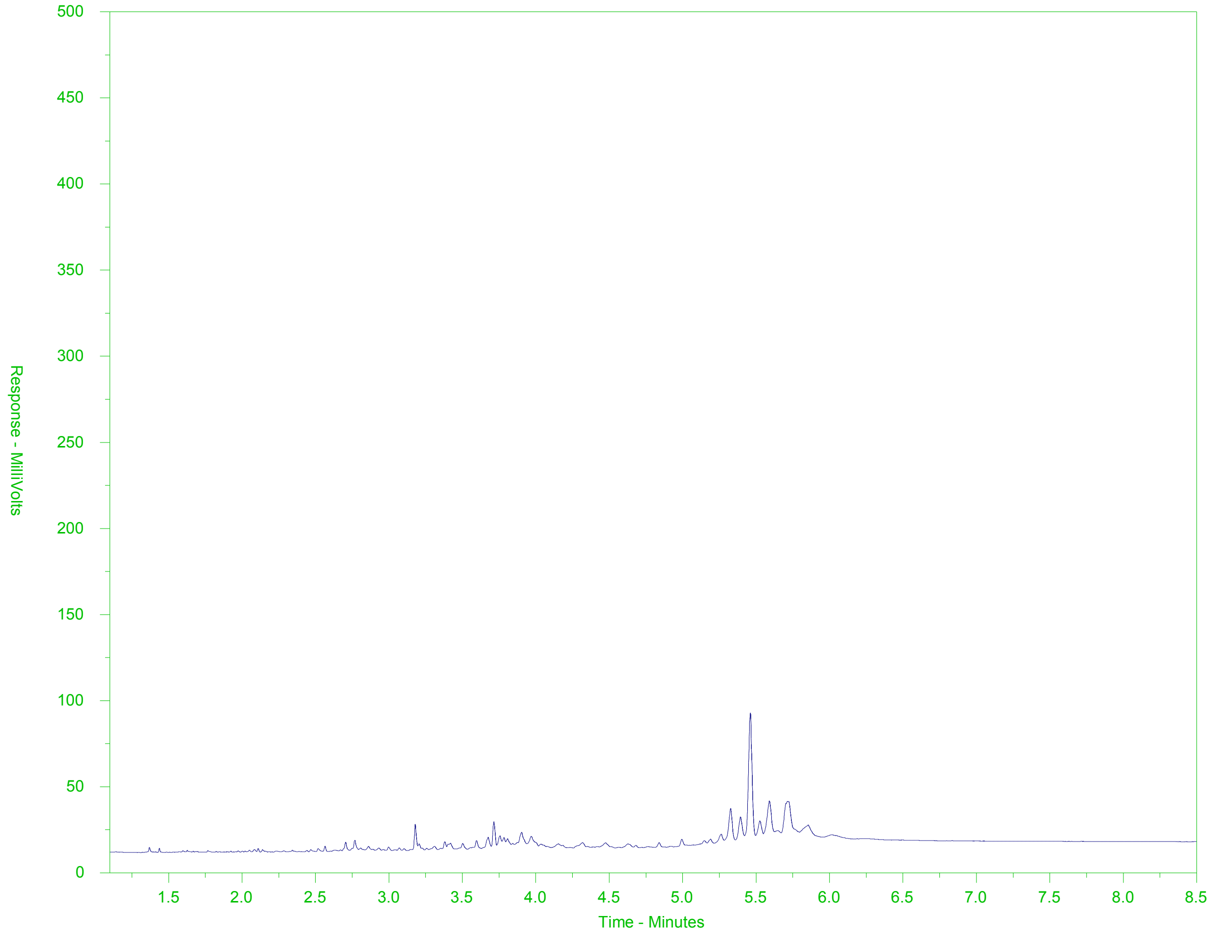
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-6
Client Sample ID: SC-5-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

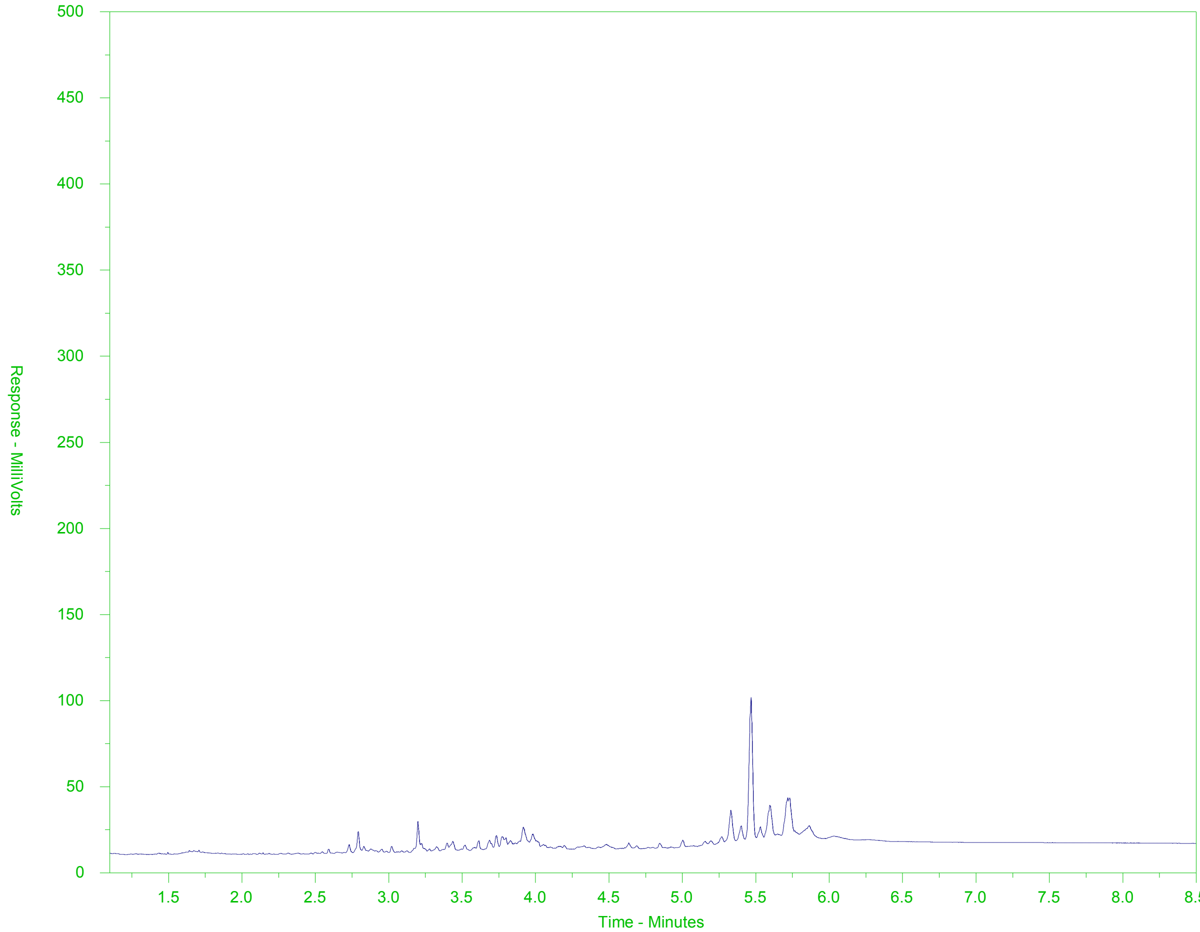
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-8
Client Sample ID: DUP-A



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

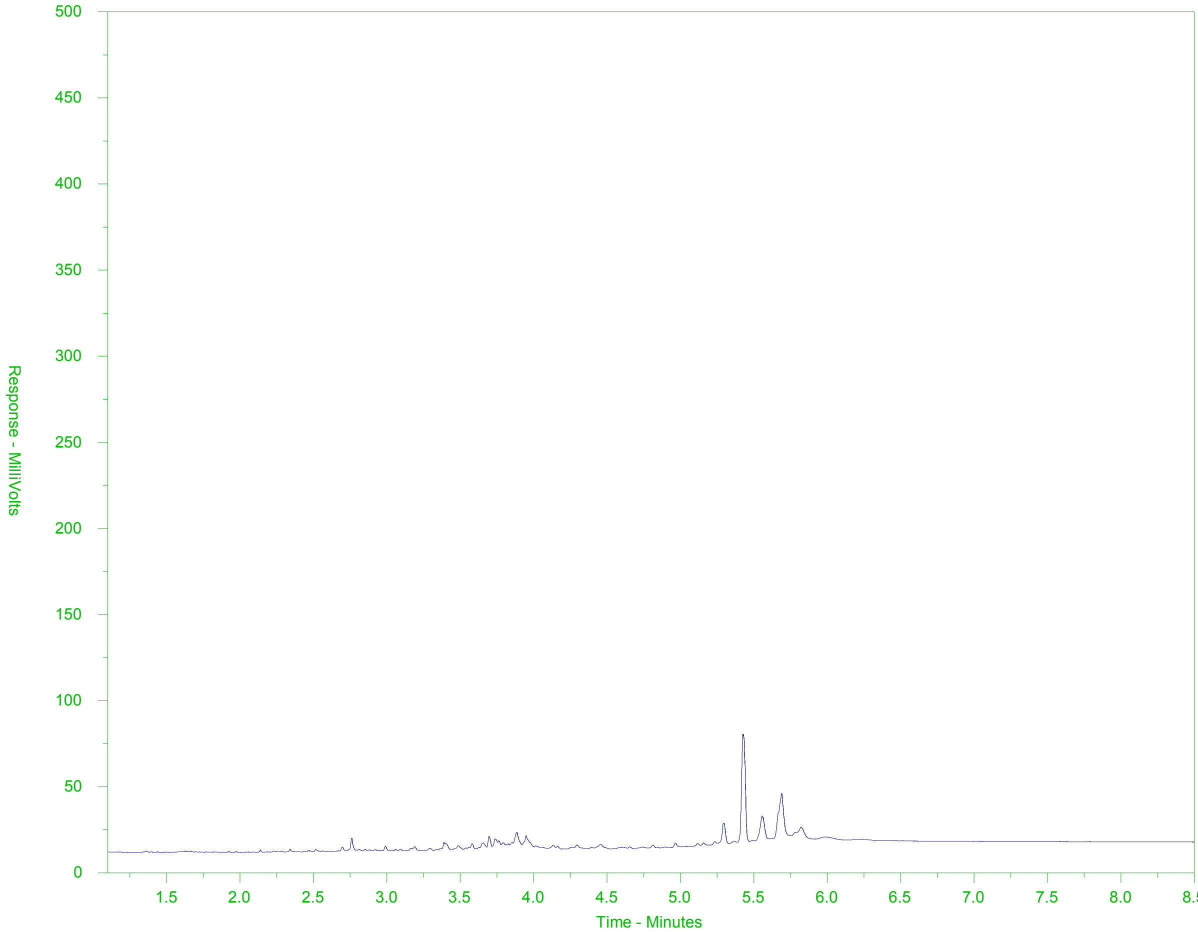
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-9
Client Sample ID: SW-5-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

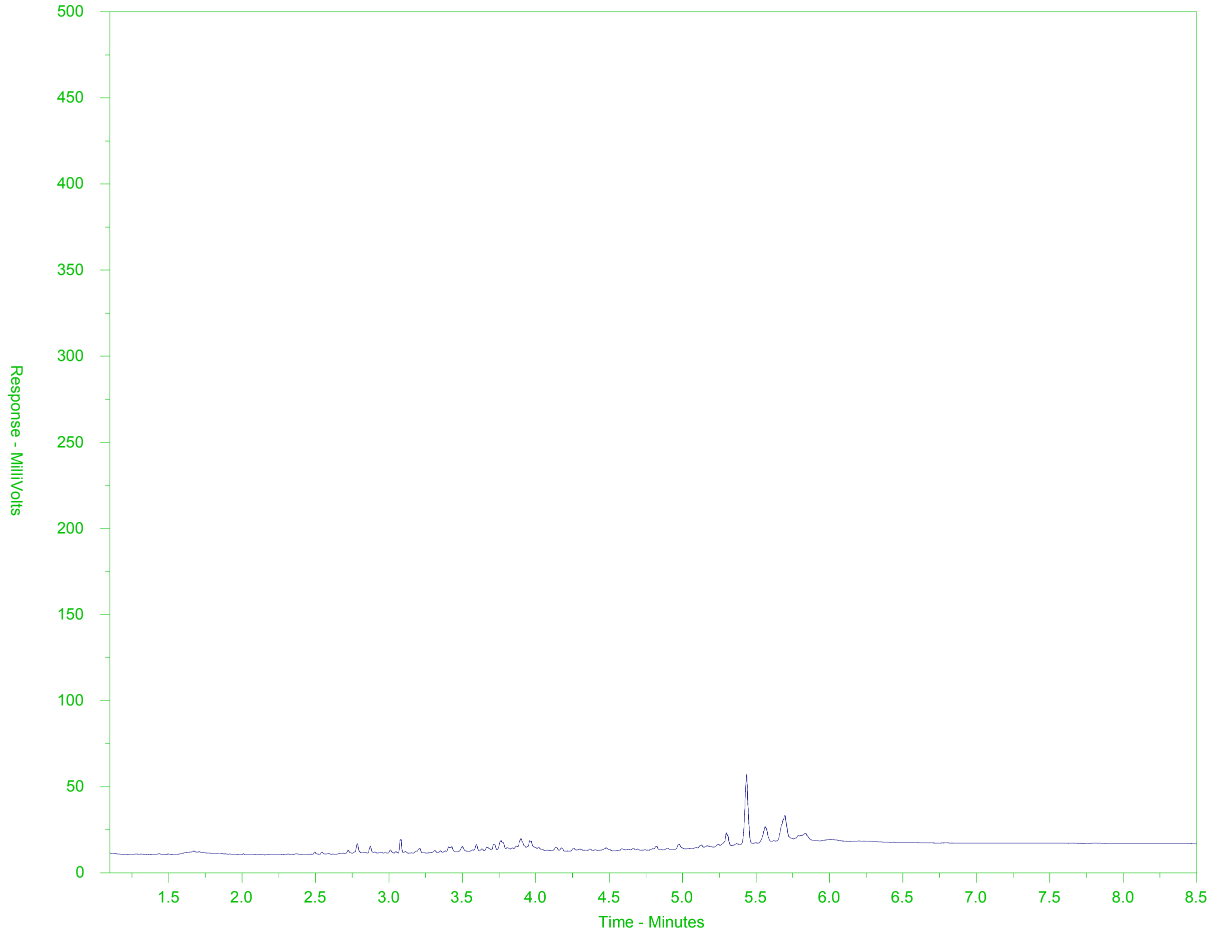
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-11
Client Sample ID: SN-4-1



F2		F3	F4
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F

←Gasoline→ ← Motor Oils/ Lube Oils/ Grease →

← Diesel/ Jet Fuels →

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

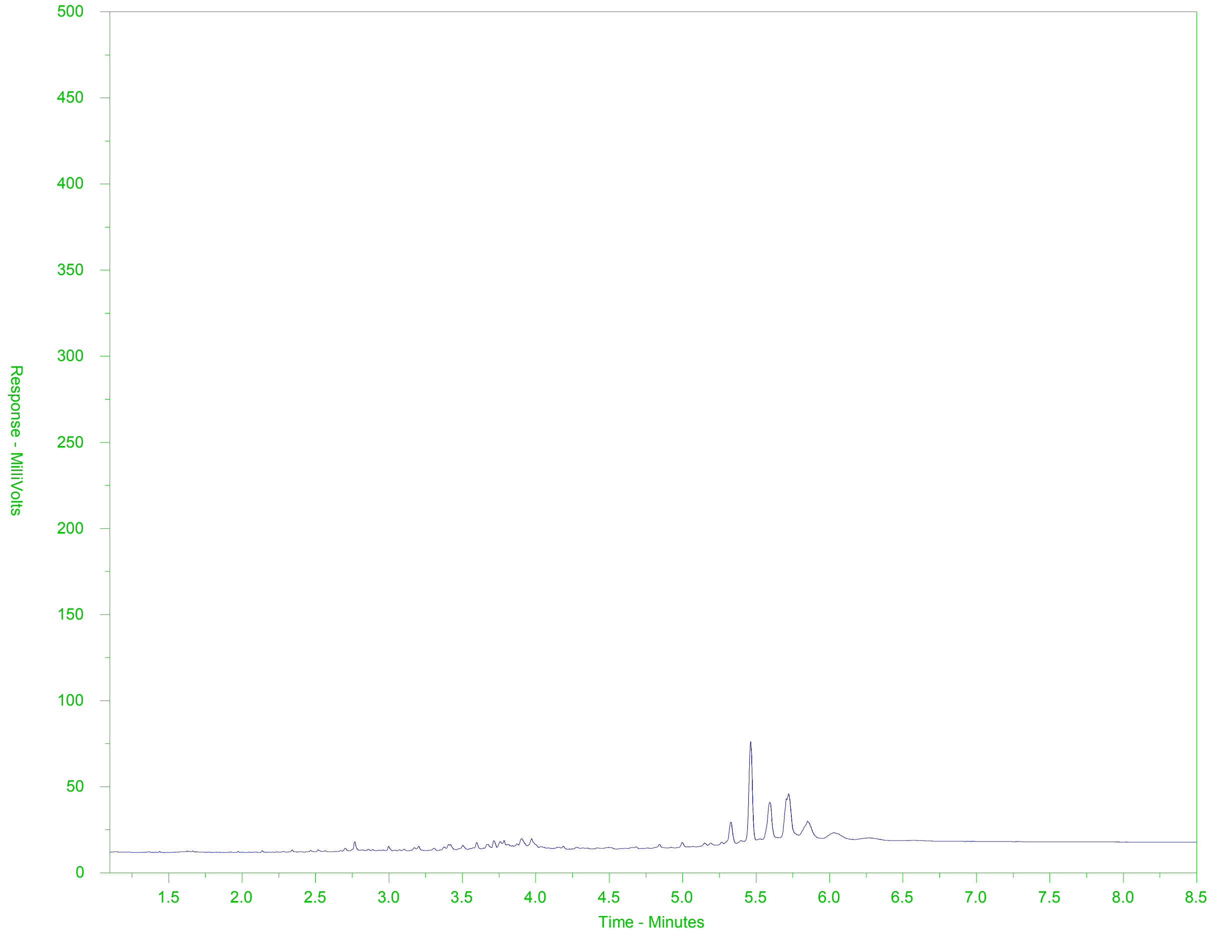
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-14
Client Sample ID: SN-3-1



← F2 →← F3 →← F4 →			
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→ ← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

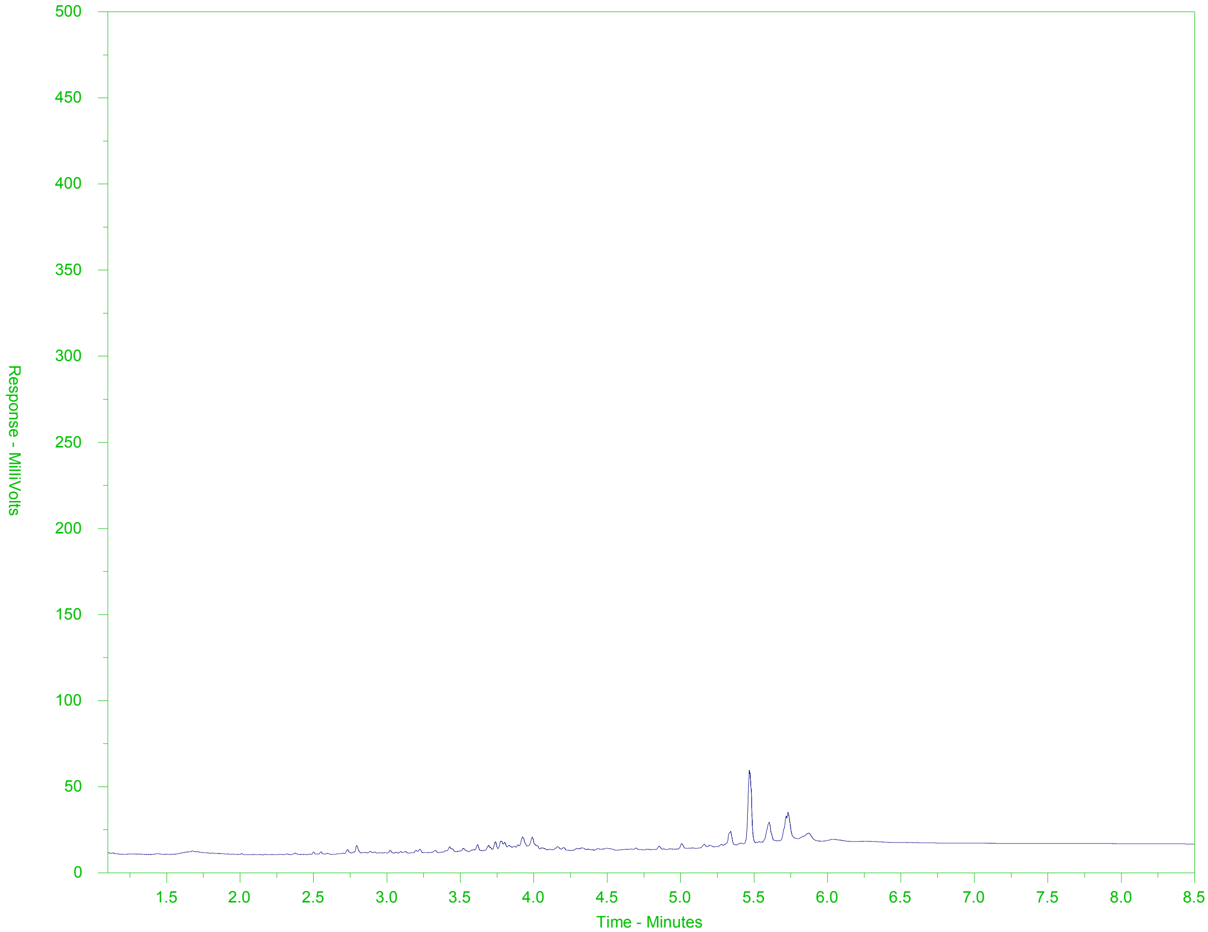
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-16
Client Sample ID: SN-2-1



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	←Motor Oils/ Lube Oils/ Grease→		
←Diesel/ Jet Fuels→			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

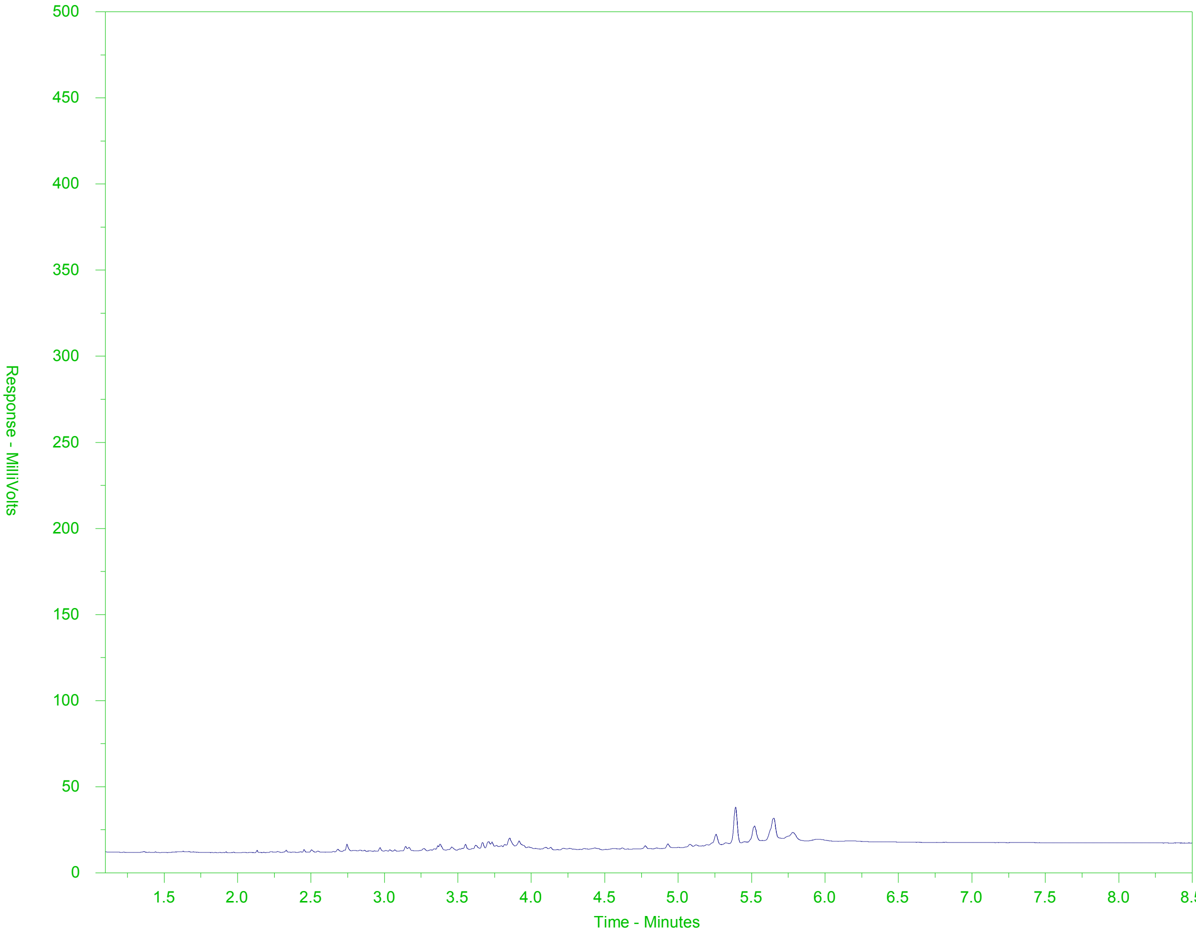
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-18
Client Sample ID: SN-1-1



← F2 →← F3 →← F4 →			
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→ ← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

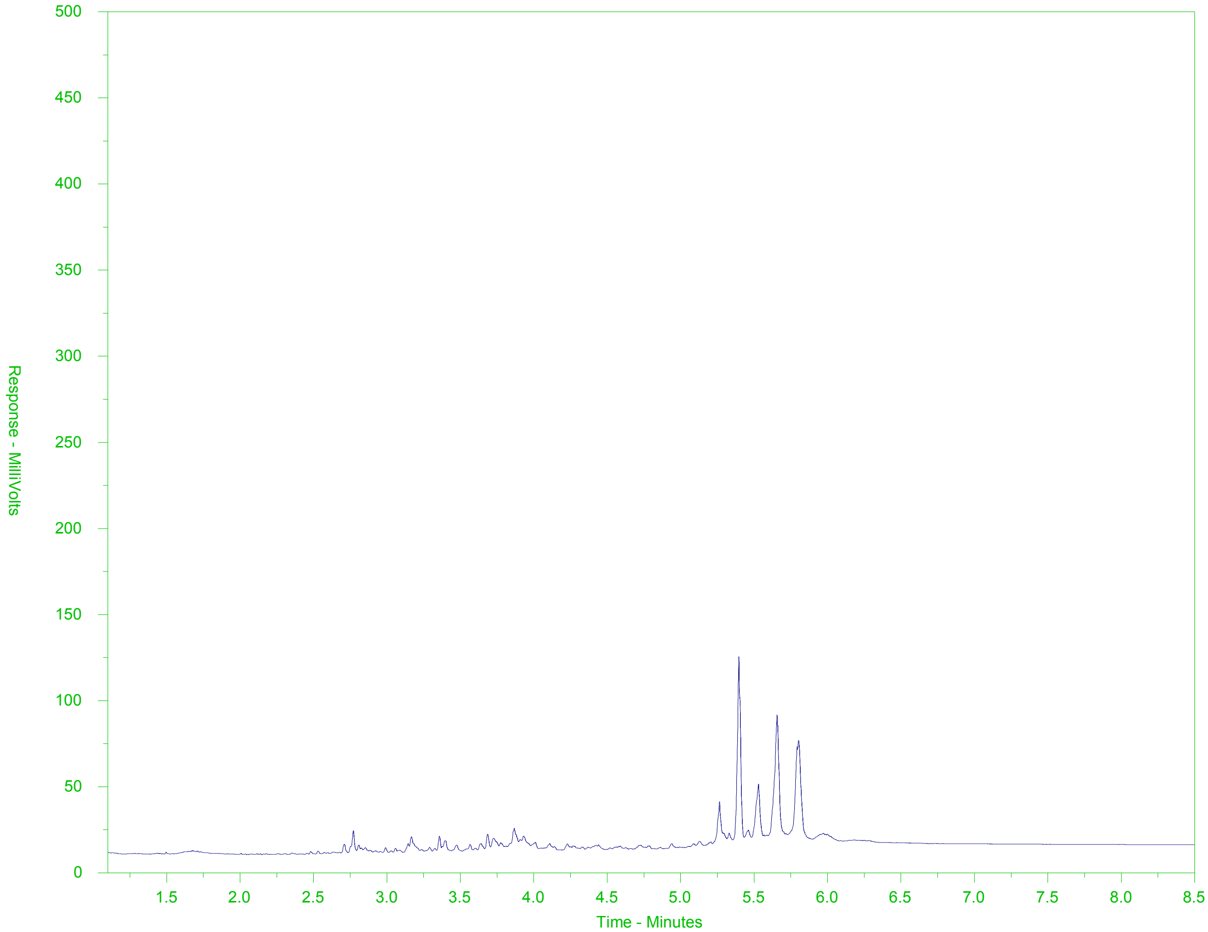
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-19
Client Sample ID: SE-5-1



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

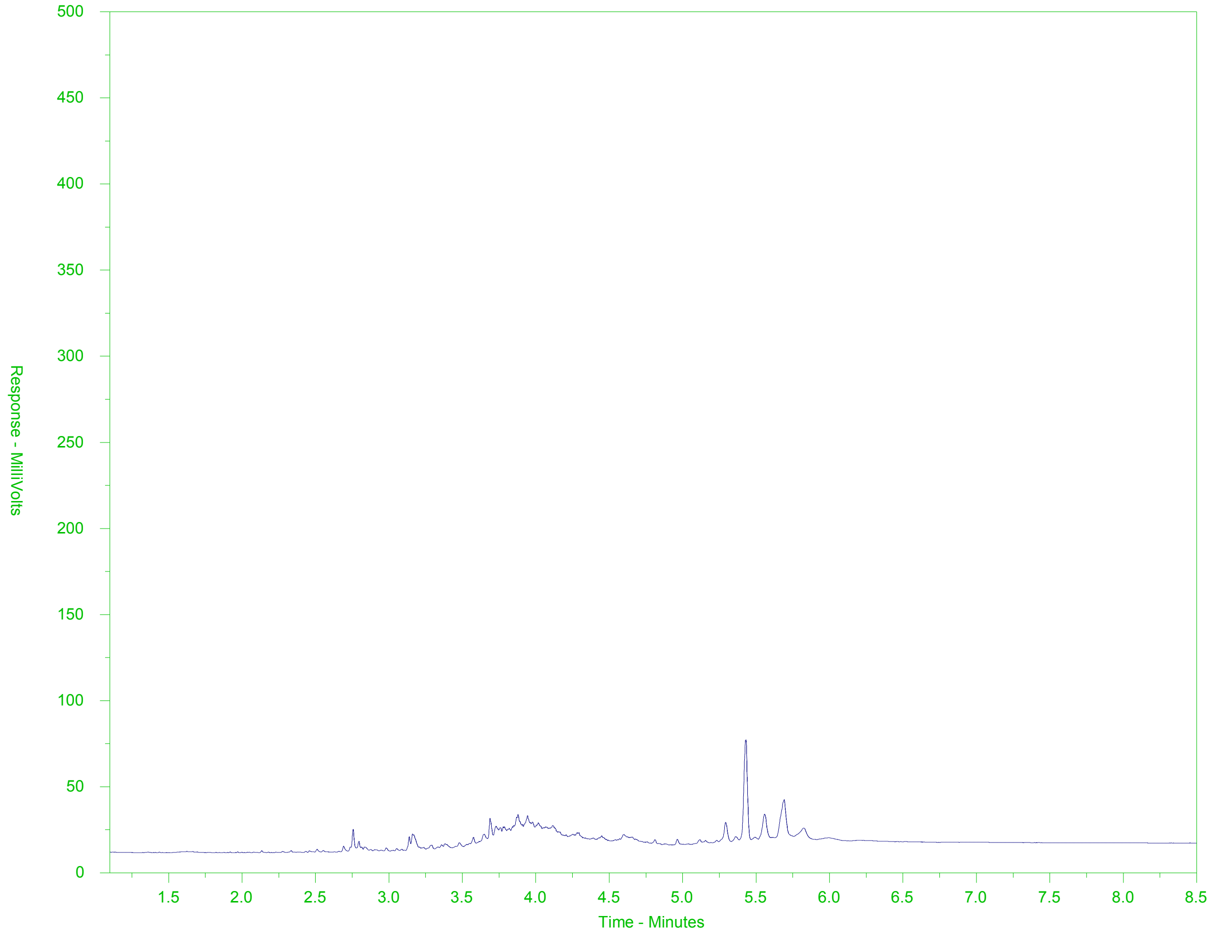
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-22
Client Sample ID: SE-4-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

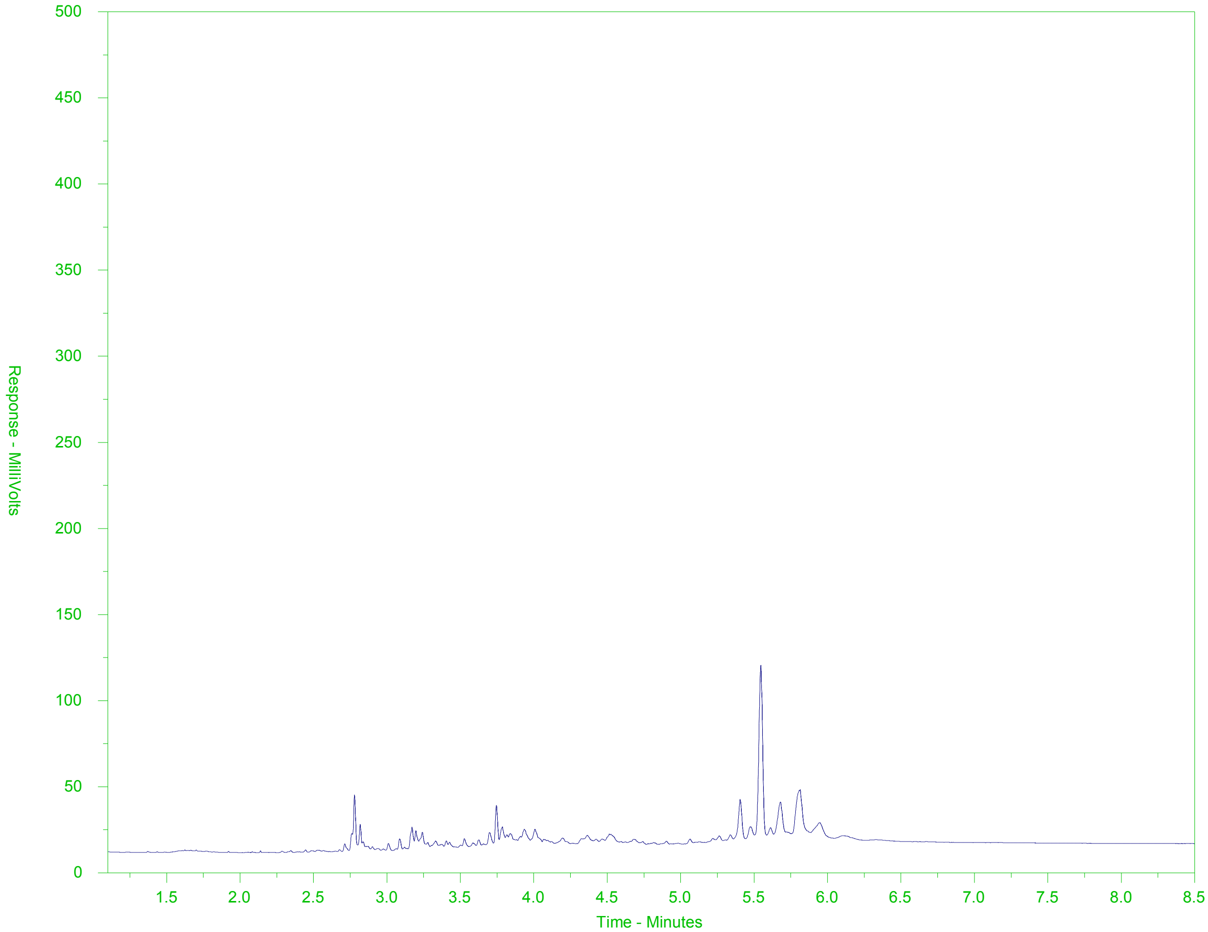
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-25
Client Sample ID: SC-2-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

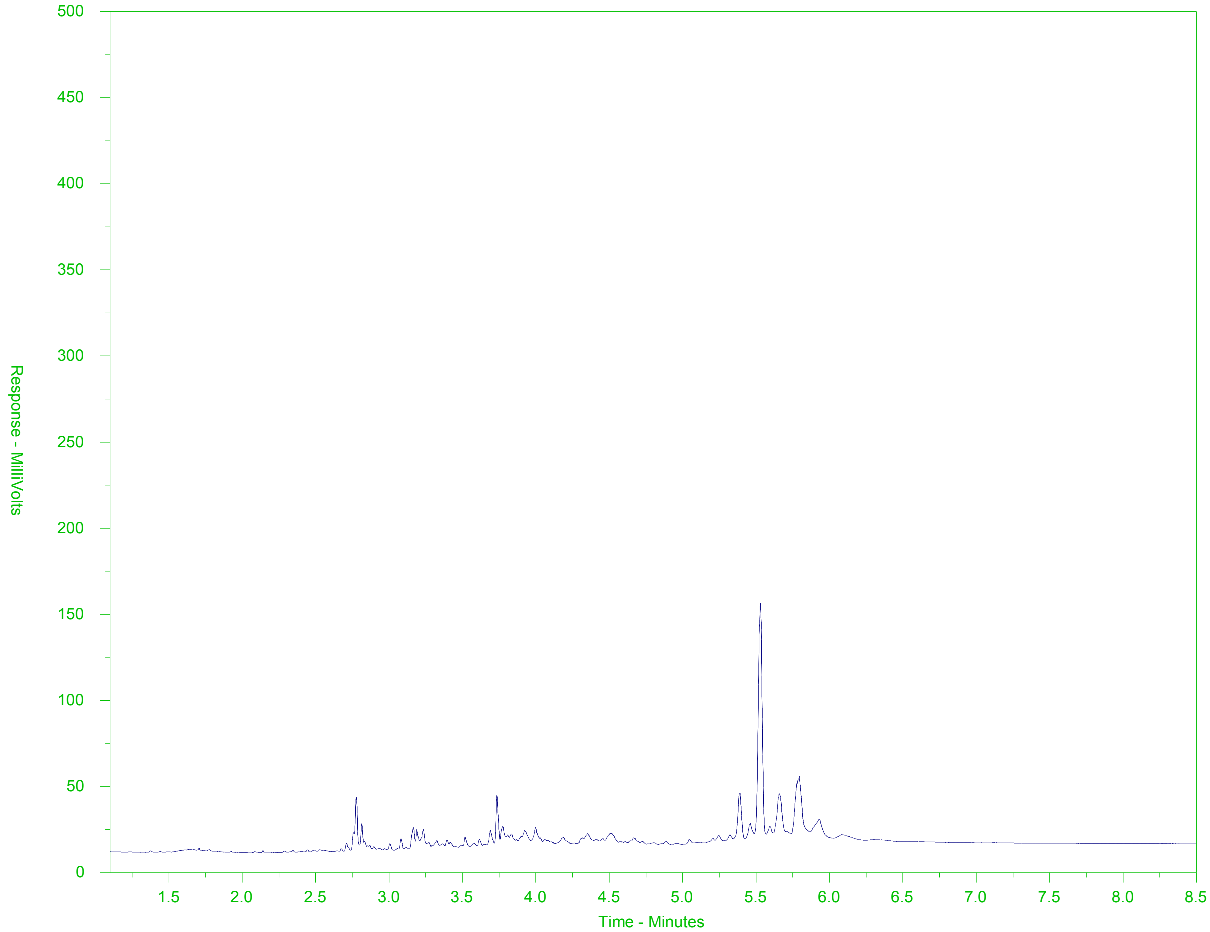
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WG2598814-C-4#L1977406-C-25
Client Sample ID: SC-2-1



← F2 →← F3 →← F4 →			
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

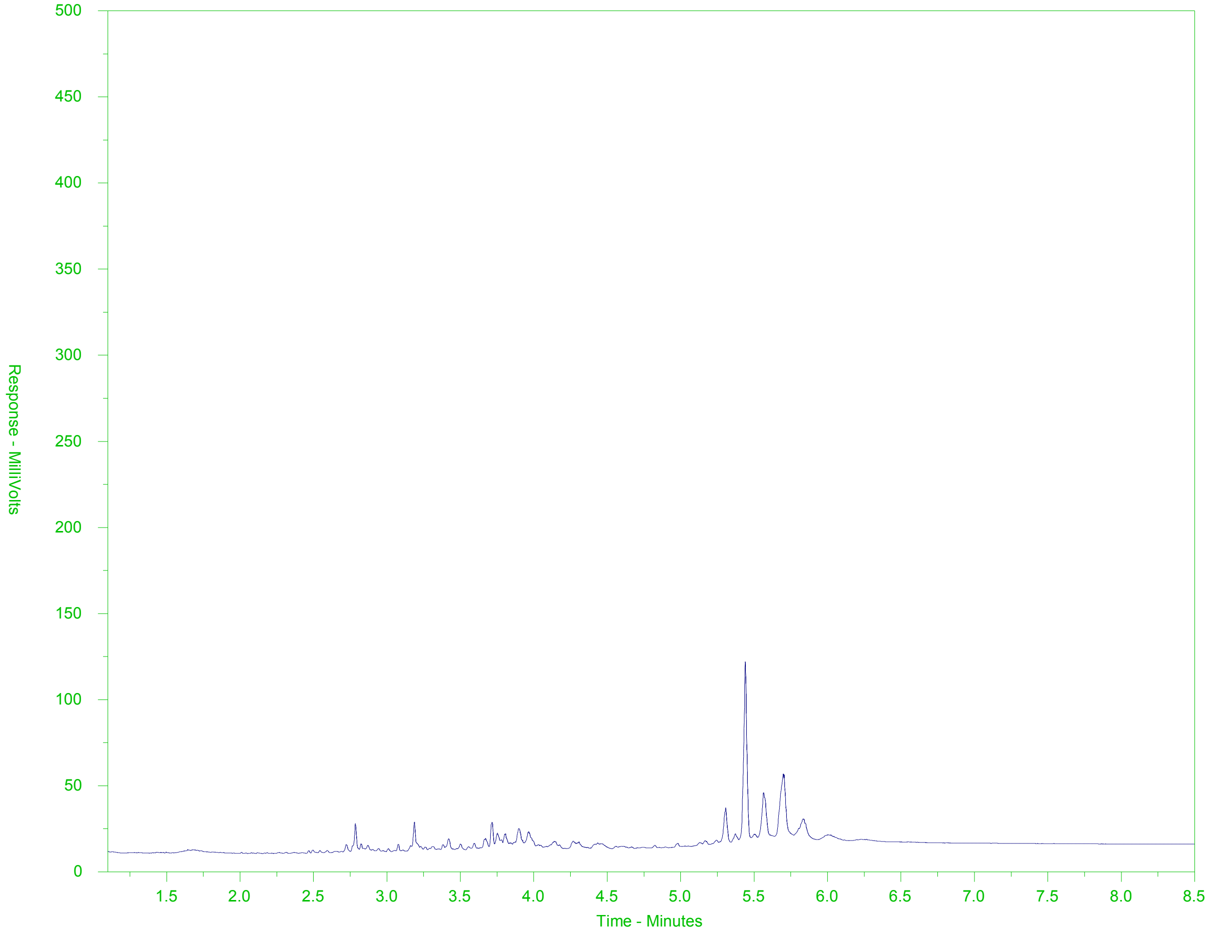
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-28
Client Sample ID: SC-3-1



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

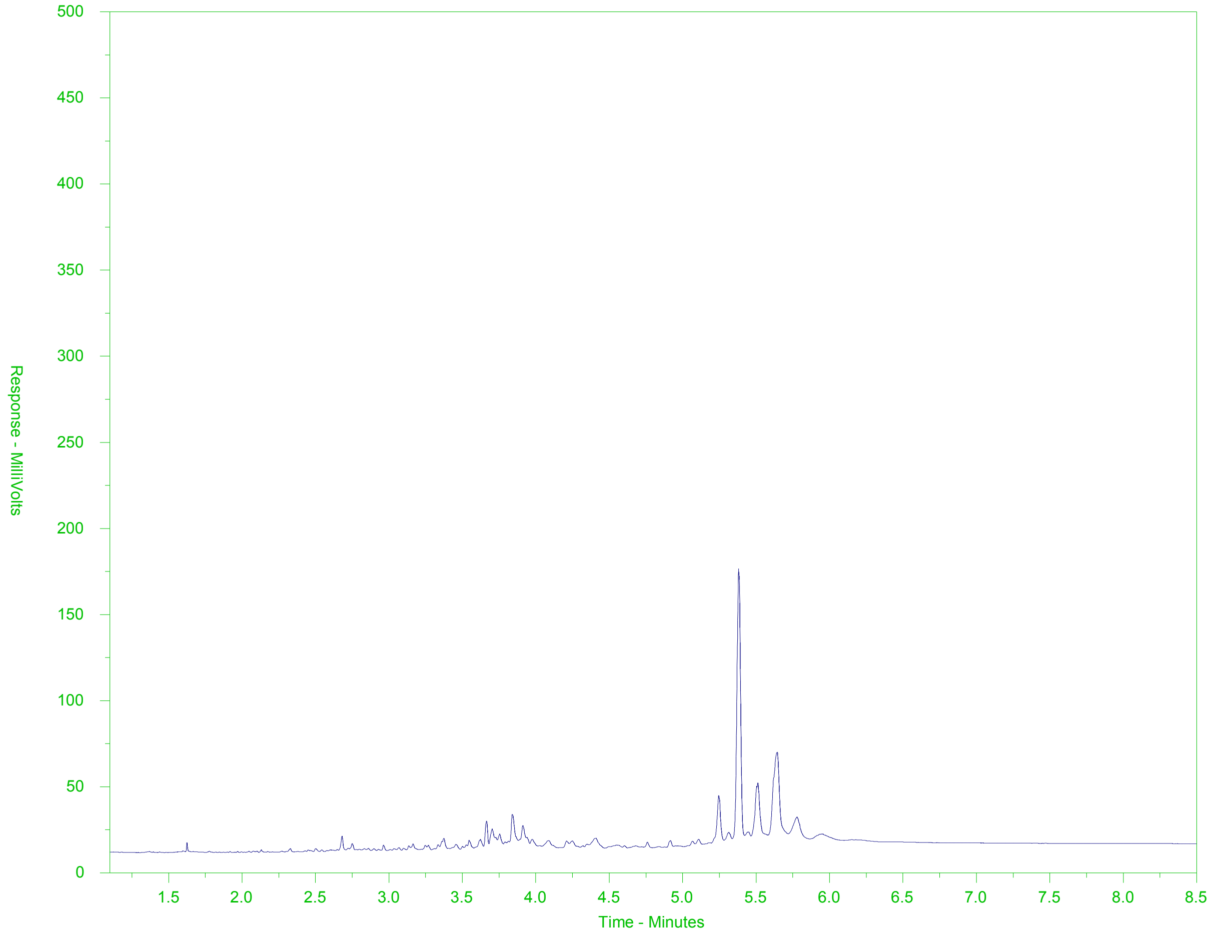
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-38
Client Sample ID: SW-5-1



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

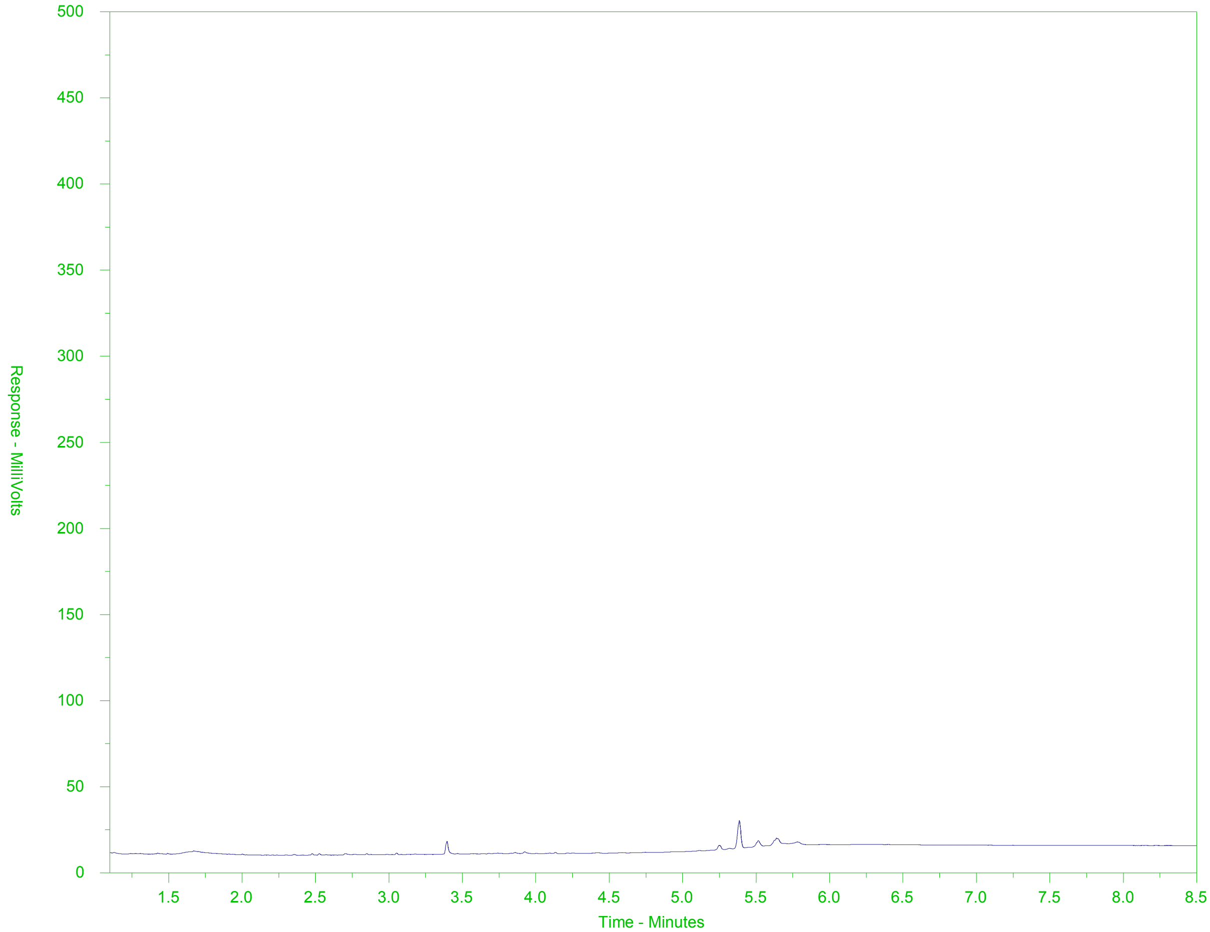
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-41
Client Sample ID: SW-1-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

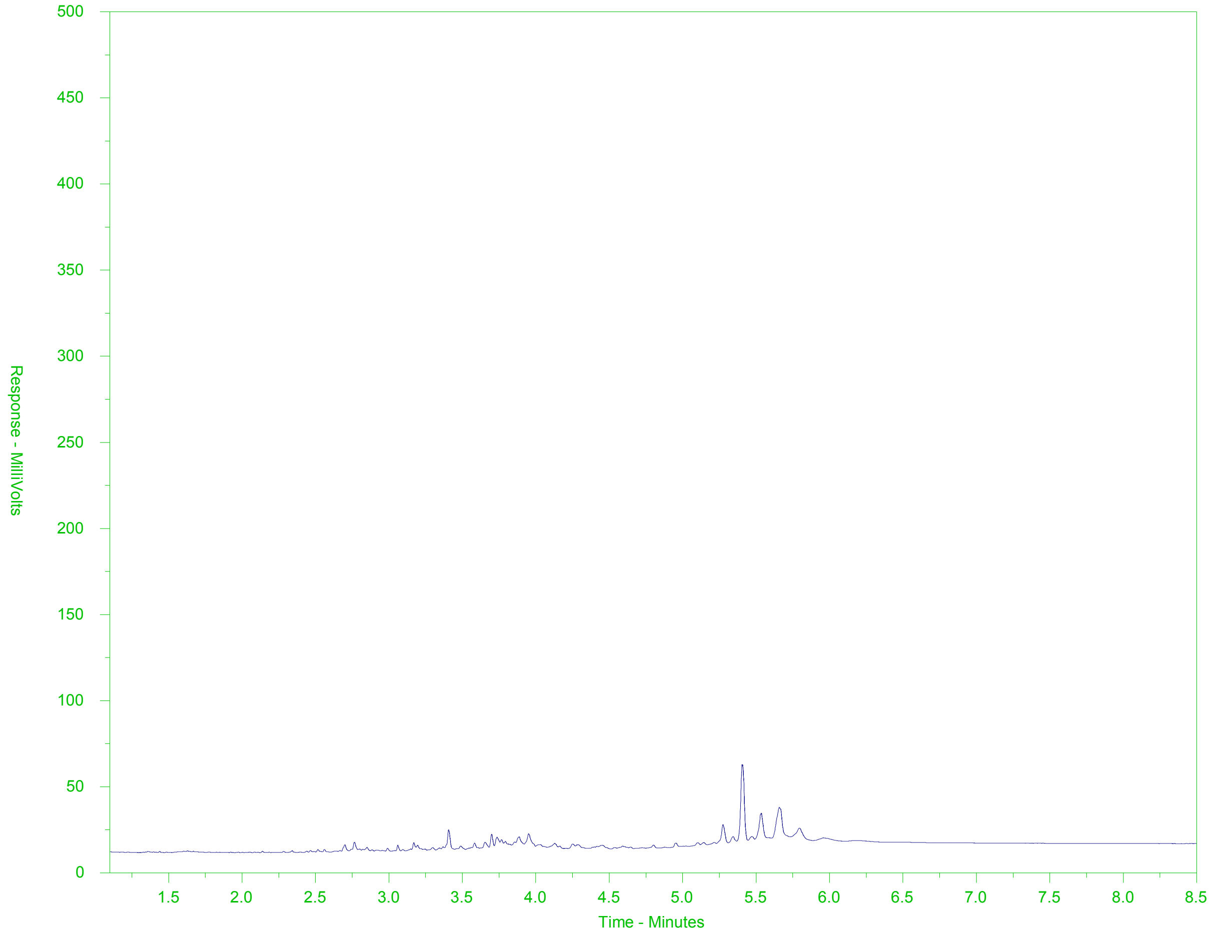
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-46
Client Sample ID: DUP F



← F2 →←	F3	→← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

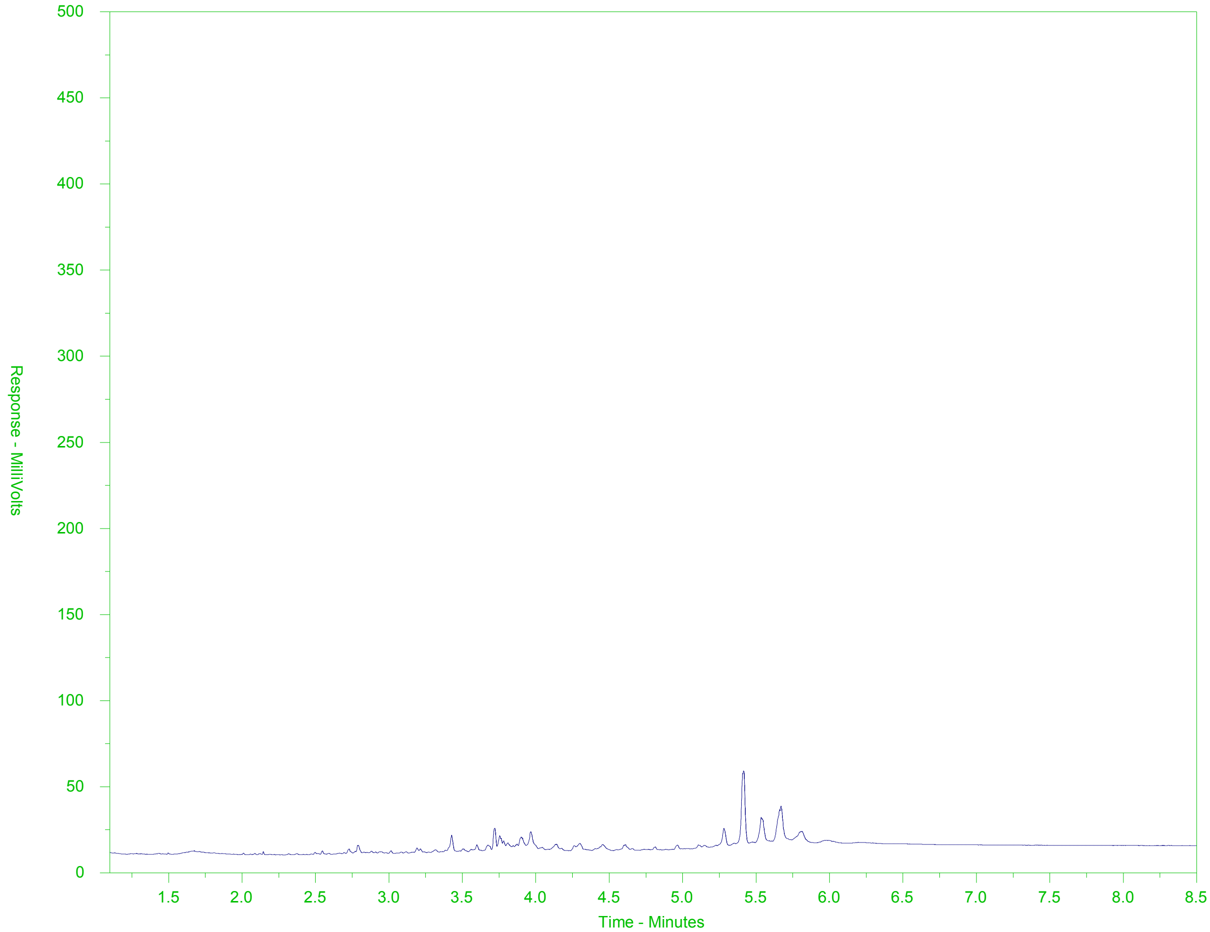
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-47
Client Sample ID: SE-1-1



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

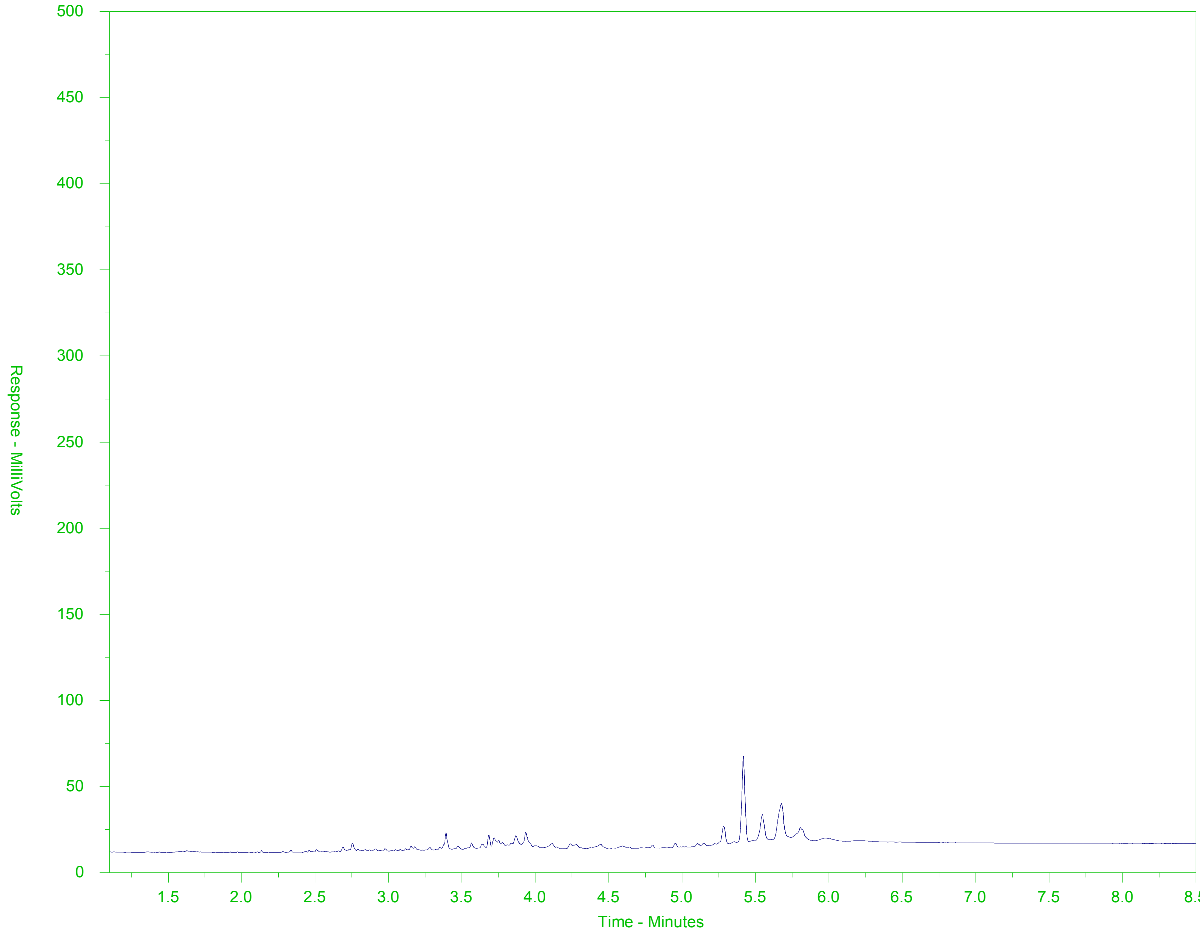
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-50
Client Sample ID: DUP E



← F2 →←	F3	→← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

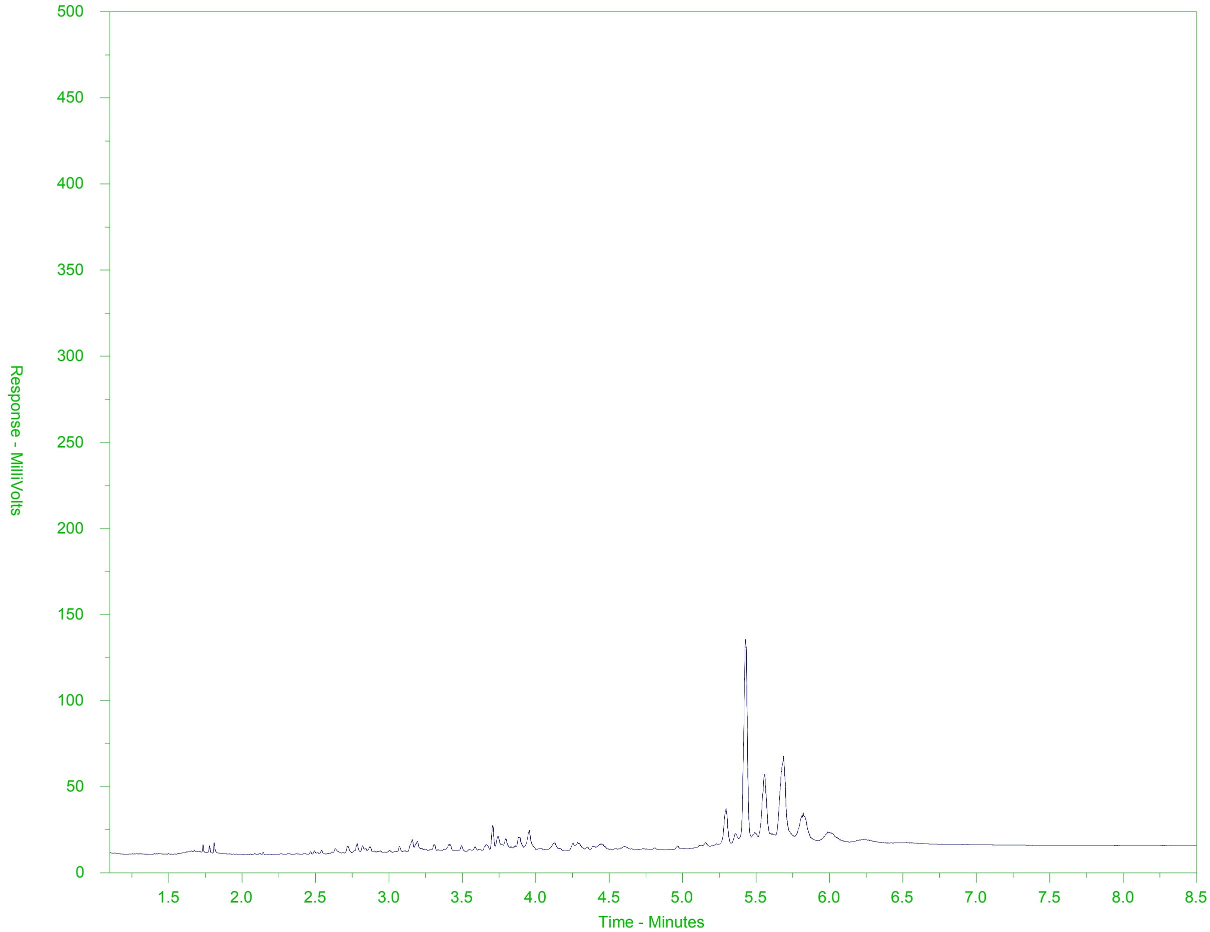
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-51
Client Sample ID: SE-2-1



← F2 →	← F3 →		← F4 →	
nC10	nC16	nC34	nC50	
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F	
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →				

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

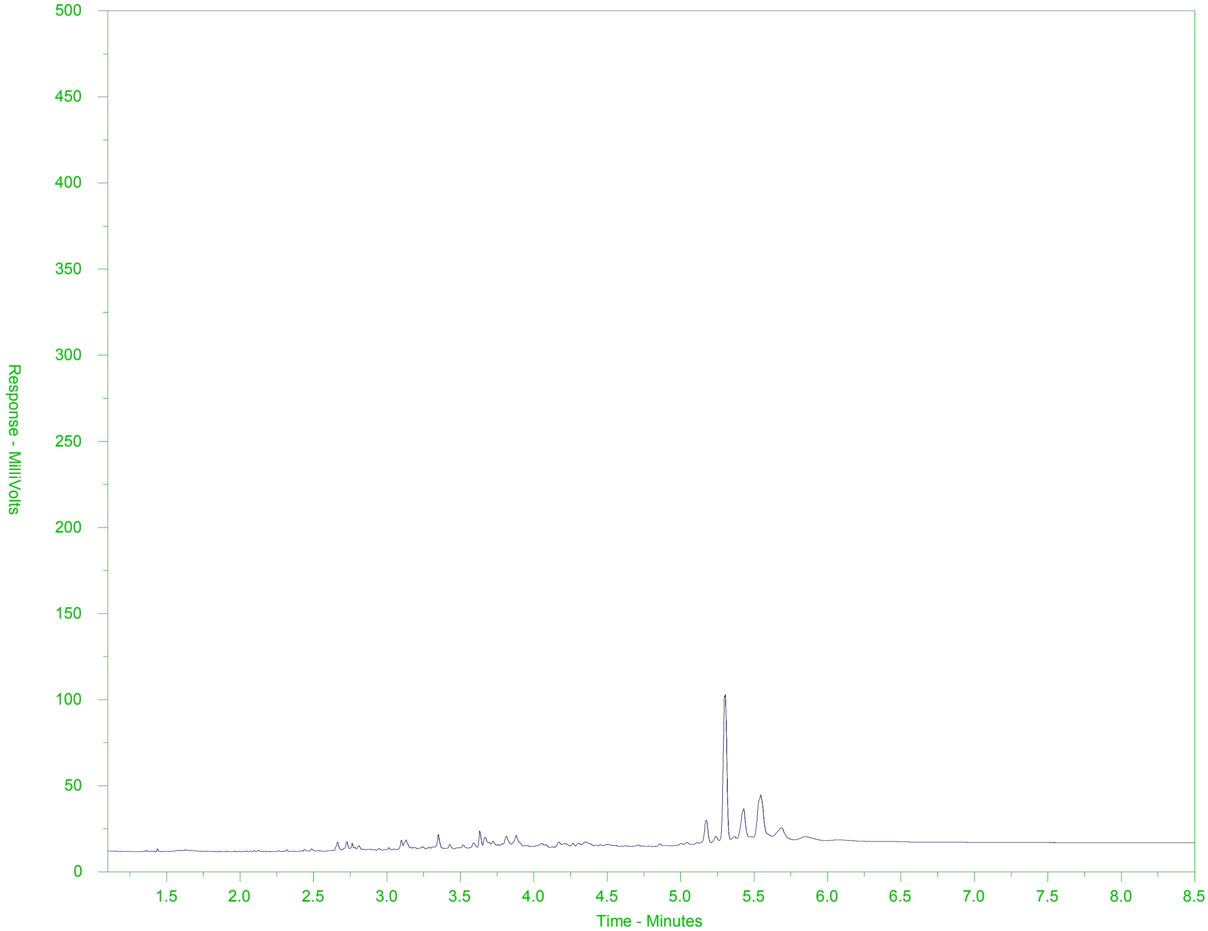
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-54
Client Sample ID: DUP D



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

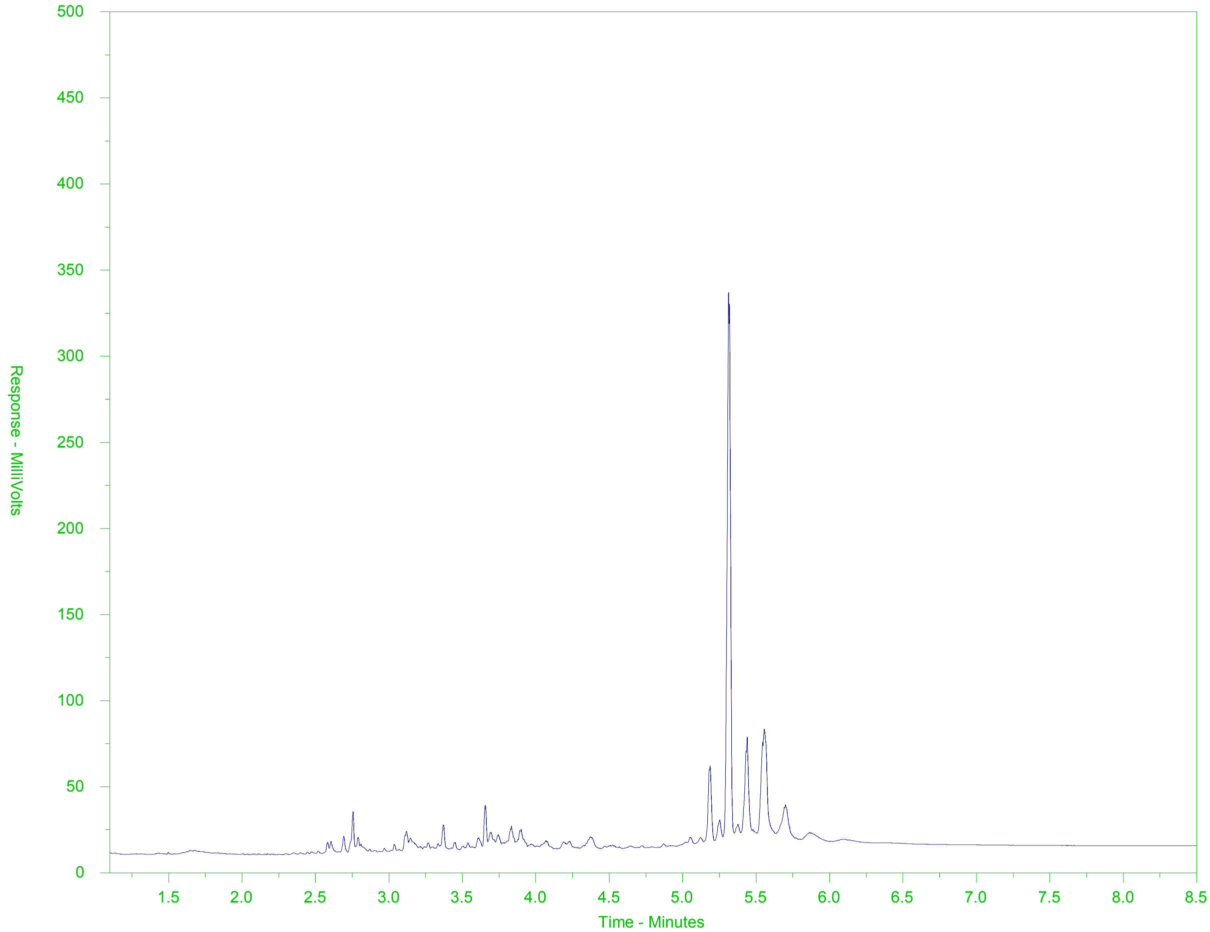
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-55
Client Sample ID: SE-3-1



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

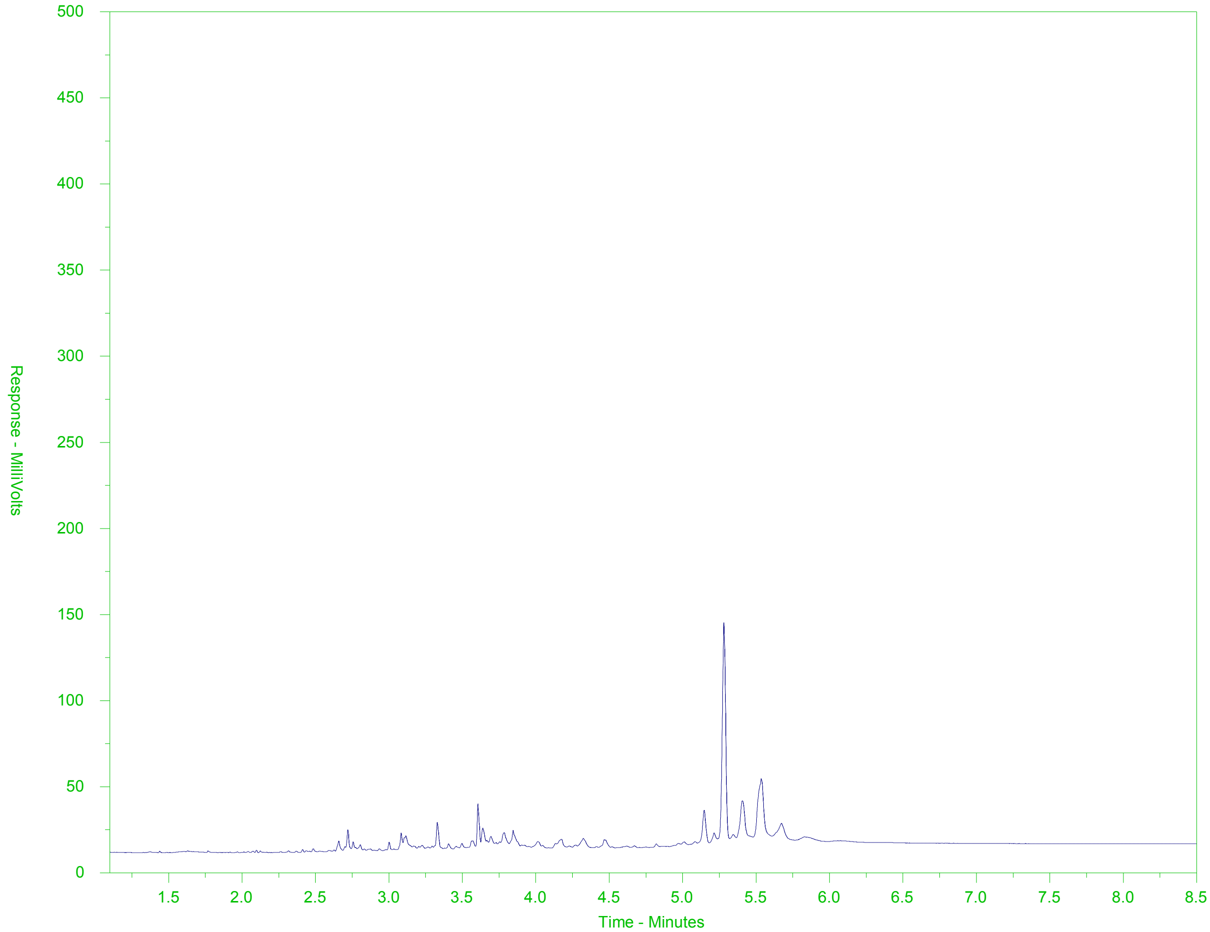
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-58
Client Sample ID: DUP C



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
←Gasoline→	←Motor Oils/ Lube Oils/ Grease→		
←Diesel/ Jet Fuels→			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

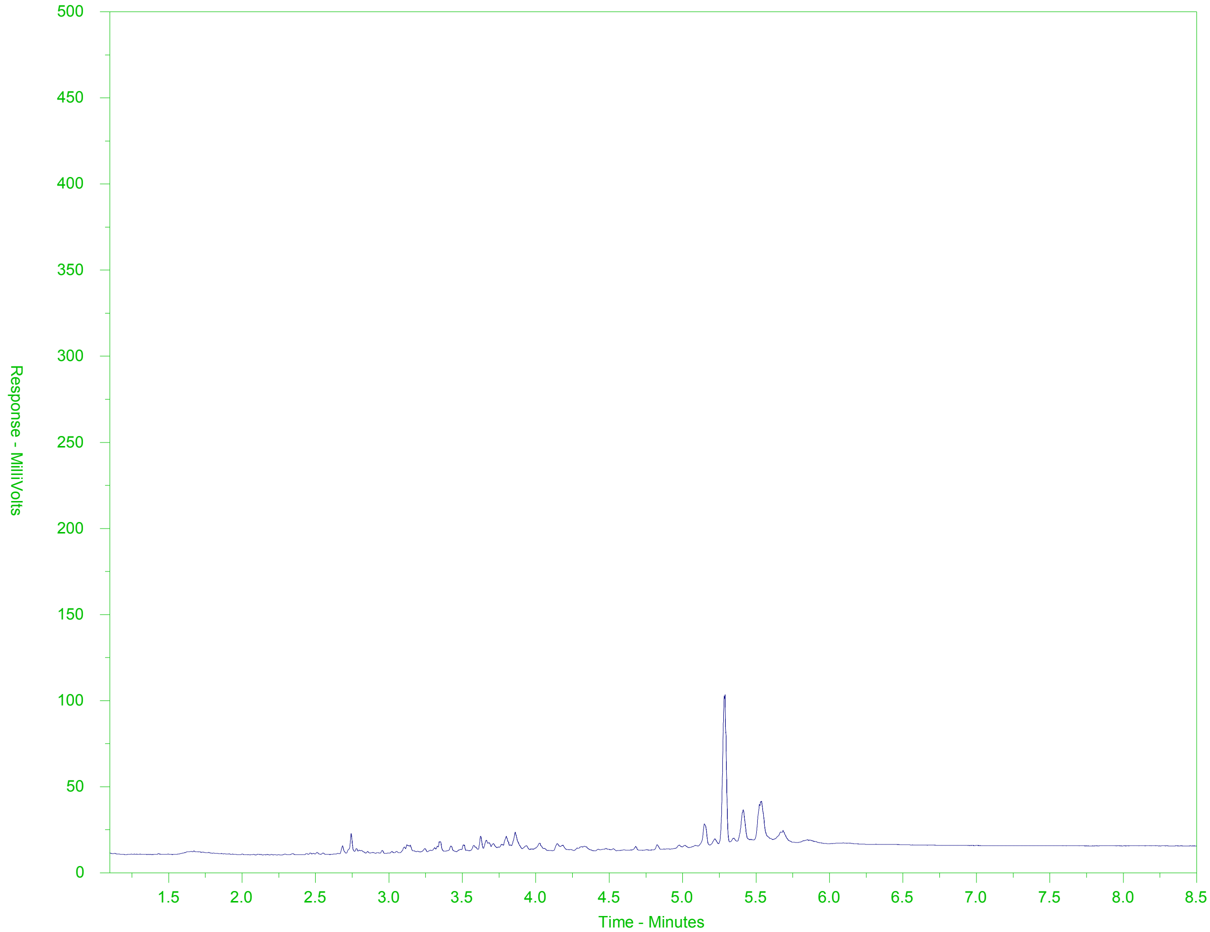
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-59
Client Sample ID: SW-4-1



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

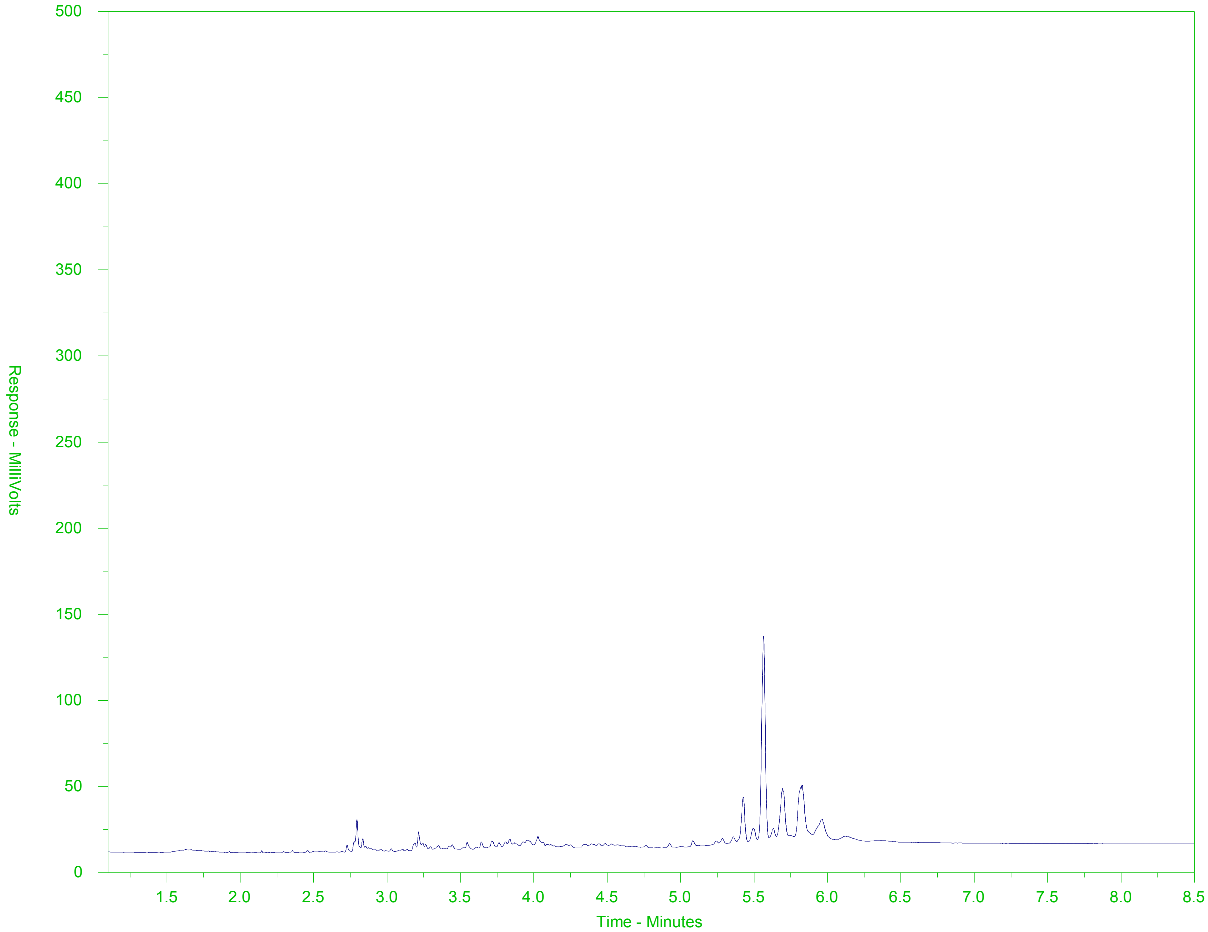
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1977406-C-61
Client Sample ID: DUP B



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

APPENDIX C-1

Chain of Custody (COC) / Analytical Request Form

SEDIMENT ANALYTICAL DATA

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1977406-COFC

COC Number: 15 - XXXXXX

Report To	Contact and company name below will appear on the final report
Company:	Golder Associatex Ltd.
Contact:	John Sherrin / Arman Ospan
Phone:	1 (250) 881 7372
	Company address below will appear on the final report
Street:	2nd floor 3795 Carey Rd.
City/Province:	Victoria BC
Postal Code:	V8Z 6T8
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	
Contact:	

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: jsherrin@golder.com

Email 2: aospan@golder.com

Email 3: mspani@golder.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax:

Email 2:

Turnaround Time (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.

Project Information

ALS Account # / Quote #: BR191034

Job #: 1663724/10000/1003

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:

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	Particle size distribution (Wentworth and phi	Organic and inorganic carbon	Available metals (extractable)	Total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene)	Hold for hydrocarbon analysis									Number of Containers
	SE-1-3	13-Aug-17	13:33	Sediment	X	X	X		X									5
	DUP E	13-Aug-17	13:33	Sediment				X										5
	SE-2-1	13-Aug-17	12:00	Sediment				X										5
	SE-2-2	13-Aug-17	12:00	Sediment					X									5
	SE-2-3	13-Aug-17	12:00	Sediment					X									5
	DUP D	13-Aug-17	12:00	Sediment				X										5
	SE-3-1	13-Aug-17	10:11	Sediment				X										5
	SE-3-2	13-Aug-17	10:11	Sediment					X									5
	SE-3-3	13-Aug-17	10:11	Sediment					X									5
	DUP C	13-Aug-17	10:11	Sediment				X										5
	SW-4-1	13-Aug-17	15:15	Sediment				X										5
	SW-4-2	13-Aug-17	15:15	Sediment					X									5
	DUP B	12-Aug-17	12:33	Sediment				X										5
	SW-2-3	13-Aug-17	14:25	Sediment					X									5
	SW-4-3	13-Aug-17	15:15	Sediment					X									5

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)

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

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Michelle Spani	Date:	Received by: Shayan	Date: Aug. 18	Time: 920	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.

temp: 15.6, 9.3, 4.9, 8.8, 6.6, 14.2, 5.8

ALS

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1977406-COFC

COC Number: 15 - XXXXXX

Page 4 of 5

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	
Company:	Golder Associatex Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Contact:	John Sherrin / Arman Ospan	Quality Control (QC) Report with Report	☑ YES ☐ NO
Phone:	1 (250) 881 7372	☐ 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:	2nd floor 3795 Carey Rd.	Email 1 or Fax	jsherrin@golder.com
City/Province:	Victoria BC	Email 2	aospan@golder.com
Postal Code:	V8Z 6T8	Email 3	mspani@golder.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:		Email 1 or Fax	
Contact:		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:

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

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	BR191034	AFE/Cost Center:	PO#
Job #:	1663724/10000/1003	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

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	Particle size distribution (Wentworth and phi	Organic and inorganic carbon	Available metals (extractable)	Total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene)	Hold for hydrocarbon analysis	Number of Containers
	SN-1-3	12-Aug-17	9:11	Sediment	X	X	X		X	5
	SW-5-1	13-Aug-17	16:10	Sediment				X		5
	SW-5-2	13-Aug-17	16:10	Sediment					X	5
	SW-5-3	13-Aug-17	16:10	Sediment					X	5
	SW-1-1	13-Aug-17	15:22	Sediment				X		5
	SW-1-2	13-Aug-17	15:22	Sediment					X	5
	SW-1-3	13-Aug-17	15:22	Sediment					X	5
	SW-3-2	13-Aug-17	14:30	Sediment					X	5
	SW-3-3	13-Aug-17	14:30	Sediment					X	5
	DUP F	13-Aug-17	14:30	Sediment				X		5
	SE-1-1	13-Aug-17	13:33	Sediment				X		5
	SE-1-2	13-Aug-17	13:33	Sediment					X	5

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)

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

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Michelle Spani	Date:	Received by: Shayan	Date: Aug 18	Time: 920	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**.

temp: 15.6, 9.3, 4.9, 8.8, 6.6, 14.2, 5.8

APPENDIX C-1
SEDIMENT ANALYTICAL DATA

Chain of Custody (COC) / Analytical Request Form

L1977406-COFC

COC Number: 15 - XXXXXX

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	
Company:	Golder Associatex Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Contact:	John Sherrin / Arman Ospan	Quality Control (QC) Report with Report	☑ YES ☐ NO
Phone:	1 (250) 881 7372	☐ 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:	2nd floor 3795 Carey Rd.	Email 1 or Fax	jsherrin@golder.com
City/Province:	Victoria BC	Email 2	aospan@golder.com
Postal Code:	V8Z 6T8	Email 3	mspani@golder.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:		Email 1 or Fax	
Contact:		Email 2	
Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	BR191034	AFE/Cost Center:	PO#
Job #:	1663724/10000/1003	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Select Service Level Below ... m 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] ☐
	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	Particle size distribution (Wentworth and phi)	Organic and inorganic carbon	Available metals (extractable)	Total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene)	Hold for hydrocarbon analysis									Number of Containers
	SC-2-1	12-Aug-17	13:51	Sediment	X	X	X	X										5
	SC-2-2	12-Aug-17	13:51	Sediment					X									5
	SC-2-3	12-Aug-17	13:51	Sediment					X									5
	SC-3-1	12-Aug-17	12:33	Sediment				X										5
	SC-3-2	12-Aug-17	12:33	Sediment					X									5
	SC-3-3	12-Aug-17	12:33	Sediment														5
	SC-4-3	12-Aug-17	11:36	Sediment														5
	SC-5-3	12-Aug-17	11:09	Sediment														5
	SN-5-3	12-Aug-17	10:43	Sediment														5
	SN-4-3	12-Aug-17	10:09	Sediment														5
	SN-3-3	12-Aug-17	9:50	Sediment														5
	SN-2-3	12-Aug-17	9:30	Sediment														5

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)

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

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: - Michelle Spani	Date:	Received by: Shayan	Date: Aug 18	Time: 9:20	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY   OCTOBER 2015 FRONT

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

temp. 15.6, 9.3, 4.9, 8.8, 6.6, 14.2, 5.8

ALS

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1977406-COFC

COC Number: 15 - XXXXXX

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	
Company:	Golder Associatex Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Contact:	John Sherrin / Arman Ospan	Quality Control (QC) Report with Report	☑ YES ☐ NO
Phone:	1 (250) 881 7372	☐ 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:	2nd floor 3795 Carey Rd.	Email 1 or Fax	jsherrin@golder.com
City/Province:	Victoria BC	Email 2	aospan@golder.com
Postal Code:	V8Z 6T8	Email 3	mspani@golder.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:		Email 1 or Fax	
Contact:		Email 2	
Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	BR191034	AFE/Cost Center:	PO#
Job #:	1663724/10000/1003	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

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] ☐
	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	Particle size distribution (Wentworth and phi)	Organic and inorganic carbon	Available metals (extractable)	Total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene)	Hold for hydrocarbon analysis	Number of Containers
	SN-3-2	11-Aug-17	12:30	Sediment	X	X	X		X	5
	SN-3-1	11-Aug-17	12:20	Sediment				X		5
	SN-2-2	11-Aug-17	11:10	Sediment					X	5
	SN-2-1	11-Aug-17	10:47	Sediment				X		5
	SN-1-2	11-Aug-17	10:28	Sediment					X	5
	SN-1-1	11-Aug-17	10:14	Sediment				X		5
	SE-5-1	12-Aug-17	16:00	Sediment				X		5
	SE-5-2	12-Aug-17	16:00	Sediment					X	5
	SE-5-3	12-Aug-17	16:00	Sediment					X	5
	SE-4-1	12-Aug-17	15:24	Sediment				X		5
	SE-4-2	12-Aug-17	15:24	Sediment					X	5
	SE-4-3	12-Aug-17	15:24	Sediment					X	5

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)

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

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Michelle Jarvi	Date:	Received by: Shayan	Date: Aug. 18	Time: 920	Received by:	Date:	Time:

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

temp: 15.6, 9.3, 4.9, 8.8, 6.6, 14.2, 5.8

APPENDIX C-1
SEDIMENT ANALYTICAL DATA

ALS

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1977406-COFC

COC Number: 15 - XXXXXX

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:	Golder Associatex Ltd.	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	John Sherrin / Arman Ospan	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐; EMERGENCY: 1 Business day [E1] ☐
Phone:	1 (250) 881 7372	☐ 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:	2nd floor 3795 Carey Rd.	Email 1 or Fax jsherrin@golder.com	**Date and Time Required for all E&P TATs:**
City/Province:	Victoria BC	Email 2 aospan@golder.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:	V8Z 6T8	Email 3 mspani@golder.com	**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:		Email 1 or Fax	
Contact:		Email 2	

Project Information		**Oil and Gas Required Fields (client use)**	
ALS Account # / Quote #:	BR191034	AFE/Cost Center:	PO#
Job #:	1663724/10000/1003	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		**ALS Contact:**	**Sampler:**

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	Particle size distribution (Wentworth and phi)	Organic and inorganic carbon	Available metals (extractable)	Total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene)	Hold for hydrocarbon analysis	Number of Containers
	SW-3-1	10-Aug-17	14:55	Sediment	X	X	X	X		5
	SW-2-2	10-Aug-17	14:22	Sediment	X	X	X		X	5
	SW-2-1	10-Aug-17	13:00	Sediment	X	X	X	X		5
	SC-4-1	11-Aug-17	16:30	Sediment	X	X	X	X		5
	SC-4-2	11-Aug-17	16:30	Sediment	X	X	X		X	5
	SC-5-1	11-Aug-17	15:30	Sediment	X	X	X	X		5
	SC-5-2	11-Aug-17	15:30	Sediment	X	X	X		X	5
	DUP-A	11-Aug-17	15:30	Sediment	X	X	X	X		5
	SW-5-1	11-Aug-17	14:07	Sediment	X	X	X	X		5
	SW-5-2	11-Aug-17	14:45	Sediment	X	X	X		X	5
	SN-4-1	11-Aug-17	13:01	Sediment	X	X	X	X		5
	SN-4-2	11-Aug-17	13:26	Sediment	X	X	X		X	5

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)

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

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Michelle Spani	Date: Aug 15 2017 9:00	Received by: Shayan	Date: Aug. 18	Time: 9:20	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.**

temp: 15.6, 9.3, 4.9, 8.8, 6.6, 14.2, 5.8

APPENDIX C-2
SEDIMENT SCREENING AGAINST CCME GUIDELINES

Sample ID		CCME		SW-3-1	SW-2-2	SW-2-1	SC-4-1	SC-4-2	SC-5-1	SC-5-2	SC-5-D	SN-5-1	SN-5-2	SN-4-1	SN-4-2	SN-3-2	SN-3-1	SN-2-2	SN-2-1
Date Sampled				10-Aug-2017	10-Aug-2017	10-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017	11-Aug-2017
Laboratory sample ID				L1977406-1	L1977406-2	L1977406-3	L1977406-4	L1977406-5	L1977406-6	L1977406-7	L1977406-8	L1977406-9	L1977406-10	L1977406-11	L1977406-12	L1977406-13	L1977406-14	L1977406-15	L1977406-16
Matrix				Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
	UNITS	ISQG	PEL																
Physical Properties																			
Moisture	%			28.5		27.5	39.5		34.1		35.7	32.7		24.8			29.9		28.8
Soluble (2:1) pH	pH Units			8.14	8.12	8.02	8.08	7.92	8.11	8.02	8.19	8.25	8.21	8.29	8.33	8.27	8.22	8.19	8.24
Gravel	%			7.7	0.5	0.5	3.0	4.5	15.4	6.8	31.2	<1.0	10.1	15.0	11.4	18.1	10.8	15.4	15.8
% sand by hydrometer	%			56.8	68.7	72.1	20.2	25.6	36.8	43.9	28.1	42.0	32.4	43.6	38.9	25.6	30.2	30.3	35.6
% silt by hydrometer	%			30.0	25.2	22.4	33.3	46.5	37.5	37.0	31.5	34.8	38.9	29.2	35.3	41.4	44.0	42.2	39.4
Clay Content	%			5.6	5.3	4.8	43.5	23.5	10.3	12.3	9.1	23.2	18.8	12.2	14.4	14.8	15.0	12.1	9.2
Percent Fines	%			35.6	30.5	27.2	76.8	70.0	47.8	49.3	40.6	58.0	57.7	41.4	49.7	56.2	59.0	54.3	48.6
TOC	%			2.36	2.01	1.83	1.71	2.6	2.21	1.89	2.03	2.07	2.7	2.06	2.51	3.2	3	3.1	2.59
Total Metals																			
Total Aluminum (Al)	mg/kg			4520	3770	3260	14700	8960	6520	6910	6640	6990	6850	5430	5940	6930	6920	6160	5490
Total Antimony (Sb)	mg/kg			<0.10	<0.10	<0.10	0.13	0.16	0.13	0.15	0.13	0.15	0.15	0.12	0.14	0.14	0.13	0.12	0.11
Total Arsenic (As)	mg/kg	7.24	41.6	3.71	4.38	3.30	5.29	4.65	2.42	3.95	2.62	6.52	7.07	5.83	5.80	6.66	**7.72**	**8.32**	6.77
Total Barium (Ba)	mg/kg			15.5	13.7	12.8	42.9	28.1	17.4	18.7	18.9	21.3	21.2	16.2	18.5	20.4	20.8	19.1	17.1
Total Beryllium (Be)	mg/kg			0.34	0.26	0.23	0.98	0.62	0.45	0.46	0.43	0.46	0.48	0.37	0.40	0.47	0.45	0.43	0.37
Total Bismuth (Bi)	mg/kg			<0.20	<0.20	<0.20	0.23	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Boron (B)	mg/kg			33.4	25.7	22.9	61.2	60.5	41.7	46.9	41.5	48.5	49.0	38.3	42.5	49.1	47.4	44.1	39.5
Total Cadmium (Cd)	mg/kg	0.7	4.2	0.038	0.026	0.042	0.080	0.120	0.071	0.082	0.068	0.090	0.095	0.074	0.088	0.074	0.075	0.066	0.044
Total Calcium (Ca)	mg/kg			79400	51700	56000	44500	73800	57500	50000	55100	80700	85100	73900	78300	86400	85700	81900	77800
Total Chromium (Cr)	mg/kg	52.3	160	17.7	14.8	13.0	63.1	29.7	23.5	24.2	23.6	22.8	22.4	17.7	19.9	22.8	23.1	21.1	19.5
Total Cobalt (Co)	mg/kg			3.04	2.69	2.27	10.1	5.11	3.64	3.79	3.73	4.34	4.27	3.37	3.84	4.28	4.35	4.05	3.52
Total Copper (Cu)	mg/kg	18.7	108	6.06	4.56	4.14	23.4	11.6	7.60	9.19	7.63	9.57	9.61	7.56	8.61	9.70	9.72	8.71	7.62
Total Iron (Fe)	mg/kg			10700	10100	8350	28900	14900	10700	11500	10800	13700	13900	11300	12400	13900	14300	13700	12300
Total Lead (Pb)	mg/kg	30.2	112	4.77	3.68	3.48	15.1	10.5	6.70	7.46	6.95	7.49	7.65	6.05	6.90	7.20	7.18	6.36	5.85
Total Lithium (Li)	mg/kg			23.8	19.3	16.9	46.0	43.6	28.8	29.7	27.9	34.3	34.2	26.6	30.8	34.1	33.2	30.3	27.5
Total Magnesium (Mg)	mg/kg			40700	26900	25300	30600	37000	33900	28100	31000	35200	36900	31200	34800	41900	40500	40100	36800
Total Manganese (Mn)	mg/kg			132	106	91.9	235	151	117	113	116	153	157	132	139	157	159	158	140
Total Mercury (Hg)	mg/kg	0.13	0.7	0.0097	0.0076	0.0063	0.0154	0.0237	0.0130	0.0177	0.0156	0.0163	0.0169	0.0127	0.0137	0.0147	0.0143	0.0138	0.0133
Total Molybdenum (Mo)	mg/kg			0.36	0.30	0.27	0.95	1.09	0.74	1.04	0.61	0.34	0.35	0.29	0.33	0.37	0.36	0.34	0.34
Total Nickel (Ni)	mg/kg			9.55	8.34	7.08	34.6	17.2	14.1	14.9	14.1	13.0	12.9	10.2	11.8	13.3	13.1	12.2	10.8
Total Phosphorus (P)	mg/kg			443	442	403	623	629	494	528	478	457	499	422	436	517	569	589	518
Total Potassium (K)	mg/kg			2020	1850	1560	5880	3980	2670	2900	2730	3040	3010	2350	2610	3030	3060	2680	2430
Total Selenium (Se)	mg/kg			<0.20	<0.20	<0.20	<0.20	0.48	0.30	0.45	0.32	0.22	0.25	0.21	<0.20	0.22	<0.20	<0.20	<0.20
Total Silver (Ag)	mg/kg			<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	mg/kg			3970	4170	3690	6500	11200	5200	7150	5670	5100	5610	4210	4670	5560	4840	4460	3990
Total Strontium (Sr)	mg/kg			46.5	35.8	60.5	44.5	62.1	41.3	52.5	42.0	55.8	61.3	51.0	52.4	56.6	56.0	52.1	55.6
Total Thallium (Tl)	mg/kg			0.092	0.094	0.076	0.285	0.190	0.129	0.137	0.124	0.127	0.124	0.101	0.111	0.127	0.127	0.110	0.101
Total Tin (Sn)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	mg/kg			253	247	211	747	339	313	299	304	256	249	209	229	281	288	284	237
Total Uranium (U)	mg/kg			0.762	0.651	0.634	2.87	1.54	1.26	1.39	1.23	0.972	0.954	0.768	0.915	0.949	0.954	0.975	0.790
Total Vanadium (V)	mg/kg			18.6	15.9	13.8	47.2	32.6	21.9	25.2	22.0	29.4	29.8	24.2	26.6	29.2	29.7	26.6	23.2
Total Zinc (Zn)	mg/kg	124	271	14.0	13.3	12.1	42.6	27.9	21.1	22.2	21.0	21.9	21.9	16.8	19.2	20.4	20.5	18.3	16.5
Total Zirconium (Zr)	mg/kg			5.2	3.7	3.5	22.7	8.8	5.5	5.0	5.3	7.3	6.9	5.6	6.1	7.1	7.3	6.4	5.5

Value	Value exceeds the CCME PEL
Value	Value exceeds the CCME ISQG

CCME-Canandian Council of Ministers of the Environment-Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. 2007. Accessed online at http://ceqg-rcqe.ccme.ca/

PEL-Probable effect level

ISQG-Interim sediment quality guidelines

Sample ID		SN-1-2	SN-1-1	SE-5-1	SE-5-2	SE-5-3	SE-4-1	SE-4-2	SE-4-3	SC-2-1	SC-2-2	SC-2-3	SC-3-1	SC-3-2	SC-3-3	SC-4-3	SC-5-3	SN-5-3	SN-4-3
Date Sampled		11-Aug-2017	11-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017	12-Aug-2017
Laboratory sample ID		L1977406-17	L1977406-18	L1977406-19	L1977406-20	L1977406-21	L1977406-22	L1977406-23	L1977406-24	L1977406-25	L1977406-26	L1977406-27	L1977406-28	L1977406-29	L1977406-30	L1977406-31	L1977406-32	L1977406-33	L1977406-34
Matrix		**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**
	UNITS																		
Physical Properties																			
Moisture	%		27.8	30.4			30.5			46.2			33.0						
Soluble (2:1) pH	pH Units	8.31	8.25	8.18	8.12	8.04	8.18	8.23	8.19	8.01	8.09	8.00	8.24	8.17	7.85	8.08	8.16	8.26	8.32
Gravel	%	34.9	44.1	6.0	1.5	17.2	37.0	1.4	18.7	5.7	3.9	6.5	11.7	13.1	2.5	15.6	11.7	14.4	12.0
% sand by hydrometer	%	36.8	27.2	49.3	69.4	54.4	30.3	66.8	50.5	20.5	29.7	25.1	25.4	21.9	25.4	33.6	40.5	34.2	29.4
% silt by hydrometer	%	23.2	23.7	36.3	20.0	21.4	24.5	24.8	23.2	53.0	51.1	50.5	47.9	49.4	52.3	35.9	32.5	33.8	40.3
Clay Content	%	5.1	5.0	8.4	9.0	7.0	8.1	7.0	7.6	20.7	15.3	17.9	15.0	15.6	19.9	14.8	15.2	17.7	18.4
Percent Fines	%	28.3	28.7	44.7	29.0	28.4	32.6	31.8	30.8	73.7	66.4	68.4	62.9	65.0	72.2	50.7	47.7	51.5	58.7
TOC	%	2.32	2.01	2.1	1.07	1.57	2.38	1.38	1.61	3.4	2.9	3.2	2.4	3.3	3.3	2.48	1.75	2.54	3
Total Metals																			
Total Aluminum (Al)	mg/kg	3850	5140	5510	3290	3610	5400	4200	4560	10700	7930	7610	7850	8720	10600	9910	8590	8630	8450
Total Antimony (Sb)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	0.26	0.16	0.19	0.16	0.19	0.29	0.17	0.13	0.16	0.17
Total Arsenic (As)	mg/kg	3.32	4.81	5.57	5.24	4.14	5.17	2.08	3.12	6.63	4.42	4.07	3.69	3.97	5.91	4.05	3.85	6.67	7.16
Total Barium (Ba)	mg/kg	13.5	16.3	15.2	13.0	12.3	17.8	11.4	12.8	29.6	25.8	19.7	20.4	27.5	25.9	36.4	23.1	23.9	23.4
Total Beryllium (Be)	mg/kg	0.28	0.33	0.37	0.23	0.25	0.36	0.28	0.30	0.70	0.51	0.50	0.51	0.55	0.65	0.60	0.53	0.53	0.56
Total Bismuth (Bi)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Boron (B)	mg/kg	29.7	37.1	39.0	23.7	24.6	37.8	29.8	33.7	81.3	54.4	55.0	54.7	61.8	73.6	64.6	51.0	58.8	61.3
Total Cadmium (Cd)	mg/kg	0.049	0.048	0.037	0.029	0.032	0.050	0.037	0.040	0.114	0.069	0.179	0.088	0.085	0.170	0.120	0.075	0.099	0.106
Total Calcium (Ca)	mg/kg	69200	78800	57200	38100	41100	65400	52400	48700	87500	80100	69400	73800	85100	72100	75600	53200	87700	98800
Total Chromium (Cr)	mg/kg	14.2	18.4	18.4	12.0	12.7	19.1	13.5	15.4	34.1	25.7	25.5	23.9	26.6	32.4	30.0	31.5	24.2	26.1
Total Cobalt (Co)	mg/kg	2.56	3.14	3.28	2.12	2.26	3.32	2.31	2.49	5.36	4.38	4.05	3.76	4.28	4.65	4.76	4.57	4.59	4.84
Total Copper (Cu)	mg/kg	5.21	6.48	6.80	4.18	4.63	6.93	4.84	5.71	13.1	9.29	9.57	8.14	9.26	13.0	9.96	9.88	10.3	10.7
Total Iron (Fe)	mg/kg	9320	11200	11000	7850	8130	11300	7850	8500	17200	13300	12300	12000	13200	14000	13600	13600	14400	15600
Total Lead (Pb)	mg/kg	4.31	5.23	5.81	3.72	4.11	6.19	4.44	4.90	10.9	8.27	8.16	8.08	9.00	10.2	9.27	8.37	8.32	8.78
Total Lithium (Li)	mg/kg	19.8	25.7	26.9	16.3	17.7	25.1	19.1	21.2	50.6	35.4	35.9	35.6	39.6	46.2	40.6	31.3	37.0	40.5
Total Magnesium (Mg)	mg/kg	30300	40500	31600	19700	20500	30500	25600	26700	50700	45700	41900	42000	46700	45800	38700	29400	39300	44500
Total Manganese (Mn)	mg/kg	109	130	117	81.9	88.8	122	90.1	94.0	172	154	132	135	147	146	146	133	176	173
Total Mercury (Hg)	mg/kg	0.0088	0.0121	0.0121	0.0072	0.0086	0.0142	0.0075	0.0076	0.0201	0.0157	0.0148	0.0174	0.0185	0.0199	0.0243	0.0148	0.0180	0.0154
Total Molybdenum (Mo)	mg/kg	0.27	0.31	0.34	0.23	0.26	0.33	0.30	0.37	1.08	0.48	1.02	0.69	0.75	2.78	0.74	0.66	0.39	0.39
Total Nickel (Ni)	mg/kg	7.86	9.87	10.1	6.59	7.06	10.7	7.49	8.36	19.2	14.4	14.5	13.0	14.6	17.7	17.8	18.5	13.8	14.8
Total Phosphorus (P)	mg/kg	354	441	465	430	530	517	340	397	747	569	523	499	556	532	526	534	478	513
Total Potassium (K)	mg/kg	1750	2220	2420	1550	1690	2360	1800	1970	4650	3390	3310	3300	3640	4480	4060	3520	3600	3590
Total Selenium (Se)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.24	<0.20	<0.20	0.63	0.29	0.37	0.34	0.36	0.63	0.59	0.28	0.25	0.24
Total Silver (Ag)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	mg/kg	3170	3880	5580	4320	4270	5050	3400	4280	10500	6920	7040	5780	7680	10100	8670	8490	5440	5160
Total Strontium (Sr)	mg/kg	50.6	48.5	40.7	34.3	33.6	56.6	36.3	35.1	65.8	56.3	50.3	51.2	69.1	51.9	65.2	68.4	62.3	68.8
Total Thallium (Tl)	mg/kg	0.079	0.100	0.103	0.066	0.077	0.107	0.115	0.096	0.207	0.142	0.146	0.138	0.155	0.206	0.172	0.149	0.145	0.151
Total Tin (Sn)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	mg/kg	204	236	243	171	178	257	196	198	385	321	283	277	299	341	336	381	283	298
Total Uranium (U)	mg/kg	0.671	0.802	0.783	0.495	0.567	0.904	0.714	0.725	1.66	1.16	1.38	1.25	1.39	1.96	1.45	1.55	1.10	1.18
Total Vanadium (V)	mg/kg	16.3	20.6	23.1	15.1	16.0	22.4	16.3	18.5	42.6	28.5	30.3	27.7	30.3	43.0	32.1	27.4	32.7	35.5
Total Zinc (Zn)	mg/kg	12.1	15.2	16.3	10.9	11.6	16.6	12.7	13.6	31.7	23.7	22.3	21.9	23.9	27.7	27.2	23.5	23.6	24.5
Total Zirconium (Zr)	mg/kg	4.8	5.9	5.8	3.3	3.7	5.2	4.7	4.9	9.1	7.3	7.0	6.7	7.3	9.0	8.1	8.9	7.8	8.8

Value	Value exceeds
Value	Value exceeds

CCME-Canadian Council of Ministers of the En
Quality Guidelins for the Protection of Aquatic Lif
http://ceqg-rcqe.ccme.ca/

PEL-Probable effect level

ISQG-Interim sediment quality guidelines

APPENDIX C-2
SEDIMENT SCREENING AGAINST CCME GUIDELINES

Sample ID		SN-3-3	SN-2-3	SN-1-3	SW-5-1	SW-5-2	SW-5-3	SW-1-1	SW-1-2	SW-1-3	SW-3-2	SW-3-3	SW-3-D	SE-1-1	SE-1-2	SE-1-3	SE-2-1	SE-2-3	SE-2-D
Date Sampled		12-Aug-2017	12-Aug-2017	12-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017
Laboratory sample ID		L1977406-35	L1977406-36	L1977406-37	L1977406-38	L1977406-39	L1977406-40	L1977406-41	L1977406-42	L1977406-43	L1977406-44	L1977406-45	L1977406-46	L1977406-47	L1977406-48	L1977406-49	L1977406-51	L1977406-53	L1977406-54
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
	UNITS																		
Physical Properties																			
Moisture	%				28.7			13.3					24.3	22.7			23.0		20.4
Soluble (2:1) pH	pH Units	8.35	8.27	8.48	8.26	8.20	8.18	8.43	8.67	8.49	8.28	8.26	8.33	8.34	8.31	8.18	8.11	8.35	8.38
Gravel	%	3.8	20.0	13.7	1.1	<1.0	1.0	25.1	48.5	51.5	5.1	19.9	11.1	9.3	22.4	45.9	82.3	10.5	22.9
% sand by hydrometer	%	27.9	37.9	44.7	66.8	61.8	54.9	73.2	50.4	46.8	56.0	41.8	49.1	54.4	44.2	33.8	13.0	47.6	59.5
% silt by hydrometer	%	47.2	32.5	32.8	28.1	32.8	37.9	1.1	0.5	1.3	30.9	31.3	31.8	28.6	26.6	16.3	3.6	32.5	13.1
Clay Content	%	21.1	9.6	8.9	4.0	4.6	6.2	0.5	0.5	0.5	8.1	7.0	7.9	7.7	6.8	4.0	1.1	9.5	4.5
Percent Fines	%	68.3	42.1	41.7	32.1	37.4	44.1	1.6	1.0	1.8	39.0	38.3	39.7	36.3	33.4	20.3	4.7	42.0	17.6
TOC	%	3	2.38	2.84	2.79	2.75	2.85	0.61	0.33	0.42	2.34	2.9	2.63	2.68	2.47	2.18	1.93	2.38	1.15
Total Metals																			
Total Aluminum (Al)	mg/kg	8500	6330	5440	3980	4250	5590	797	810	1100	5160	6070	5060	4850	4770	3990	3800	5310	2960
Total Antimony (Sb)	mg/kg	0.17	0.12	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Arsenic (As)	mg/kg	4.43	6.79	2.31	2.72	3.74	7.03	0.44	0.45	0.47	4.93	5.39	4.24	3.75	4.96	4.06	3.79	2.95	4.05
Total Barium (Ba)	mg/kg	22.2	17.5	15.0	13.3	14.8	22.0	1.90	2.24	3.90	17.6	20.4	15.3	15.3	15.4	13.2	12.5	15.6	10.5
Total Beryllium (Be)	mg/kg	0.55	0.44	0.35	0.27	0.32	0.38	<0.10	<0.10	<0.10	0.34	0.42	0.34	0.31	0.34	0.30	0.25	0.37	0.23
Total Bismuth (Bi)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Boron (B)	mg/kg	59.3	46.6	39.3	30.3	31.5	42.2	7.8	7.3	7.7	35.6	42.9	36.8	35.6	35.6	30.0	27.2	36.5	23.8
Total Cadmium (Cd)	mg/kg	0.104	0.051	0.080	0.033	<0.020	0.033	<0.020	<0.020	<0.020	0.035	0.039	0.034	0.048	0.040	0.039	0.038	0.052	0.030
Total Calcium (Ca)	mg/kg	89800	75000	73800	68600	75100	88100	37500	26000	20900	72900	86600	72800	71000	72200	62300	55000	74900	56700
Total Chromium (Cr)	mg/kg	27.7	20.0	18.1	15.2	16.9	21.3	2.56	3.06	3.65	19.3	22.1	18.2	16.5	16.2	14.8	12.8	17.3	10.2
Total Cobalt (Co)	mg/kg	4.76	3.73	3.12	3.04	3.11	3.95	0.58	0.59	0.76	3.26	3.86	3.02	2.96	3.01	2.74	2.26	3.03	1.88
Total Copper (Cu)	mg/kg	11.0	8.06	6.66	5.96	6.45	8.16	1.21	1.13	1.56	6.19	7.50	5.84	6.21	6.16	8.16	4.29	6.66	3.80
Total Iron (Fe)	mg/kg	14500	12500	10200	10700	11600	15600	1970	3200	4040	11600	13300	10700	12100	11400	11600	9610	10100	7660
Total Lead (Pb)	mg/kg	8.34	6.23	5.19	3.57	3.82	5.01	1.14	1.20	0.94	4.97	5.78	4.77	4.97	4.92	4.18	3.91	5.31	3.42
Total Lithium (Li)	mg/kg	40.7	31.1	25.7	22.0	23.7	29.7	4.9	4.5	5.9	24.5	28.8	23.7	23.6	24.1	19.9	17.7	25.5	15.7
Total Magnesium (Mg)	mg/kg	43900	37500	35200	36100	39700	45900	15400	12200	10600	38700	46900	39900	34800	35300	30900	24100	38000	23800
Total Manganese (Mn)	mg/kg	152	143	113	137	135	166	31.7	31.9	35.9	128	153	119	127	131	126	92.2	127	80.2
Total Mercury (Hg)	mg/kg	0.0141	0.0121	0.0087	0.0056	0.0059	0.0085	<0.0050	<0.0050	<0.0050	0.0089	0.0100	0.0079	0.0104	0.0092	0.0084	0.0076	0.0097	0.0071
Total Molybdenum (Mo)	mg/kg	0.41	0.39	0.33	0.29	0.29	0.35	0.12	0.10	0.12	0.30	0.39	0.30	0.32	0.33	0.35	0.41	0.30	0.26
Total Nickel (Ni)	mg/kg	15.5	11.3	9.97	8.36	9.14	11.7	1.87	1.48	2.14	10.3	11.8	9.66	9.10	9.12	8.43	6.99	9.63	5.91
Total Phosphorus (P)	mg/kg	460	518	344	466	504	1050	87	77	95	533	563	483	376	441	365	385	594	378
Total Potassium (K)	mg/kg	3530	2710	2290	1930	1960	2540	330	360	490	2410	2740	2280	2150	2090	1770	1760	2330	1350
Total Selenium (Se)	mg/kg	0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Silver (Ag)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	mg/kg	5310	4520	3330	4900	3580	5180	1480	1410	1600	3990	5030	4060	4000	3790	4520	3690	4130	3090
Total Strontium (Sr)	mg/kg	59.1	51.8	48.6	41.8	43.3	67.1	25.5	16.0	12.8	50.0	56.2	44.8	48.0	50.1	43.9	55.0	50.3	43.0
Total Thallium (Tl)	mg/kg	0.154	0.113	0.097	0.090	0.080	0.116	<0.050	<0.050	<0.050	0.107	0.116	0.092	0.093	0.089	0.080	0.078	0.100	0.061
Total Tin (Sn)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	mg/kg	309	250	238	251	250	317	32.8	36.4	57.2	290	334	266	235	224	211	198	241	145
Total Uranium (U)	mg/kg	1.29	0.886	0.850	0.654	0.748	0.930	0.216	0.217	0.213	0.869	0.894	0.749	0.798	0.755	0.722	0.651	0.845	0.545
Total Vanadium (V)	mg/kg	32.7	24.8	20.4	14.3	15.7	20.1	3.08	3.34	3.79	20.6	23.4	20.6	19.1	18.9	17.1	15.8	21.1	13.2
Total Zinc (Zn)	mg/kg	23.9	18.2	15.4	12.3	12.2	17.4	2.2	2.4	3.4	15.8	17.8	14.4	14.7	14.0	13.9	11.4	14.7	9.3
Total Zirconium (Zr)	mg/kg	9.7	6.9	7.3	5.7	6.0	7.2	1.3	1.4	1.6	5.6	6.6	6.2	5.9	5.7	4.4	4.6	6.9	3.5

Value	Value exceeds
Value	Value exceeds

CCME-Canadian Council of Ministers of the En
Quality Guidelins for the Protection of Aquatic Lif
http://ceqg-rcqe.ccme.ca/

PEL-Probable effect level

ISQG-Interim sediment quality guidelines

Sample ID		SE-3-1	SE-3-2	SE-3-3	SE-3-D	SW-4-1	SW-4-2	SC-3-D	SW2-3	SW-4-3
Date Sampled		13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017
Laboratory sample ID		L1977406-55	L1977406-56	L1977406-57	L1977406-58	L1977406-59	L1977406-60	L1977406-61	L1977406-62	L1977406-63
Matrix		**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**	**Sediment**
	UNITS									
Physical Properties										
Moisture	%	31.9			25.5	24.3		41.6		
Soluble (2:1) pH	pH Units	8.23	8.27	8.23	8.14	8.18	8.17	8.02	8.20	8.19
Gravel	%	7.8	30.8	32.0	50.0	9.2	3.2	5.1	13.0	4.4
% sand by hydrometer	%	63.6	47.6	46.4	34.7	55.1	61.9	22.4	81.7	48.1
% silt by hydrometer	%	21.1	15.6	16.0	11.7	29.3	29.0	49.5	4.0	39.3
Clay Content	%	7.6	5.9	5.6	3.5	6.5	5.9	23.0	1.3	8.2
Percent Fines	%	28.7	21.5	21.6	15.2	35.8	34.9	72.5	5.3	47.5
TOC	%	1.53	1.79	1.32	1.6	1.99	2.18	3.5	0.74	3.03
Total Metals										
Total Aluminum (Al)	mg/kg	4140	4440	4500	4380	4940	4140	8520	917	6090
Total Antimony (Sb)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.21	<0.10	0.10
Total Arsenic (As)	mg/kg	3.28	3.23	3.50	3.25	6.53	6.54	4.10	0.72	**10.3**
Total Barium (Ba)	mg/kg	12.9	14.3	14.8	13.7	16.9	14.9	23.2	2.80	22.9
Total Beryllium (Be)	mg/kg	0.28	0.31	0.28	0.30	0.33	0.29	0.57	<0.10	0.41
Total Bismuth (Bi)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Boron (B)	mg/kg	32.2	30.8	30.6	31.6	37.8	31.9	61.4	8.4	45.1
Total Cadmium (Cd)	mg/kg	0.043	0.042	0.031	0.055	0.056	<0.020	0.097	<0.020	0.042
Total Calcium (Ca)	mg/kg	56700	55000	52900	57900	70800	73400	80500	19500	94500
Total Chromium (Cr)	mg/kg	13.2	14.5	15.1	13.9	18.0	16.0	27.5	4.58	22.6
Total Cobalt (Co)	mg/kg	2.34	2.50	2.54	2.34	3.19	2.78	4.39	0.70	4.06
Total Copper (Cu)	mg/kg	5.03	5.40	4.76	4.81	6.07	5.15	10.1	1.30	8.08
Total Iron (Fe)	mg/kg	8740	9700	9970	9390	12300	10700	13500	5410	15200
Total Lead (Pb)	mg/kg	4.69	4.50	4.43	4.45	4.60	4.02	9.66	1.19	5.95
Total Lithium (Li)	mg/kg	20.4	20.5	20.0	20.0	23.7	22.1	41.8	5.5	30.9
Total Magnesium (Mg)	mg/kg	26200	27000	26600	25300	35200	34300	45300	8950	47000
Total Manganese (Mn)	mg/kg	88.1	98.4	96.9	91.9	136	118	146	36.1	194
Total Mercury (Hg)	mg/kg	0.0094	0.0123	0.0087	0.0103	0.0090	0.0073	0.0208	<0.0050	0.0097
Total Molybdenum (Mo)	mg/kg	0.52	0.36	0.32	0.29	0.32	0.26	1.19	0.18	0.42
Total Nickel (Ni)	mg/kg	7.71	8.09	7.83	7.68	9.90	8.66	15.8	2.06	12.5
Total Phosphorus (P)	mg/kg	388	366	400	379	599	548	538	110	929
Total Potassium (K)	mg/kg	1890	2050	2000	1970	2350	2040	3630	430	2810
Total Selenium (Se)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.40	<0.20	<0.20
Total Silver (Ag)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	mg/kg	4800	3580	3710	4580	4400	4050	7420	1350	5020
Total Strontium (Sr)	mg/kg	43.0	40.2	43.0	45.5	54.2	47.2	56.4	15.1	66.6
Total Thallium (Tl)	mg/kg	0.082	0.077	0.083	0.078	0.101	0.088	0.170	<0.050	0.126
Total Tin (Sn)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	mg/kg	201	198	218	193	277	243	308	53.7	312
Total Uranium (U)	mg/kg	0.806	0.682	0.734	0.674	0.694	0.669	1.59	0.293	0.961
Total Vanadium (V)	mg/kg	17.3	17.4	17.5	17.7	20.3	17.0	33.1	4.40	23.8
Total Zinc (Zn)	mg/kg	12.3	12.6	12.9	12.0	13.9	12.1	24.0	3.4	16.9
Total Zirconium (Zr)	mg/kg	3.9	4.7	4.6	4.7	6.0	5.6	7.8	1.4	7.5

Value	Value exceeds
Value	Value exceeds

CCME-Canadian Council of Ministers of the En
Quality Guidelins for the Protection of Aquatic Lif
http://ceqg-rcqe.ccme.ca/

PEL-Probable effect level

ISQG-Interim sediment quality guidelines

APPENDIX C-3
SYSTAT PCA

SYSTAT Report on Principal Component Analysis

▼File: Untitled1.syz

IMPORT successfully completed. Processed 40 variables and 63 cases.

▼Factor Analysis

Latent Roots (Eigenvalues)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
29.242	2.699	1.675	1.398	0.865	0.469	0.318	0.277	0.182	0.162	0.123	0.092	0.082	0.070	0.064	0.048	0.043	0.035	0.032	0.023	0.022	0.016	0.014

Latent Roots (Eigenvalues) (Contd.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
0.012	0.009	0.007	0.006	0.004	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000

Component Loadings

	1	2	3	4
PH	-0.552	-0.284	-0.373	0.341
GRAVEL	-0.399	0.191	-0.651	0.467
SAND	-0.663	-0.295	0.514	-0.305
SILT	0.898	-0.180	0.064	-0.281
CLAY	0.902	0.163	0.122	0.059
INORGANIC_CARBON	0.871	-0.061	-0.303	-0.088
TOTAL_CARBON_BY_COMBUSTION	0.881	-0.269	-0.251	-0.208
TOC	0.821	-0.355	-0.199	-0.254
ALUMINUM__AL_	0.985	0.094	0.024	0.101
ANTIMONY__SB_	0.776	0.392	-0.218	-0.178
ARSENIC__AS_	0.702	-0.500	-0.007	-0.023
BARIUM__BA_	0.969	-0.037	0.079	0.101
BERYLLIUM__BE_	0.989	0.036	0.035	0.099
BORON__B_	0.984	0.028	-0.095	-0.059
CADMIUM__CD_	0.834	0.323	-0.236	-0.110
CALCIUM__CA_	0.732	-0.532	-0.346	-0.174
CHROMIUM__CR_	0.966	0.052	0.155	0.177
COBALT__CO_	0.967	-0.059	0.121	0.195
COPPER__CU_	0.965	0.032	0.081	0.175
IRON__FE_	0.920	-0.189	0.137	0.245
LEAD__PB_	0.976	0.152	0.003	0.093
LITHIUM__LI_	0.993	-0.016	-0.053	-0.036
MAGNESIUM__MG_	0.841	-0.385	-0.188	-0.181
MANGANESE__MN_	0.919	-0.345	0.028	0.114
MERCURY__HG_	0.907	0.217	-0.192	-0.067
MOLYBDENUM__MO_	0.728	0.512	0.089	-0.213

APPENDIX C-3
SYSTAT PCA

Component Loadings	1	2	3	4
NICKEL__NI_	0.967	0.077	0.137	0.166
PHOSPHORUS__P_	0.799	-0.392	0.190	-0.104
POTASSIUM__K_	0.992	0.043	0.040	0.069
SELENIUM__SE_	0.631	0.601	-0.161	-0.360
SODIUM__NA_	0.886	0.258	0.074	-0.210
STRONTIUM__SR_	0.821	-0.313	-0.194	-0.105
THALLIUM__TL_	0.973	0.120	0.115	0.068
TITANIUM__TI_	0.918	-0.103	0.252	0.194
URANIUM__U_	0.936	0.247	0.134	0.118
VANADIUM__V_	0.985	0.025	-0.031	0.049
ZINC__ZN_	0.985	0.086	0.058	0.087
ZIRCONIUM__ZR_	0.903	-0.071	0.149	0.324

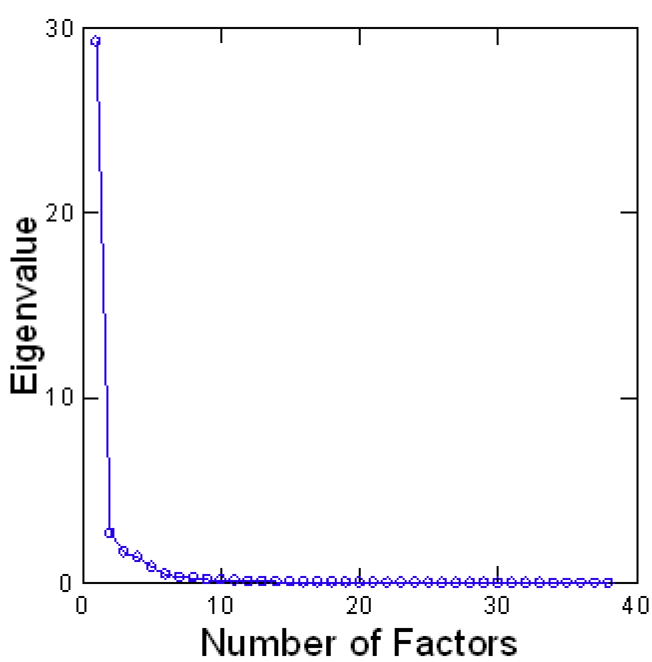
Variance Explained by Components

1	2	3	4
29.242	2.699	1.675	1.398

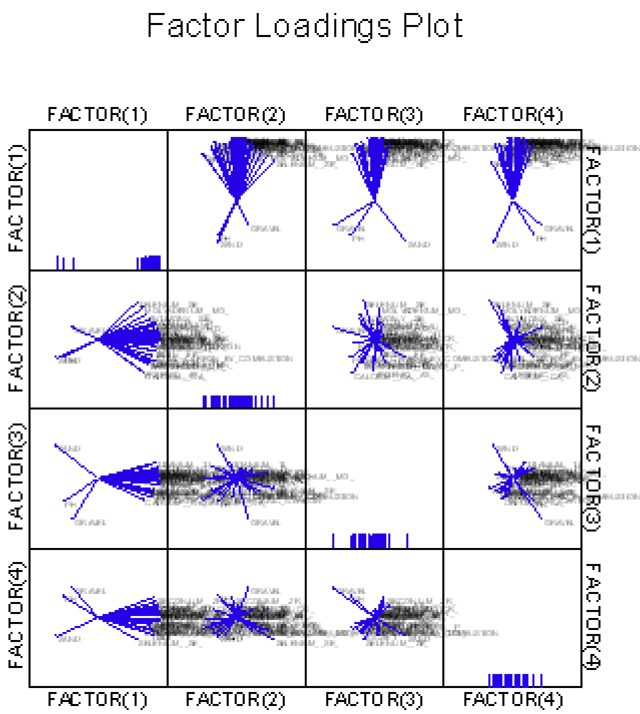
Percent of Total Variance Explained

1	2	3	4
76.952	7.102	4.408	3.680

Scree Plot



APPENDIX C-3
SYSTAT PCA



Coefficients for Standardized Factor Scores				
	1	2	3	4
PH	-0.019	-0.105	-0.223	0.244
GRAVEL	-0.014	0.071	-0.389	0.334
SAND	-0.023	-0.109	0.307	-0.218
SILT	0.031	-0.067	0.038	-0.201
CLAY	0.031	0.061	0.073	0.042
INORGANIC_CARBON	0.030	-0.023	-0.181	-0.063
TOTAL_CARBON_BY_COMBUSTION	0.030	-0.100	-0.150	-0.148
TOC	0.028	-0.131	-0.119	-0.181
ALUMINUM__AL_	0.034	0.035	0.014	0.072
ANTIMONY__SB_	0.027	0.145	-0.130	-0.127
ARSENIC__AS_	0.024	-0.185	-0.004	-0.017
BARIUM__BA_	0.033	-0.014	0.047	0.073
BERYLLIUM__BE_	0.034	0.013	0.021	0.071
BORON__B_	0.034	0.010	-0.057	-0.042
CADMIUM__CD_	0.029	0.120	-0.141	-0.079
CALCIUM__CA_	0.025	-0.197	-0.206	-0.124
CHROMIUM__CR_	0.033	0.019	0.093	0.126
COBALT__CO_	0.033	-0.022	0.073	0.139
COPPER__CU_	0.033	0.012	0.049	0.125
IRON__FE_	0.031	-0.070	0.082	0.176
LEAD__PB_	0.033	0.056	0.002	0.066
LITHIUM__LI_	0.034	-0.006	-0.032	-0.026
MAGNESIUM__MG_	0.029	-0.143	-0.112	-0.130
MANGANESE__MN_	0.031	-0.128	0.017	0.082
MERCURY__HG_	0.031	0.081	-0.115	-0.048
MOLYBDENUM__MO_	0.025	0.190	0.053	-0.153

APPENDIX C-3
SYSTAT PCA

Coefficients for Standardized Factor Scores				
	1	2	3	4
NICKEL__NI_	0.033	0.029	0.082	0.119
PHOSPHORUS__P_	0.027	-0.145	0.114	-0.074
POTASSIUM__K_	0.034	0.016	0.024	0.050
SELENIUM__SE_	0.022	0.223	-0.096	-0.257
SODIUM__NA_	0.030	0.096	0.044	-0.150
STRONTIUM__SR_	0.028	-0.116	-0.116	-0.075
THALLIUM__TL_	0.033	0.045	0.069	0.049
TITANIUM__TI_	0.031	-0.038	0.150	0.138
URANIUM__U_	0.032	0.092	0.080	0.084
VANADIUM__V_	0.034	0.009	-0.019	0.035
ZINC__ZN_	0.034	0.032	0.035	0.063
ZIRCONIUM__ZR_	0.031	-0.026	0.089	0.232

Standardized Scores have been saved.

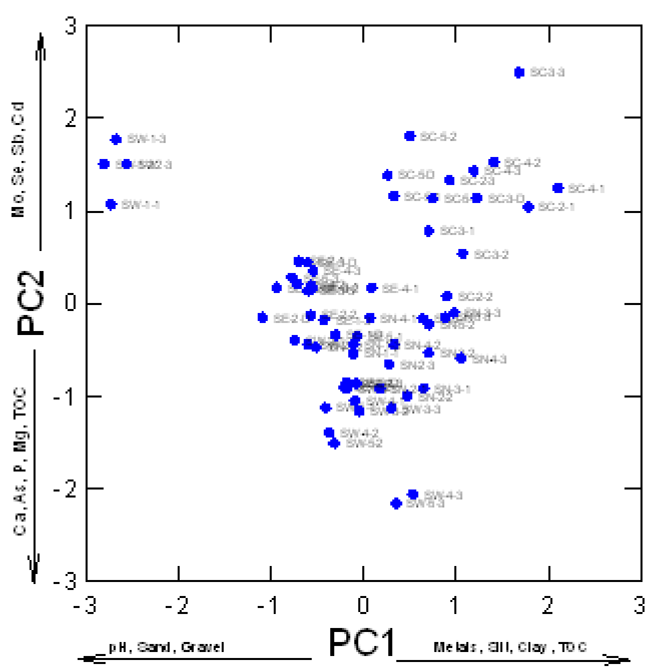
▼File: C:\Users\aospan\Desktop\PCA_Sed_BIM_2017.syz

Number of Variables : 6
Number of Cases : 63

SYSTAT Rectangular file C:\Users\aospan\Desktop\PCA_Sed_BIM_2017.syz,
Created data file Thu Jan 25 15:40:02 2018 containing variables:

FACTOR(1)	FACTOR(2)	FACTOR(3)	FACTOR(4)	TSQUARE	PROB

▼Scatter Plot



APPENDIX C-3
SYSTAT PCA

Successfully saved file C:\Users\aospan\Desktop\Sed_BIM.syz
Processed 40 Variables and 63 Cases.
Successfully saved file C:\Users\aospan\Desktop\PCA_Sed_BIM_2017.syz
Processed 7 Variables and 63 Cases.

APPENDIX C-3:
SEDIMENT QUALITY RELATIVE PERCENT DIFFERENCE

Client Sample ID			SC-5-1	SC-5-2	SC-5-3	DUP-A		SC-3-1	SC-3-2	SC-3-3	DUP B	
Date Sampled			11-Aug-2017	11-Aug-2017	12-Aug-2017	11-Aug-2017		12-Aug-2017	12-Aug-2017	12-Aug-2017	13-Aug-2017	
Time Sampled			15:30	15:30	11:09	15:30		12:33	12:33	12:33	12:33	
ALS Sample ID			L1977406-6	L1977406-7	L1977406-32	L1977406-8		L1977406-28	L1977406-29	L1977406-30	L1977406-61	
Parameter	Lowest Detection Limit	Units	Soil	Soil	Soil	Soil	Relative Percent Difference	Soil	Soil	Soil	Soil	Relative Percent Difference
Physical Tests (Soil)												
Moisture	0.25	%	34.1			35.7	-	33.0			41.6	-
pH (1:2 soil:water)	0.10	pH	8.11	8.02	8.16	8.19	1.1%	8.24	8.17	7.85	8.02	0.8%
Organic / Inorganic Carbon (Soil)												
Inorganic Carbon	0.050	%	2.12	1.74	1.79	1.79	5.1%	2.26	2.18	2.44	2.38	3.7%
Total Carbon by Combustion	0.05	%	4.33	3.63	3.54	3.82	0.3%	4.66	5.44	5.78	5.85	10.0%
Total Organic Carbon	0.050	%	2.21	1.89	1.75	2.03	4.0%	2.4	3.3	3.3	3.5	15.4%
Metals (Soil)												
Aluminum (Al)	50	mg/kg	6520	6910	8590	6640	10.0%	7850	8720	10600	8520	6.1%
Antimony (Sb)	0.10	mg/kg	0.13	0.15	0.13	0.13	5.0%	0.16	0.19	0.29	0.21	1.6%
Arsenic (As)	0.10	mg/kg	2.42	3.95	3.85	2.62	26.1%	3.69	3.97	5.91	4.10	9.8%
Barium (Ba)	0.50	mg/kg	17.4	18.7	23.1	18.9	4.3%	20.4	27.5	25.9	23.2	5.9%
Beryllium (Be)	0.10	mg/kg	0.45	0.46	0.53	0.43	11.0%	0.51	0.55	0.65	0.57	0.0%
Bismuth (Bi)	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20	<0.20	-
Boron (B)	5.0	mg/kg	41.7	46.9	51.0	41.5	11.4%	54.7	61.8	73.6	61.4	3.2%
Cadmium (Cd)	0.020	mg/kg	0.071	0.082	0.075	0.068	11.1%	0.088	0.085	0.170	0.097	16.4%
Calcium (Ca)	50	mg/kg	57500	50000	53200	55100	2.8%	73800	85100	72100	80500	4.4%
Chromium (Cr)	0.50	mg/kg	23.5	24.2	31.5	23.6	11.2%	23.9	26.6	32.4	27.5	0.5%
Cobalt (Co)	0.10	mg/kg	3.64	3.79	4.57	3.73	7.0%	3.76	4.28	4.65	4.39	3.7%
Copper (Cu)	0.50	mg/kg	7.60	9.19	9.88	7.63	15.3%	8.14	9.26	13.0	10.1	0.3%
Iron (Fe)	50	mg/kg	10700	11500	13600	10800	10.0%	12000	13200	14000	13500	3.3%
Lead (Pb)	0.50	mg/kg	6.70	7.46	8.37	6.95	7.7%	8.08	9.00	10.2	9.66	6.0%
Lithium (Li)	2.0	mg/kg	28.8	29.7	31.3	27.9	7.0%	35.6	39.6	46.2	41.8	3.2%
Magnesium (Mg)	20	mg/kg	33900	28100	29400	31000	1.7%	42000	46700	45800	45300	1.0%
Manganese (Mn)	1.0	mg/kg	117	113	133	116	4.2%	135	147	146	146	2.3%
Mercury (Hg)	0.0050	mg/kg	0.0130	0.0177	0.0148	0.0156	2.8%	0.0174	0.0185	0.0199	0.0208	11.2%
Molybdenum (Mo)	0.10	mg/kg	0.74	1.04	0.66	0.61	28.6%	0.69	0.75	2.78	1.19	16.7%
Nickel (Ni)	0.50	mg/kg	14.1	14.9	18.5	14.1	11.6%	13.0	14.6	17.7	15.8	4.5%
Phosphorus (P)	50	mg/kg	494	528	534	478	8.2%	499	556	532	538	1.7%
Potassium (K)	100	mg/kg	2670	2900	3520	2730	10.4%	3300	3640	4480	3630	4.8%
Selenium (Se)	0.20	mg/kg	0.30	0.45	0.28	0.32	7.0%	0.34	0.36	0.63	0.40	10.3%
Silver (Ag)	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	-
Sodium (Na)	50	mg/kg	5200	7150	8490	5670	20.2%	5780	7680	10100	7420	5.7%
Strontium (Sr)	0.50	mg/kg	41.3	52.5	68.4	42.0	25.1%	51.2	69.1	51.9	56.4	1.8%
Sulfur (S)	1000	mg/kg	1000	1600	1300	1100	16.7%	<1000	1300	3100	1400	-
Thallium (Tl)	0.050	mg/kg	0.129	0.137	0.149	0.124	10.9%	0.138	0.155	0.206	0.170	2.2%
Tin (Sn)	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	-
Titanium (Ti)	1.0	mg/kg	313	299	381	304	8.5%	277	299	341	308	0.8%
Tungsten (W)	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	-
Uranium (U)	0.050	mg/kg	1.26	1.39	1.55	1.23	12.9%	1.25	1.39	1.96	1.59	3.6%
Vanadium (V)	0.20	mg/kg	21.9	25.2	27.4	22.0	12.1%	27.7	30.3	43.0	33.1	1.7%
Zinc (Zn)	2.0	mg/kg	21.1	22.2	23.5	21.0	5.9%	21.9	23.9	27.7	24.0	2.1%
Zirconium (Zr)	1.0	mg/kg	5.5	5.0	8.9	5.3	19.8%	6.7	7.3	9.0	7.8	1.7%
Volatile Organic Compounds (Soil)												
VOC Sample Container		-	Field MeOH			Field MeOH		Field MeOH			Field MeOH	
Benzene	0.0050	mg/kg	<0.0050			<0.0050	-	<0.0050			<0.0050	-
Ethylbenzene	0.015	mg/kg	<0.015			<0.015	-	<0.015			<0.015	-
Methyl t-butyl ether (MTBE)	0.20	mg/kg	<0.20			<0.20	-	<0.20			<0.20	-
Styrene	0.050	mg/kg	<0.050			<0.050	-	<0.050			<0.050	-
Toluene	0.050	mg/kg	<0.050			<0.050	-	<0.050			<0.050	-
ortho-Xylene	0.050	mg/kg	<0.050			<0.050	-	<0.050			<0.050	-
meta- & para-Xylene	0.050	mg/kg	<0.050			<0.050	-	<0.050			<0.050	-
Xylenes	0.075	mg/kg	<0.075			<0.075	-	<0.075			<0.075	-
4-Bromofluorobenzene (SS)		%	89.6			97.2	-	92			81	-
1,4-Difluorobenzene (SS)		%	87			97.1	-	85.2			80.5	-
Hydrocarbons (Soil)												
F1 (C6-C10)	10	mg/kg	<10			<10	-	<10			<10	-
F1-BTEX	10	mg/kg	<10			<10	-	<10			<10	-
F2 (C10-C16)	30	mg/kg	<30			<30	-	<30			<30	-
F3 (C16-C34)	50	mg/kg	<50			<50	-	<50			<50	-
F4 (C34-C50)	50	mg/kg	<50			<50	-	<50			<50	-
Chrom. to baseline at nC50		-	YES			YES	-	YES			YES	-
2-Bromobenzotrifluoride, F2-F4		%	88.7			90.5	-	77.3			76.9	-
3,4-Dichlorotoluene (SS)		%	94.1			95.5	-	103.3			89.6	-
Polycyclic Aromatic Hydrocarbons (Soil)												
Acenaphthene	0.0050	mg/kg	<0.0050			<0.0050	-	<0.0050			<0.0050	-
Acenaphthylene	0.0050	mg/kg	<0.0050			<0.0050	-	<0.0050			<0.0050	-
Anthracene	0.0040	mg/kg	<0.0040			<0.0040	-	<0.0040			<0.0040	-
Benz(a)anthracene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Benzo(a)pyrene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Benzo(b&j)fluoranthene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Benzo(b+j+k)fluoranthene	0.015	mg/kg	<0.015			<0.015	-	<0.015			<0.015	-
Benzo(g,h,i)perylene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Benzo(k)fluoranthene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Chrysene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Dibenz(a,h)anthracene	0.0050	mg/kg	<0.0050			<0.0050	-	<0.0050			<0.0050	-
Fluoranthene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Fluorene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Indeno(1,2,3-c,d)pyrene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
2-Methylnaphthalene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Naphthalene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Phenanthrene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Pyrene	0.010	mg/kg	<0.010			<0.010	-	<0.010			<0.010	-
Acenaphthene d10		%	93.9			81.5	-	98.7			74.6	-
Chrysene d12		%	97.4			80.1	-	107.6			89	-
Naphthalene d8		%	80.5			78.6	-	87.2			72	-
Phenanthrene d10		%	101.8			91.3	-	99.3			84.2	-
B(a)P Total Potency Equivalent	0.020	mg/kg	<0.020			<0.020	-	<0.020			<0.020	-
IACR (CCME)	0.15	mg/kg	<0.15			<0.15	-	<0.15			<0.15	-

Client Sample ID	SE-3-1	SE-3-2	SE-3-3	DUP C		SE-2-2	SE-2-3	SE-2-1	DUP D	
Date Sampled	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017		13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	
Time Sampled	10:11	10:11	10:11	10:11		12:00	12:00	12:00	12:00	
ALS Sample ID	L1977406-55	L1977406-56	L1977406-57	L1977406-58		L1977406-52	L1977406-53	L1977406-51	L1977406-54	
Parameter	Soil	Soil	Soil	Soil	Relative Percent Difference	Soil	Soil	Soil	Soil	Relative Percent Difference
Physical Tests (Soil)										
Moisture	31.9			25.5	-			23.0	20.4	-
pH (1:2 soil:water)	8.23	8.27	8.23	8.14	1.3%	8.35	8.35	8.11	8.38	1.3%
Organic / Inorganic Carbon (Soil)										
Inorganic Carbon	1.83	1.71	1.77	1.56	12.6%	1.83	1.92	1.66	1.39	25.9%
Total Carbon by Combustion	3.36	3.50	3.09	3.16	4.8%	3.18	4.30	3.59	2.54	36.9%
Total Organic Carbon	1.53	1.79	1.32	1.6	3.4%	1.35	2.38	1.93	1.15	48.5%
Metals (Soil)										
Aluminum (Al)	4140	4440	4500	4380	0.5%	4140	5310	3800	2960	39.5%
Antimony (Sb)	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	-
Arsenic (As)	3.28	3.23	3.50	3.25	2.6%	4.04	2.95	3.79	4.05	11.9%
Barium (Ba)	12.9	14.3	14.8	13.7	2.2%	14.6	15.6	12.5	10.5	30.2%
Beryllium (Be)	0.28	0.31	0.28	0.30	3.4%	0.29	0.37	0.25	0.23	27.5%
Bismuth (Bi)	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20	<0.20	-
Boron (B)	32.2	30.8	30.6	31.6	1.3%	31.5	36.5	27.2	23.8	28.6%
Cadmium (Cd)	0.043	0.042	0.031	0.055	34.9%	0.046	0.052	0.038	0.030	40.7%
Calcium (Ca)	56700	55000	52900	57900	5.4%	61400	74900	55000	56700	11.7%
Chromium (Cr)	13.2	14.5	15.1	13.9	2.6%	13.7	17.3	12.8	10.2	35.5%
Cobalt (Co)	2.34	2.50	2.54	2.34	5.0%	2.56	3.03	2.26	1.88	32.8%
Copper (Cu)	5.03	5.40	4.76	4.81	5.1%	4.96	6.66	4.29	3.80	33.0%
Iron (Fe)	8740	9700	9970	9390	0.8%	10500	10100	9610	7660	27.2%
Lead (Pb)	4.69	4.50	4.43	4.45	2.0%	4.49	5.31	3.91	3.42	28.8%
Lithium (Li)	20.4	20.5	20.0	20.0	1.5%	20.0	25.5	17.7	15.7	29.2%
Magnesium (Mg)	26200	27000	26600	25300	5.0%	29300	38000	24100	23800	24.6%
Manganese (Mn)	88.1	98.4	96.9	91.9	2.8%	109	127	92.2	80.2	30.8%
Mercury (Hg)	0.0094	0.0123	0.0087	0.0103	1.6%	0.0077	0.0097	0.0076	0.0071	16.0%
Molybdenum (Mo)	0.52	0.36	0.32	0.29	31.9%	0.32	0.30	0.41	0.26	27.6%
Nickel (Ni)	7.71	8.09	7.83	7.68	2.5%	8.83	9.63	6.99	5.91	35.8%
Phosphorus (P)	388	366	400	379	1.5%	403	594	385	378	19.7%
Potassium (K)	1890	2050	2000	1970	0.5%	1840	2330	1760	1350	37.7%
Selenium (Se)	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20	<0.20	-
Silver (Ag)	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	-
Sodium (Na)	4800	3580	3710	4580	12.8%	3640	4130	3690	3090	21.1%
Strontium (Sr)	43.0	40.2	43.0	45.5	7.8%	44.8	50.3	55.0	43.0	15.1%
Sulfur (S)	<1000	<1000	<1000	<1000	-	<1000	<1000	<1000	<1000	-
Thallium (Tl)	0.082	0.077	0.083	0.078	3.4%	0.082	0.100	0.078	0.061	34.8%
Tin (Sn)	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	-
Titanium (Ti)	201	198	218	193	6.4%	202	241	198	145	38.3%
Tungsten (W)	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	-
Uranium (U)	0.806	0.682	0.734	0.674	9.4%	0.746	0.845	0.651	0.545	31.3%
Vanadium (V)	17.3	17.4	17.5	17.7	1.7%	19.1	21.1	15.8	13.2	34.3%
Zinc (Zn)	12.3	12.6	12.9	12.0	4.9%	13.2	14.7	11.4	9.3	33.9%
Zirconium (Zr)	3.9	4.7	4.6	4.7	6.6%	4.5	6.9	4.6	3.5	41.5%
Volatile Organic Compounds (Soil)										
VOC Sample Container	Field MeOH			Field MeOH				Field MeOH	Field MeOH	
Benzene	<0.0050			<0.0050	-			<0.0050	<0.0050	-
Ethylbenzene	<0.015			<0.015	-			<0.015	<0.015	-
Methyl t-butyl ether (MTBE)	<0.20			<0.20	-			<0.20	<0.20	-
Styrene	<0.050			<0.050	-			<0.050	<0.050	-
Toluene	<0.050			<0.050	-			<0.050	<0.050	-
ortho-Xylene	<0.050			<0.050	-			<0.050	<0.050	-
meta- & para-Xylene	<0.050			<0.050	-			<0.050	<0.050	-
Xylenes	<0.075			<0.075	-			<0.075	<0.075	-
4-Bromofluorobenzene (SS)	88.5			71.6	-			81.3	90.4	-
1,4-Difluorobenzene (SS)	87.3			70.7	-			82.5	87.7	-
Hydrocarbons (Soil)										
F1 (C6-C10)	<10			<10	-			<10	<10	-
F1-BTEX	<10			<10	-			<10	<10	-
F2 (C10-C16)	<30			<30	-			<30	<30	-
F3 (C16-C34)	<50			<50	-			<50	<50	-
F4 (C34-C50)	<50			<50	-			<50	<50	-
Chrom. to baseline at nC50	YES			YES	-			YES	YES	-
2-Bromobenzotrifluoride, F2-F4	78.1			80.3	-			78.5	88.4	-
3,4-Dichlorotoluene (SS)	91			71.6	-			98	128.9	-
Polycyclic Aromatic Hydrocarbons (Soil)										
Acenaphthene	<0.0050			<0.0050	-			<0.0050	<0.0050	-
Acenaphthylene	<0.0050			<0.0050	-			<0.0050	<0.0050	-
Anthracene	<0.0040			<0.0040	-			<0.0040	<0.0040	-
Benz(a)anthracene	<0.010			<0.010	-			<0.010	<0.010	-
Benzo(a)pyrene	<0.010			<0.010	-			<0.010	<0.010	-
Benzo(b&j)fluoranthene	<0.010			<0.010	-			<0.010	<0.010	-
Benzo(b+j+k)fluoranthene	<0.015			<0.015	-			<0.015	<0.015	-
Benzo(g,h,i)perylene	<0.010			<0.010	-			<0.010	<0.010	-
Benzo(k)fluoranthene	<0.010			<0.010	-			<0.010	<0.010	-
Chrysene	<0.010			<0.010	-			<0.010	<0.010	-
Dibenz(a,h)anthracene	<0.0050			<0.0050	-			<0.0050	<0.0050	-
Fluoranthene	<0.010			<0.010	-			<0.010	<0.010	-
Fluorene	<0.010			<0.010	-			<0.010	<0.010	-
Indeno(1,2,3-c,d)pyrene	<0.010			<0.010	-			<0.010	<0.010	-
2-Methylnaphthalene	<0.010			<0.010	-			<0.010	<0.010	-
Naphthalene	<0.010			<0.010	-			<0.010	<0.010	-
Phenanthrene	<0.010			<0.010	-			<0.010	<0.010	-
Pyrene	<0.010			<0.010	-			<0.010	<0.010	-
Acenaphthene d10	82.9			79.4	-			76.8	80.7	-
Chrysene d12	92.7			98.7	-			91.3	95.2	-
Naphthalene d8	78.3			80.3	-			71.7	76.1	-
Phenanthrene d10	91.9			90.6	-			85.2	89.4	-
B(a)P Total Potency Equivalent	<0.020			<0.020	-			<0.020	<0.020	-
IACR (CCME)	<0.15			<0.15	-			<0.15	<0.15	-

Client Sample ID	SE-1-2	SE-1-3	SE-1-1	DUP E		SW-3-2	SW-3-3	SW-1-3	DUP F	
Date Sampled	13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017		13-Aug-2017	13-Aug-2017	13-Aug-2017	13-Aug-2017	
Time Sampled	13:33	13:33	13:33	13:33		14:30	14:30	15:22	14:30	
ALS Sample ID	L1977406-48	L1977406-49	L1977406-47	L1977406-50		L1977406-44	L1977406-45	L1977406-43	L1977406-46	
Parameter	Soil	Soil	Soil	Soil	Relative Percent Difference	Soil	Soil	Soil	Soil	Relative Percent Difference
Physical Tests (Soil)										
Moisture			22.7	21.1	-				24.3	-
pH (1:2 soil:water)	8.31	8.18	8.34	8.25	0.3%	8.28	8.26	8.49	8.33	0.2%
Organic / Inorganic Carbon (Soil)										
Inorganic Carbon	1.86	1.80	2.00	1.74	8.1%	2.06	1.73	0.828	1.54	0.0%
Total Carbon by Combustion	4.33	3.98	4.68	3.95	9.2%	4.40	4.63	1.25	4.17	19.6%
Total Organic Carbon	2.47	2.18	2.68	2.21	10.0%	2.34	2.9	0.42	2.63	32.9%
Metals (Soil)										
Aluminum (Al)	4770	3990	4850	4800	5.6%	5160	6070	1100	5060	20.7%
Antimony (Sb)	<0.10	<0.10	<0.10	<0.10	-	<0.10	0.11	<0.10	0.10	-
Arsenic (As)	4.96	4.06	3.75	3.89	9.0%	4.93	5.39	0.47	4.24	16.4%
Barium (Ba)	15.4	13.2	15.3	14.6	0.2%	17.6	20.4	3.90	15.3	9.1%
Beryllium (Be)	0.34	0.30	0.31	0.33	4.1%	0.34	0.42	<0.10	0.34	-
Bismuth (Bi)	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20	<0.20	-
Boron (B)	35.6	30.0	35.6	34.6	2.5%	35.6	42.9	7.7	36.8	24.6%
Cadmium (Cd)	0.040	0.039	0.048	0.041	3.2%	0.035	0.039	<0.020	0.034	-
Calcium (Ca)	72200	62300	71000	74200	8.0%	72900	86600	20900	72800	19.1%
Chromium (Cr)	16.2	14.8	16.5	17.1	7.7%	19.3	22.1	3.65	18.2	19.2%
Cobalt (Co)	3.01	2.74	2.96	2.81	3.3%	3.26	3.86	0.76	3.02	13.9%
Copper (Cu)	6.16	8.16	6.21	5.80	16.5%	6.19	7.50	1.56	5.84	13.9%
Iron (Fe)	11400	11600	12100	11200	4.4%	11600	13300	4040	10700	10.4%
Lead (Pb)	4.92	4.18	4.97	4.78	1.9%	4.97	5.78	0.94	4.77	20.2%
Lithium (Li)	24.1	19.9	23.6	23.5	4.2%	24.5	28.8	5.9	23.7	18.3%
Magnesium (Mg)	35300	30900	34800	31800	5.7%	38700	46900	10600	39900	21.8%
Manganese (Mn)	131	126	127	118	8.1%	128	153	35.9	119	11.9%
Mercury (Hg)	0.0092	0.0084	0.0104	0.0113	19.1%	0.0089	0.0100	<0.0050	0.0079	-
Molybdenum (Mo)	0.33	0.35	0.32	0.30	10.5%	0.30	0.39	0.12	0.30	10.5%
Nickel (Ni)	9.12	8.43	9.10	9.06	2.0%	10.3	11.8	2.14	9.66	17.8%
Phosphorus (P)	441	365	376	394	0.0%	533	563	95	483	19.5%
Potassium (K)	2090	1770	2150	2090	4.2%	2410	2740	490	2280	19.2%
Selenium (Se)	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20	<0.20	-
Silver (Ag)	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	-
Sodium (Na)	3790	4520	4000	3480	16.4%	3990	5030	1600	4060	13.7%
Strontium (Sr)	50.1	43.9	48.0	50.8	7.1%	50.0	56.2	12.8	44.8	12.2%
Sulfur (S)	<1000	<1000	<1000	<1000	-	<1000	<1000	<1000	<1000	-
Thallium (Tl)	0.089	0.080	0.093	0.097	10.5%	0.107	0.116	<0.050	0.092	-
Tin (Sn)	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	-
Titanium (Ti)	224	211	235	215	3.8%	290	334	57.2	266	15.8%
Tungsten (W)	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	-
Uranium (U)	0.755	0.722	0.798	0.827	8.7%	0.869	0.894	0.213	0.749	12.8%
Vanadium (V)	18.9	17.1	19.1	18.3	0.4%	20.6	23.4	3.79	20.6	25.6%
Zinc (Zn)	14.0	13.9	14.7	13.4	5.8%	15.8	17.8	3.4	14.4	15.5%
Zirconium (Zr)	5.7	4.4	5.9	6.0	11.8%	5.6	6.6	1.6	6.2	29.6%
Volatile Organic Compounds (Soil)										
VOC Sample Container			Field MeOH	Field MeOH					Field MeOH	
Benzene			<0.0050	<0.0050	-				<0.0050	-
Ethylbenzene			<0.015	<0.015	-				<0.015	-
Methyl t-butyl ether (MTBE)			<0.20	<0.20	-				<0.20	-
Styrene			<0.050	<0.050	-				<0.050	-
Toluene			<0.050	<0.050	-				<0.050	-
ortho-Xylene			<0.050	<0.050	-				<0.050	-
meta- & para-Xylene			<0.050	<0.050	-				<0.050	-
Xylenes			<0.075	<0.075	-				<0.075	-
4-Bromofluorobenzene (SS)			105.8	99	-				94.3	-
1,4-Difluorobenzene (SS)			97.8	90.5	-				87.3	-
Hydrocarbons (Soil)										
F1 (C6-C10)			<10	<10	-				<10	-
F1-BTEX			<10	<10	-				<10	-
F2 (C10-C16)			<30	<30	-				<30	-
F3 (C16-C34)			<50	<50	-				<50	-
F4 (C34-C50)			<50	<50	-				<50	-
Chrom. to baseline at nC50			YES	YES	-				YES	-
2-Bromobenzotrifluoride, F2-F4			80.7	84.6	-				89	-
3,4-Dichlorotoluene (SS)			105.6	Not Reportable	-				104.8	-
Polycyclic Aromatic Hydrocarbons (Soil)										
Acenaphthene			<0.0050	<0.0050	-				<0.0050	-
Acenaphthylene			<0.0050	<0.0050	-				<0.0050	-
Anthracene			<0.0040	<0.0040	-				<0.0040	-
Benz(a)anthracene			<0.010	<0.010	-				<0.010	-
Benzo(a)pyrene			<0.010	<0.010	-				<0.010	-
Benzo(b&j)fluoranthene			<0.010	<0.010	-				<0.010	-
Benzo(b+j+k)fluoranthene			<0.015	<0.015	-				<0.015	-
Benzo(g,h,i)perylene			<0.010	<0.010	-				<0.010	-
Benzo(k)fluoranthene			<0.010	<0.010	-				<0.010	-
Chrysene			<0.010	<0.010	-				<0.010	-
Dibenz(a,h)anthracene			<0.0050	<0.0050	-				<0.0050	-
Fluoranthene			<0.010	<0.010	-				<0.010	-
Fluorene			<0.010	<0.010	-				<0.010	-
Indeno(1,2,3-c,d)pyrene			<0.010	<0.010	-				<0.010	-
2-Methylnaphthalene			<0.010	<0.010	-				<0.010	-
Naphthalene			<0.010	<0.010	-				<0.010	-
Phenanthrene			<0.010	<0.010	-				<0.010	-
Pyrene			<0.010	<0.010	-				<0.010	-
Acenaphthene d10			75.3	101.2	-				78.2	-
Chrysene d12			82.4	111.2	-				91.5	-
Naphthalene d8			68.7	91.6	-				74.2	-
Phenanthrene d10			80.4	106.5	-				89.4	-
B(a)P Total Potency Equivalent			<0.020	<0.020	-				<0.020	-
IACR (CCME)			<0.15	<0.15	-				<0.15	-

Qualifier Legend

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.

APPENDIX D

Substrate, Macroflora and Benthic Epifauna

APPENDIX D-1
UNDERWATER VIDEO TRANSECT DATA

Transect	UTM Coordinates				Video File Name	Video Analysis Start	Video Anslysis End	Distance Analyzed (m)	Substrate (Percent Cover)	Macroflora (Time viewed in seconds)	Epifauna (Count)
	Transect Start		Transect End								
	Easting	Northing	Easting	Northing							
West	503148	7976545	501623	7976447	MilnePort_WT2017_Sept3.MOV	00:28	35:44	1,645	Fine (68.7%) Mixed (21.3%) Medium (9.7%) Not Classifiable (0.3%)	*Desmarestia* sp. (1,021) Chondrus sp. (328) Agarum sp. (152) Laminaria sp. (17) Chlorophyta (2)	sea urchin (1,758) brittle star(1,624) deep-sea scallop (279) sea butterfly (90) polychaete worm (45) unidentified bivalve (39) sea star (28) tunicate (26) whelk (24) Iceland scallop (22) unidentified sculpin (8) sea anemone (6) wrinkled rock borer (5) sea spider (3) unidentified jelly fish (3) marine amphipod (3)
East	503460	7976689	504929	7976654	MilnePort_ET2017#1_Sept2.MOV MilnePort_ET2017#2_Sept2.MOV	00:39 00:05	52:40 01:28	1,567	Medium (67.7%) Mixed (24.6%) Fine (6.6%) Not Classifiable (1.1%)	*Desmarestia* sp. (2,056) Chondrus sp. (530) Agarum sp. (422) Encrusting corraline (114) Laminaria sp. (14) Chlorophyta (4)	brittle star(2,944) sea urchin (1,948) deep-sea scallop (147) unidentified gastropod (73) unidentified bivalve (72) tunicate (72) sea star (46) sea butterfly (24) Iceland scallop (13) polychaete worm (11) unidentified sculpin (10) sea anemone (6) wrinkled rock borer (4) unidentified jellyfish (3) mud star (3) sun star (3)
North	503492	7978355	503300	7976750	MilnePort_NT2017_Sept3.MOV	02:14	1:31:04	1,626	Fine (71.4%) Mixed (20.3%) Medium (7.6%) Not Classifiable (0.7%)	No macroflora observed	brittle star (35,750) sea urchin (282) polychaete worm (515) sea star (161) tunicate (27) sea anemone (13) eelpout (12) feather star (8) unidentified gastropod (7) deep-sea scallop (3) sea spider (3) sun star (2) unidentified jellyfish (2) unidentified clam (2) mud star (1) unidentified sculpin (1)
Coastal	504929	7976654	506947	7979471	MilnePort_CT2017#1_Sept2.MOV MilnePort_CT2017#2_Sept2.MOV	01:03 01:06	41:50 31:27	3,373	Medium (58.4%) Mixed (27.2%) Fine (2.3%) Not Classifiable (12.1%)	*Desmarestia* sp. (3,056) Agarum sp. (780) Chondrus sp. (130) Laminaria sp. (112) Fucus sp. (11)	brittle star (7,105) sea urchin (1,803) deep-sea scallop (102) unidentified clam (59) sea star (31) marine amphipod (22) unidentified gastropod (14) sea anemone (13) tunicate (11) wrinkled rock borer (8) sea cucumber (5) Iceland scallop (5) unidentified jellyfish (5) whelk (3) unidentified sculpin (3) sea butterfly (1)

APPENDIX D-2
MACROFLORA AND EPIFAUNA DATA FOR ANALYSIS

West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
5	8	11	190	20	9	5	10	38	5	10	0
10	9	12	195	10	2	10	8	51	10	12	0
15	9	14	200	36	8	15	7	50	15	14	0
20	35	3	205	9	2	20	14	24	20	14	0
25	27	19	210	7	6	25	9	19	25	7	0
30	23	10	215	3	4	30	11	39	30	9	0
35	9	7	220	11	7	35	12	48	35	5	0
40	22	22	225	31	0	40	4	47	40	17	0
45	21	17	230	24	0	45	10	32	45	14	0
50	6	20	235	37	1	50	10	33	50	11	0
55	4	17	240	12	8	55	7	46	55	28	0
60	12	2	245	38	8	60	13	16	60	24	0
65	36	20	250	13	3	65	17	24	65	18	0
70	12	25	255	6	10	70	38	16	70	28	0
75	9	4	260	12	10	75	21	17	75	10	0
80	7	4	265	35	5	80	13	0	80	24	0
85	9	11	270	34	9	85	12	0	85	17	0
90	10	5	275	4	5	90	7	8	90	8	0
95	7	12	280	7	3	95	30	7	95	15	0
100	77	9	285	10	17	100	7	5	100	38	0
105	47	15	290	13	3	105	10	7	105	79	0
110	10	18	295	23	9	110	9	42	110	132	0
115	9	14	300	10	3	115	11	19	115	170	0
120	28	16	305	8	8	120	14	39	120	183	0
125	8	13	310	41	6	125	5	14	125	184	0
130	9	12	315	25	2	130	6	43	130	241	0
135	10	13	320	32	0	135	14	27	135	250	0
140	3	10	325	11	0	140	12	35	140	213	0
145	37	12	330	13	0	145	10	50	145	170	0
150	34	19	335	35	0	150	10	65	150	128	0
155	5	17	340	28	15	155	10	60	155	123	0
160	8	0	345	10	9	160	13	31	160	252	0
165	20	0	350	29	9	165	5	26	165	232	0
170	18	0	355	32	6	170	9	41	170	235	0
175	21	16	360	45	8	175	10	33	175	213	0
180	6	18	365	47	3	180	6	34	180	214	0
185	4	1	370	13	15	185	7	12	185	178	0
190	7	14	375	52	7	190	9	14	190	241	0
195	36	11	380	46	7	195	8	37	195	177	0
200	65	17	385	30	1	200	12	47	200	234	0
205	50	35	390	30	8	205	12	8	205	158	0
210	13	19	395	69	3	210	16	15	210	202	0
215	1	15	400	44	8	215	11	47	215	163	0
220	9	12	405	39	3	220	11	25	220	228	0
225	8	2	410	37	3	225	6	12	225	238	0
230	28	19	415	24	9	230	11	26	230	222	0
235	8	12	420	75	0	235	10	20	235	173	0
240	8	8	425	78	0	240	8	21	240	232	0
245	14	6	430	56	0	245	8	58	245	165	0
250	7	20	435	104	3	250	7	36	250	206	0
255	10	13	440	48	8	255	11	24	255	178	0
260	16	6	445	80	9	260	9	16	260	239	0
265	10	11	450	57	4	265	10	37	265	226	0
270	8	16	455	16	2	270	4	36	270	242	0
275	8	14	460	22	2	275	12	42	275	186	0
280	13	21	465	14	8	280	13	75	280	223	0
285	21	4	470	24	9	285	6	20	285	205	0
290	17	11	475	12	6	290	4	48	290	223	0
295	9	4	480	20	0	295	10	46	295	202	0
300	6	5	485	32	0	300	4	7	300	215	0
305	8	0	490	12	10	305	10	35	305	246	0
310	22	0	495	13	3	310	12	10	310	168	0
315	13	4	500	41	3	315	13	15	315	247	0
320	22	15	505	15	3	320	9	36	320	232	0
325	6	21	510	11	7	325	11	27	325	255	0
330	9	11	515	22	3	330	10	39	330	202	0
335	23	17	520	14	1	335	17	50	335	230	0
340	31	18	525	13	6	340	12	19	340	157	0
345	2	9	530	32	5	345	12	50	345	212	0
350	16	9	535	14	10	350	10	19	350	146	0
355	9	17	540	38	7	355	7	27	355	152	0
360	9	3	545	13	3	360	5	10	360	78	0
365	6	11	550	13	9	365	12	31	365	44	0
370	7	3	555	41	8	370	7	51	370	20	0
375	37	4	560	36	7	375	14	38	375	31	0
380	1	17	565	82	15	380	28	13	380	21	0
385	10	12	570	28	22	385	23	33	385	43	0
390	25	8	575	35	17	390	28	45	390	37	0
395	3	17	580	29	6	395	33	10	395	26	0
400	27	1	585	14	5	400	38	19	400	42	0
405	8	9	590	25	9	405	10	23	405	17	0
410	17	0	595	51	3	410	7	33	410	15	0
415	9	0	600	13	4	415	11	38	415	27	0
420	20	20	605	14	0	420	11	28	420	45	0
425	21	19	610	11	0	425	41	8	425	40	0
430	26	5	615	12	9	430	22	25	430	34	0
435	8	15	620	9	4	435	26	52	435	35	0
440	8	8	625	5	14	440	9	37	440	16	0
445	44	9	630	11	4	445	8	38	445	15	0

APPENDIX D-2
MACROFLORA AND EPIFAUNA DATA FOR ANALYSIS

West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
450	20	19	635	45	3	450	15	25	450	31	0
455	8	13	640	17	12	455	7	42	455	30	0
460	10	20	645	9	4	460	8	31	460	17	0
465	9	15	650	13	12	465	3	18	465	44	0
470	4	19	655	7	1	470	11	0	470	38	0
475	9	3	660	42	13	475	34	5	475	15	0
480	1	16	665	26	6	480	32	22	480	38	0
485	8	8	670	10	13	485	11	45	485	31	0
490	24	4	675	12	10	490	5	31	490	42	0
495	30	10	680	9	10	495	2	41	495	41	0
500	43	6	685	13	7	500	12	78	500	25	0
505	30	10	690	36	4	505	10	36	505	44	0
510	6	9	695	38	2	510	9	10	510	25	0
515	9	10	700	9	4	515	12	51	515	40	0
520	26	4	705	11	0	520	15	24	520	21	0
525	7	8	710	10	0	525	9	52	525	29	0
530	21	5	715	14	14	530	6	20	530	18	0
535	11	12	720	11	10	535	3	42	535	44	0
540	8	1	725	7	9	540	13	27	540	29	0
545	3	3	730	34	6	545	11	40	545	17	0
550	6	14	735	69	4	550	3	20	550	20	0
555	24	9	740	57	7	555	15	51	555	38	0
560	10	8	745	5	13	560	6	25	560	32	0
565	11	6	750	43	2	565	14	52	565	29	0
570	5	13	755	8	8	570	8	17	570	29	0
575	27	14	760	49	4	575	26	48	575	36	0
580	57	16	765	14	14	580	10	25	580	20	0
585	18	13	770	37	6	585	7	16	585	11	0
590	10	16	775	22	2	590	9	16	590	29	0
595	9	6	780	43	11	595	12	12	595	38	0
600	7	4	785	55	8	600	7	33	600	17	0
605	1	0	790	38	10	605	10	95	605	43	0
610	16	0	795	17	5	610	10	55	610	15	0
615	2	13	800	35	8	615	6	93	615	11	0
620	6	17	805	43	9	620	9	81	620	22	0
625	5	11	810	5	9	625	11	93	625	35	0
630	17	6	815	8	5	630	4	62	630	35	0
635	7	13	820	3	13	635	12	74	635	24	0
640	8	14	825	48	8	640	16	75	640	37	0
645	8	5	830	23	5	645	10	93	645	25	0
650	13	15	835	46	2	650	45	39	650	30	0
655	5	17	840	49	7	655	39	95	655	14	0
660	19	4	845	20	18	660	7	87	660	33	0
665	9	9	850	29	15	665	6	70	665	16	0
670	8	9	855	11	25	670	11	71	670	29	0
675	12	14	860	22	10	675	9	75	675	39	0
680	7	6	865	18	4	680	8	52	680	25	0
685	7	6	870	38	5	685	9	75	685	14	0
690	54	0	875	34	4	690	14	60	690	26	0
695	63	0	880	5	17	695	7	49	695	14	0
700	18	12	885	7	0	700	14	52	700	47	0
705	2	3	890	14	0	705	14	70	705	43	0
710	7	15	895	20	20	710	12	46	710	37	0
715	18	14	900	52	18	715	10	85	715	37	0
720	27	2	905	25	12	720	14	91	720	122	0
725	4	2	910	38	13	725	8	85	725	159	0
730	4	12	915	24	13	730	11	88	730	122	0
735	6	15	920	5	10	735	13	99	735	177	0
740	2	8	925	14	13	740	10	91	740	209	0
745	9	9	930	47	0	745	11	70	745	230	0
750	9	13	935	52	0	750	14	80	750	222	0
755	10	11	940	24	16	755	8	95	755	235	0
760	23	14	945	57	10	760	7	46	760	199	0
765	1	5	950	42	20	765	11	55	765	192	0
770	18	5	955	44	8	770	8	41	770	224	0
775	11	13	960	7	16	775	8	46	775	218	0
780	10	13	965	8	11	780	9	43	780	202	0
785	8	10	970	6	6	785	10	56	785	252	0
790	13	0	975	20	11	790	7	33	790	206	0
795	12	0	980	12	1	795	30	77	795	198	0
800	17	5	985	26	2	800	42	48	800	260	0
805	14	5	990	11	12	805	7	80	805	193	0
810	28	1	995	7	14	810	11	87	810	186	0
815	6	15	1000	14	18	815	11	54	815	226	0
820	10	8	1005	20	13	820	8	33	820	201	0
825	9	7	1010	14	5	825	9	39	825	231	0
830	9	15	1015	11	8	830	7	69	830	232	0
835	10	2	1020	24	12	835	27	53	835	194	0
840	8	13	1025	8	18	840	24	90	840	201	0
845	23	6	1030	7	11	845	8	96	845	227	0
850	7	8	1035	28	14	850	12	94	850	247	0
855	2	7	1040	20	15	855	12	64	855	227	0
860	10	10	1045	13	17	860	7	57	860	248	0
865	10	7	1050	20	17	865	15	86	865	246	0
870	17	2	1055	5	2	870	10	70	870	190	0
875	7	11	1060	25	17	875	8	55	875	194	0
880	13	3	1065	8	5	880	4	49	880	202	0
885	22	10	1070	26	17	885	10	99	885	266	0
890	10	14	1075	12	3	890	15	64	890	259	0
895	7	13	1080	12	12	895	15	52	895	237	0

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West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
900	4	8	1085	14	34	900	31	39	900	184	0
905	11	14	1090	9	34	905	14	38	905	225	0
910	6	5	1095	5	37	910	10	60	910	183	0
915	17	17	1100	13	17	915	11	81	915	265	0
920	9	11	1105	6	38	920	9	38	920	225	0
925	9	14	1110	12	38	925	12	93	925	234	0
930	12	3	1115	9	12	930	12	47	930	182	0
935	8	10	1120	12	21	935	10	36	935	254	0
940	9	11	1125	8	20	940	12	51	940	216	0
945	4	4	1130	14	24	945	7	99	945	205	0
950	8	3	1135	7	35	950	10	50	950	220	0
955	6	6	1140	13	21	955	12	57	955	214	0
960	8	0	1145	11	0	960	9	77	960	228	0
965	6	10	1150	6	0	965	12	51	965	225	0
970	19	8	1155	7	5	970	6	95	970	199	0
975	9	3	1160	8	18	975	10	64	975	223	0
980	6	8	1165	8	13	980	11	68	980	210	0
985	5	13	1170	25	5	985	9	74	985	232	0
990	6	12	1175	6	32	990	10	63	990	205	0
995	9	3	1180	7	29	995	9	39	995	264	0
1000	10	10	1185	14	29	1000	7	91	1000	265	0
1005	3	15	1190	3	19	1005	8	90	1005	214	0
1010	7	12	1195	11	6	1010	12	35	1010	214	0
1015	6	7	1200	13	15	1015	6	84	1015	186	0
1020	10	2	1205	9	26	1020	25	58	1020	234	0
1025	17	13	1210	23	38	1025	12	48	1025	229	0
1030	4	8	1215	7	21	1030	6	57	1030	215	0
1035	7	11	1220	9	8	1035	9	89	1035	171	0
1040	4	7	1225	22	20	1040	8	84	1040	126	0
1045	7	2	1230	12	22	1045	10	75	1045	97	0
1050	7	0	1235	20	5	1050	3	71	1050	108	0
1055	7	25	1240	15	0	1055	13	51	1055	83	0
1060	6	19	1245	20	0	1060	8	83	1060	94	0
1065	8	15	1250	8	16	1065	12	55	1065	74	0
1070	9	15	1255	4	27	1070	6	69	1070	99	0
1075	4	16	1260	3	37	1075	7	61	1075	116	0
1080	9	15	1265	2	3	1080	16	36	1080	120	0
1085	4	21	1270	5	6	1085	11	37	1085	102	0
1090	3	2	1275	9	8	1090	16	71	1090	92	0
1095	7	20	1280	5	30	1095	9	85	1095	112	0
1100	6	4	1285	4	12	1100	13	60	1100	102	0
1105	9	13	1290	7	35	1105	11	91	1105	112	0
1110	21	4	1295	12	26	1110	10	92	1110	118	0
1115	18	23	1300	6	17	1115	7	10	1115	92	0
1120	29	7	1305	12	2	1120	12	15	1120	111	0
1125	12	21	1310	4	17	1125	24	35	1125	113	0
1130	19	9	1315	8	1	1130	7	45	1130	85	0
1135	11	22	1320	14	3	1135	9	52	1135	73	0
1140	12	13	1325	8	33	1140	8	36	1140	92	0
1145	7	24	1330	7	26	1145	4	56	1145	117	0
1150	7	4	1335	2	2	1150	12	69	1150	111	0
1155	4	23	1340	21	19	1155	7	33	1155	119	0
1160	7	38	1345	19	15	1160	10	86	1160	103	0
1165	9	35	1350	15	31	1165	16	60	1165	111	0
1170	8	4	1355	5	37	1170	4	95	1170	77	0
1175	4	22	1360	4	7	1175	12	95	1175	87	0
1180	5	48	1365	7	8	1180	11	80	1180	110	0
1185	10	29	1370	7	20	1185	13	83	1185	85	0
1190	3	9	1375	13	22	1190	39	67	1190	122	0
1195	9	5	1380	3	20	1195	29	40	1195	119	0
1200	7	8	1385	2	21	1200	27	74	1200	84	0
1205	8	18	1390	5	14	1205	45	85	1205	79	0
1210	4	12	1395	10	19	1210	16	65	1210	73	0
1215	5	5	1400	31	21	1215	14	61	1215	72	0
1220	21	16	1405	14	12	1220	12	81	1220	95	0
1225	8	9	1410	20	4	1225	12	54	1225	115	0
1230	4	18	1415	27	13	1230	12	49	1230	84	0
1235	9	14	1420	14	10	1235	16	45	1235	64	0
1240	6	20	1425	8	5	1240	11	61	1240	88	0
1245	23	23	1430	15	14	1245	11	96	1245	91	0
1250	17	18	1435	5	2	1250	9	88	1250	109	0
1255	16	18	1440	8	26	1255	7	54	1255	104	0
1260	15	21	1445	11	23	1260	11	73	1260	120	0
1265	3	8	1450	24	37	1265	27	55	1265	114	0
1270	5	9	1455	11	34	1270	3	43	1270	98	0
1275	7	24	1460	10	10	1275	12	65	1275	83	0
1280	6	25	1465	13	0	1280	14	79	1280	89	0
1285	15	15				1285	21	80	1285	93	0
1290	4	7				1290	7	95	1290	91	0
1295	7	21				1295	10	58	1295	111	0
1300	9	10				1300	13	75	1300	114	0
1305	8	22				1305	7	94	1305	115	0
1310	13	10				1310	16	49	1310	113	0
1315	4	11				1315	12	63	1315	78	0
1320	8	2				1320	17	52	1320	84	0
1325	5	12				1325	6	55	1325	102	0
1330	7	6				1330	7	89	1330	118	0
1335	5	22				1335	9	89	1335	79	0
1340	3	20				1340	6	55	1340	90	0
1345	7	2				1345	11	78	1345	114	0

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West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
1350	10	9				1350	11	48	1350	104	0
1355	3	7				1355	10	79	1355	95	0
1360	6	0				1360	15	44	1360	71	0
1365	15	9				1365	24	68	1365	93	0
1370	34	9				1370	8	81	1370	85	0
1375	12	8				1375	13	51	1375	121	0
1380	21	10				1380	13	82	1380	107	0
1385	5	6				1385	9	41	1385	94	0
1390	11	4				1390	7	74	1390	88	0
1395	4	6				1395	12	71	1395	120	0
1400	21	2				1400	6	38	1400	114	0
1405	18	4				1405	7	26	1405	120	0
1410	7	0				1410	30	84	1410	103	0
1415	13	0				1415	16	56	1415	84	0
1420	3	8				1420	12	81	1420	64	0
1425	6	3				1425	3	70	1425	65	0
1430	3	1				1430	6	58	1430	94	0
1435	6	5				1435	10	78	1435	98	0
1440	8	2				1440	10	42	1440	84	0
1445	9	4				1445	8	39	1445	97	0
1450	15	2				1450	10	39	1450	89	0
1455	27	8				1455	6	59	1455	69	0
1460	14	7				1460	10	59	1460	83	0
1465	3	4				1465	4	37	1465	116	0
1470	9	3				1470	8	79	1470	117	0
1475	14	10				1475	10	83	1475	108	0
1480	10	6				1480	9	36	1480	99	0
1485	10	2				1485	9	27	1485	105	0
1490	7	4				1490	16	26	1490	106	0
1495	12	7				1495	14	79	1495	108	0
1500	15	2				1500	10	74	1500	108	0
1505	14	6				1505	10	46	1505	109	0
1510	12	6				1510	12	38	1510	95	0
1515	8	5				1515	7	48	1515	90	0
1520	9	1				1520	12	59	1520	89	0
1525	15	4				1525	7	76	1525	106	0
1530	16	3				1530	11	53	1530	94	0
1535	19	2				1535	10	36	1535	101	0
1540	4	7				1540	15	76	1540	84	0
1545	2	9				1545	3	78	1545	93	0
1550	18	3				1550	12	44	1550	75	0
1555	8	2				1555	4	35	1555	71	0
1560	8	3				1560	15	29	1560	83	0
1565	12	6				1565	26	28	1565	89	0
1570	8	2				1570	9	35			
1575	6	0				1575	11	69			
1580	12	0				1580	4	65			
1585	17	0				1585	14	38			
1590	7	8				1590	16	32			
						1595	10	32			
						1600	12	26			
						1605	3	75			
						1610	7	17			
						1615	14	22			
						1620	14	29			
						1625	6	36			
						1630	10	39			
						1635	13	54			
						1640	9	61			
						1645	15	56			
						1650	11	76			
						1655	10	47			
						1660	8	16			
						1665	34	41			
						1670	30	22			
						1675	10	75			
						1680	11	45			
						1685	8	72			
						1690	15	66			
						1695	12	27			
						1700	5	77			
						1705	10	58			
						1710	14	17			
						1715	9	21			
						1720	8	61			
						1725	9	47			
						1730	14	26			
						1735	10	41			
						1740	11	24			
						1745	12	55			
						1750	8	55			
						1755	14	52			
						1760	9	33			
						1765	7	61			
						1770	8	44			
						1775	10	68			
						1780	11	22			
						1785	10	71			
						1790	10	36			
						1795	9	22			

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West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
						1800	7	53			
						1805	10	57			
						1810	7	21			
						1815	8	39			
						1820	9	56			
						1825	8	59			
						1830	12	37			
						1835	11	55			
						1840	11	64			
						1845	8	30			
						1850	15	18			
						1855	8	29			
						1860	8	61			
						1865	7	24			
						1870	5	36			
						1875	9	70			
						1880	16	37			
						1885	14	53			
						3330	11	31			
						3335	37	11			
						3340	11	30			
						3345	6	55			
						3350	12	54			
						3355	11	20			
						3360	12	54			
						3365	29	26			
						3370	15	45			
						3375	11	38			
						3380	7	34			
						3385	14	43			
						3390	11	11			
						3395	18	47			
						3400	14	26			
						3405	7	48			
						3410	13	20			
						3415	10	76			
						3420	10	43			
						3425	12	34			
						3430	9	49			
						3435	16	14			
						3440	15	39			
						3445	16	28			
						3450	13	60			
						3455	7	21			
						3460	9	36			
						3465	32	19			
						3470	18	36			
						3475	8	14			
						3480	14	51			
						3485	13	21			
						3490	12	51			
						3495	12	20			
						3500	7	63			
						3505	9	16			
						3510	19	5			
						3515	10	12			
						3520	10	54			
						3525	11	25			
						3530	12	16			
						3535	12	20			
						3540	11	33			
						3545	18	13			
						3550	12	43			
						3555	14	21			
						3560	11	13			
						3565	7	10			
						3570	7	47			
						3575	14	47			
						3580	7	41			
						3585	13	31			
						3590	7	22			
						3595	48	12			
						3600	10	47			
						3605	7	13			
						3610	7	8			
						3615	11	44			
						3620	11	9			
						3625	9	19			
						3630	12	39			
						3635	41	5			
						3640	12	15			
						3645	7	30			
						3650	12	39			
						3655	17	46			
						3660	15	12			
						3665	14	11			
						3670	24	37			
						3675	7	10			
						3680	10	46			
						3685	15	40			

MACROFLORA AND EPIFAUNA DATA FOR ANALYSIS

West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
						3690	13	6			
						3695	35	14			
						3700	42	47			
						3705	46	24			
						3710	25	21			
						3715	10	31			
						3720	16	48			
						3725	14	18			
						3730	4	11			
						3735	12	40			
						3740	9	20			
						3745	8	41			
						3750	32	16			
						3755	33	35			
						3760	11	46			
						3765	4	32			
						3770	29	15			
						3775	37	25			
						3780	12	25			
						3785	9	44			
						3790	7	8			
						3795	38	46			
						3800	7	14			
						3805	22	49			
						3810	11	18			
						3815	25	45			
						3820	14	42			
						3825	32	38			
						3830	34	35			
						3835	12	32			
						3840	22	22			
						3845	7	41			
						3850	13	44			
						3855	11	24			
						3860	12	9			
						3865	17	48			
						3870	21	7			
						3875	38	47			
						3880	5	24			
						3885	13	48			
						3890	7	6			
						3895	12	28			
						3900	44	34			
						3905	7	40			
						3910	14	21			
						3915	39	30			
						3920	51	66			
						3925	40	89			
						3930	41	70			
						3935	12	19			
						3940	11	49			
						3945	35	23			
						3950	46	35			
						3955	45	30			
						3960	28	49			
						3965	16	0			
						3970	26	0			
						3975	17	41			
						3980	28	28			
						3985	36	36			
						3990	47	9			
						3995	27	42			
						4000	11	24			
						4005	10	35			
						4010	13	7			
						4015	13	29			
						4020	50	45			
						4025	16	38			
						4030	12	31			
						4035	13	31			
						4040	28	24			
						4045	13	44			
						4050	16	36			
						4055	14	18			
						4060	9	15			
						4065	43	27			
						4070	10	32			
						4075	36	6			
						4080	27	10			
						4085	14	20			
						4090	9	30			
						4095	12	26			
						4100	44	10			
						4105	31	23			
						4110	17	23			
						4115	31	12			
						4120	35	22			
						4125	8	24			
						4130	16	38			
						4135	34	50			

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West Transect			East Transect			Coastal Transect			North Transect		
Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover	Distance from Transect Start (m)	Epifauna Abudnance	Macroflora % Cover
						4140	13	40			
						4145	34	16			
						4150	40	20			
						4155	32	26			
						4160	11	49			
						4165	7	7			
						4170	12	46			
						4175	35	44			
						4180	44	48			
						4185	35	39			
						4190	9	27			
						4195	18	11			
						4200	15	47			
						4205	15	19			
						4210	46	6			
						4215	45	31			
						4220	21	30			
						4225	49	49			
						4230	21	30			
						4235	10	31			
						4240	52	26			
						4245	6	11			
						4250	23	5			
						4255	38	7			
						4260	12	17			
						4265	8	15			
						4270	31	25			
						4275	33	11			
						4280	22	36			
						4285	38	46			
						4290	46	25			
						4295	11	47			
						4300	42	6			
						4305	37	25			
						4310	17	46			
						4315	18	49			
						4320	37	40			
						4325	51	14			
						4330	14	12			
						4335	39	48			
						4340	30	22			
						4345	18	34			
						4350	13	12			
						4355	7	51			
						4360	34	39			
						4365	12	26			
						4370	11	43			
						4375	17	22			
						4380	48	35			
						4385	18	34			
						4390	8	15			
						4395	9	19			
						4400	36	5			
						4405	7	12			
						4410	14	12			
						4415	16	51			
						4420	45	9			
						4425	32	12			
						4430	15	43			
						4435	13	43			
						4440	27	7			
						4445	58	16			
						4450	12	20			
						4455	40	33			
						4460	48	32			
						4465	37	8			
						4470	42	32			
						4475	9	6			
						4480	10	36			
						4485	9	14			
						4490	43	6			

APPENDIX E

Fish Survey Data

Otolith Analysis
Client: Golder
Project: Baffinlands Iron Mine

Sample Inventory

Sample arrival: Oct 16, 2017
Number of samples: 2
Biologica project number: ms17-039

Otolith Collection

The fish were thawed and tissue was removed for chemistry analyses (data sent to Golder in November 2017). The heads were removed and the sagittal otoliths were removed from each fish head, cleaned and placed in a labelled vial.

Otolith Aging

Age was estimated by counting the number of annuli, identified as translucent bands that extend through the otolith (Table 1). Whole otoliths were placed in small glass petri dish with distilled water, and examined over a black background using dissecting microscopes (10-40x magnification) and refracted light. Incomplete or weak bands were considered to be false annuli and therefore not counted. Vatharithic (malformed) or damaged otoliths were not processed.

Table 1. Length (mm), weight (g), and estimated age (# of annuli observed) of fish samples for Golder Baffinlands Iron Mine 2017.

Client #	Date sampled	Biologica #	Length (mm)	Weight (g)	Age (# of annuli)
Arch002-GN11	29-Aug-17	ms17-039-001	266	175	NA *
Arch010-GN05	27-Aug-17	ms17-039-002	630	2950	11

*Otolith was damaged and could not be analyzed. This fish was estimated to be 5 years old based on length and biomass (Aymes *et al*., 2016).

Data

Results were provided to the Golder project manager in Excel spreadsheets via email.

References

Aymes, J. C., Vignon, M., Beall, E., Guéraud, F., & Gaudin, P. 2016. Age validation of the Kerguelen Islands brown trout, Salmo trutta L., and selection of the otolith optimal zone for investigating chronological data series. Fisheries Research, 176, 22-29.

Panfili, J., De Pontual, H., Troadec, H., & Wrigh, P. J. 2002. Manual of fish sclerochronology.

Stevenson, D. K., & Campana, S. E. 1992. Otolith microstructure examination and analysis. Department of Fisheries and Oceans

biologica

Fish Stomach Enumeration and Identification Methods
Client: Golder
Project: Baffin Island Iron Mine

Sample Inventory

Sample arrival: Oct 16, 2017
Number of samples: 2
Biologica project number: ms17-039

Upon arrival, the samples were examined and double-checked against the chain of custody to ensure (1) all samples were accounted for, (2) each sample had the appropriate number of jars as indicated on the COC. Any discrepancies were reported to the client and were resolved before further sample handling. Samples were then assigned a unique identification number.

Table 1. Summary of fish stomachs processed for Golder Baffin Island Iron Mine 2017.

Client Sample #	Date Sampled	Biologica Sample #	Fish Length (mm)	Fish Weight (g)	Full stomach weight (g)	% Stomach Fullness	% Material Digested
Arch002-GN11	8/29/2017	ms17-039-001	266	175	10.4811	50	75
Arch010-GN05	8/27/2017	ms17-039-002	630	2950	73.1927	75	75

Sample Processing

Before dissection and identification, the percent fullness and percent digestion of each stomach was recorded based on the professional judgement of the taxonomist(s). For each new project, if multiple taxonomists are involved, they must agree on the categorization for the first 30 stomachs to ensure consistency of reporting.

The stomach contents were dissected out and weighed as per the following protocol:

1. Intestines were removed just anterior to the pyloric caecae and discarded. The esophagus was included with the stomach.

2. A longitudinal incision was made with a scalpel or scissors, avoiding damage to the contents, to reveal the food bolus. At this time stomach fullness was determined and the corresponding code for the degree of fullness is recorded (Table 2). Fullness was estimated by considering two factors: the degree of distention of the stomach, and the weight of the bolus relative to the size of the fish. Comparing stomach fullness estimates between analysts helps to develop consistency amongst analysts.

Table 2. Stomach fullness categories.

0	Empty
10	Trace of prey
25	Trace -25% full
50	25-50% full
75	50-75% full
100	75-100% full (distended)

3. Percent digestion was determined based on the following categories. This ranking was given before the bolus was dissected based on observable condition of the prey organisms (Table 3).

Table 3. Percent digestion of stomach contents.

0	All material is undigested, only whole organisms visible
0-10	Trace only; few posterior-most prey items are digested
25	10-25% digested. Posterior-most 25% digested and more than half of the organisms are whole
50	25-50% digested; approximately half of the organisms are whole
75	50-75% digested, less than half of organisms are whole
100	All material is digested, no whole organisms visible

4. Excess moisture was blotted from the food bolus with paper towel, avoiding excessive pressure on the food bolus. Material that was obviously composed of parasites, stomach lining, rocks, or any other non-prey is removed. (These items were not included in the stomach weight, but were noted in the comments).

5. The bolus was dissected, working anterior-posterior, and its identifiable components weighed to the nearest 0.01mg nearest 0.0001g. Prey items were identified to the lowest practicable taxonomic level (species when possible). Digested and unidentifiable material were categorized (e.g. Unidentified parts, digested tissue, non-food, etc.). Each identifiable unit (taxon or category) was placed in small drops of water on petri dish to prevent desiccation during the identification process.

6. All prey categories (taxa and unidentifiable categories) were blotted and weighed to the nearest 0.01mg of wet weight.

Data

Results were provided to the Golder project manager in Excel spreadsheets via email.

References

Brey, T. 2012. Virtual Handbook on Population Dynamics. http://www.thomas-brey.de/science/virtualhandbook/navlog/index.html. Accessed November 2016.

Waters, T. F. 1977. Secondary production in inland waters. Adv. Ecol. Res. 10: 91-164.

Wetzel, R.G. and Likens, G.E. 1978. Limnological Analyses. 3rd Ed. Springer: 429p.

Ricciardi, A. and Bouret, E. 1998. Weight-to-weight conversion factors for marine benthic macroinvertebrates. Mar. Ecol. Prog. Ser. 163: 245-251.

biologica

Fish Tissue Analysis Methods
Client: Golder
Project: Baffinlands Iron Mine, 2017

Sample Inventory

Sample arrival: Oct 16, 2017
Number of samples: 2
Biologica project number: ms17-039

Upon arrival, the samples were examined and double-checked against the chain of custody to ensure all samples were accounted for. Any discrepancies were reported to the client and were resolved before further sample handling. Samples were then assigned a unique identification number.

Table 1. Summary of fish stomachs processed for Golder Baffin Island Iron Mine 2017.

Client Sample #	Date Sampled	Biologica Sample #	Maxxam Sample #	Fish Length (mm)	Fish Weight (g)
Arch002-GN11	8/29/2017	ms17-039-001	BAFF-11	266	175
Arch010-GN05	8/27/2017	ms17-039-002	BAFF-05	630	2950

Tissue Collection

Latex gloves were worn when handling the fish samples, and changed between each sample to avoid potential contamination. The fish samples were examined for any lesions or tumors, and none were noted. The internal organs (e.g. stomachs, intestines, gonads, etc.) and heads were removed with a knife. To avoid contamination different dissecting trays were used and the knife was rinsed with distilled water and dried in between samples. After tissue removal the tissue samples were rinsed with distilled water, wrapped in clean, food grade aluminum foil (with the dull side in contact with the fish), and placed in clean, pre-labelled food grade plastic bags. Samples were placed back in the freezer as quickly as possible, and delivered to Maxxam Analytics in a cooler with icepacks for analysis.

Sample Processing and Data Analysis

Tissue sample processing was performed at the Maxxam Analytics' laboratory in Victoria, BC. Results were provided to the Golder project manager in Excel spreadsheets via email.

References

Kasich, J., Taylor, G. M., & Scott, J.N. 2012. Fish Tissue Collection Manual. Cooperative Fish Tissue Monitoring Program. US EPA. Ohio.

Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Vol 1: Fish Sampling and Analysis. 3rd edition. 2000. Office of Water. US EPA. Washington.

APPENDIX E-4
CERTIFICATE OF ANALYSIS

Site Location: MISA REI
Your C.O.C. #: V020778

Attention:Dave Hasek

Biologica Environmental Services, Ltd.
488-F Bay St.
Victoria, BC
Canada V8T 5H2

Report Date: 2017/12/12
Report #: R2490220
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A0106
Received: 2017/11/08, 10:47

Sample Matrix: TISSUE
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Elements by CRC ICPMS - Tissue Wet Wt	2	2017/12/07	2017/12/12	BBY7SOP-00021,	BCLM2005,EPA6020bR2m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
BC Env Customer Service, BC Environmental Customer Service
Email: Enviro.CS.BC@maxxam.ca
Phone# (604) 734 7276
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7A0106
Report Date: 2017/12/12

Biologica Environmental Services, Ltd.
Site Location: MISA REI

ELEMENTS BY ATOMIC SPECTROSCOPY - WET WT (TISSUE)

Maxxam ID		SL3356	SL3357		
Sampling Date		2017/08/27	2017/08/29		
COC Number		V020778	V020778		
	UNITS	**BAF05**	**BAF11**	**RDL**	**QC Batch**
Total Metals by ICPMS					
Total Aluminum (Al)	mg/kg	<0.20	<0.20	0.20	8855761
Total Antimony (Sb)	mg/kg	<0.0010	<0.0010	0.0010	8855761
Total Arsenic (As)	mg/kg	1.09	0.523	0.0050	8855761
Total Barium (Ba)	mg/kg	<0.010	<0.010	0.010	8855761
Total Beryllium (Be)	mg/kg	<0.0020	<0.0020	0.0020	8855761
Total Bismuth (Bi)	mg/kg	<0.020	<0.020	0.020	8855761
Total Boron (B)	mg/kg	<0.40	<0.40	0.40	8855761
Total Cadmium (Cd)	mg/kg	0.0091	0.0084	0.0020	8855761
Total Calcium (Ca)	mg/kg	132	222	2.0	8855761
Total Chromium (Cr)	mg/kg	<0.010	<0.010	0.010	8855761
Total Cobalt (Co)	mg/kg	<0.0040	0.0074	0.0040	8855761
Total Copper (Cu)	mg/kg	0.473	0.648	0.010	8855761
Total Iron (Fe)	mg/kg	5.9	6.1	1.0	8855761
Total Lead (Pb)	mg/kg	<0.0020	0.0027	0.0020	8855761
Total Magnesium (Mg)	mg/kg	311	303	2.0	8855761
Total Manganese (Mn)	mg/kg	0.081	0.103	0.020	8855761
Total Mercury (Hg)	mg/kg	0.0860	0.0348	0.0020	8855761
Total Molybdenum (Mo)	mg/kg	<0.010	<0.010	0.010	8855761
Total Nickel (Ni)	mg/kg	<0.010	0.012	0.010	8855761
Total Phosphorus (P)	mg/kg	2990	2940	2.0	8855761
Total Potassium (K)	mg/kg	4390	4550	2.0	8855761
Total Selenium (Se)	mg/kg	0.444	0.449	0.010	8855761
Total Silver (Ag)	mg/kg	<0.0040	<0.0040	0.0040	8855761
Total Sodium (Na)	mg/kg	622	551	2.0	8855761
Total Strontium (Sr)	mg/kg	0.259 (1)	0.490	0.010	8855761
Total Thallium (Tl)	mg/kg	0.00218	0.00331	0.00040	8855761
Total Tin (Sn)	mg/kg	<0.020	<0.020	0.020	8855761
Total Titanium (Ti)	mg/kg	0.072	<0.050	0.050	8855761
Total Uranium (U)	mg/kg	<0.00040	<0.00040	0.00040	8855761
Total Vanadium (V)	mg/kg	<0.020	<0.020	0.020	8855761
Total Zinc (Zn)	mg/kg	5.45	6.22	0.040	8855761

RDL = Reportable Detection Limit

(1) Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

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Maxxam Job #: B7A0106
Report Date: 2017/12/12

Biologica Environmental Services, Ltd.
Site Location: MISA REI

GENERAL COMMENTS

Results relate only to the items tested.

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Maxxam Job #: B7A0106
Report Date: 2017/12/12

QUALITY ASSURANCE REPORT

Biologica Environmental Services, Ltd.
Site Location: MISA REI

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8855761	Total Aluminum (Al)	2017/12/12					0.20, RDL=0.20	mg/kg	NC	35		
8855761	Total Antimony (Sb)	2017/12/12	119	75 - 125	119	75 - 125	<0.0010	mg/kg	NC	35		
8855761	Total Arsenic (As)	2017/12/12	NC	75 - 125	97	75 - 125	<0.0050	mg/kg	0.12	35	102	75 - 125
8855761	Total Barium (Ba)	2017/12/12	120	75 - 125	119	75 - 125	<0.010	mg/kg	NC	35		
8855761	Total Beryllium (Be)	2017/12/12	98	75 - 125	97	75 - 125	<0.0020	mg/kg	NC	35		
8855761	Total Bismuth (Bi)	2017/12/12					<0.020	mg/kg	NC	35		
8855761	Total Boron (B)	2017/12/12					<0.40	mg/kg	NC	35		
8855761	Total Cadmium (Cd)	2017/12/12	107	75 - 125	104	75 - 125	<0.0020	mg/kg	6.8	35	109	75 - 125
8855761	Total Calcium (Ca)	2017/12/12					<2.0	mg/kg	3.0	35		
8855761	Total Chromium (Cr)	2017/12/12	107	75 - 125	106	75 - 125	<0.010	mg/kg	NC	35	94	75 - 125
8855761	Total Cobalt (Co)	2017/12/12	107	75 - 125	106	75 - 125	<0.0040	mg/kg	NC	35		
8855761	Total Copper (Cu)	2017/12/12	113	75 - 125	104	75 - 125	<0.010	mg/kg	2.1	35	102	75 - 125
8855761	Total Iron (Fe)	2017/12/12					<1.0	mg/kg	4.0	35	113	75 - 125
8855761	Total Lead (Pb)	2017/12/12	105	75 - 125	102	75 - 125	<0.0020	mg/kg	NC	35	59 (2)	75 - 125
8855761	Total Magnesium (Mg)	2017/12/12					<2.0	mg/kg	4.2	35		
8855761	Total Manganese (Mn)	2017/12/12	110	75 - 125	107	75 - 125	<0.020	mg/kg	0.62	35		
8855761	Total Mercury (Hg)	2017/12/12	NC	75 - 125	118	75 - 125	<0.0020	mg/kg	12	35	99	75 - 125
8855761	Total Molybdenum (Mo)	2017/12/12	116	75 - 125	116	75 - 125	<0.010	mg/kg	NC	35		
8855761	Total Nickel (Ni)	2017/12/12	105	75 - 125	104	75 - 125	<0.010	mg/kg	14	35	102	75 - 125
8855761	Total Phosphorus (P)	2017/12/12					<2.0	mg/kg	3.4	35		
8855761	Total Potassium (K)	2017/12/12					<2.0	mg/kg	5.7	35		
8855761	Total Selenium (Se)	2017/12/12	104	75 - 125	106	75 - 125	<0.010	mg/kg	3.0	35	108	75 - 125
8855761	Total Silver (Ag)	2017/12/12	101	75 - 125	102	75 - 125	<0.0040	mg/kg	NC	35		
8855761	Total Sodium (Na)	2017/12/12					<2.0	mg/kg	4.8	35		
8855761	Total Strontium (Sr)	2017/12/12	160 (1)	75 - 125	103	75 - 125	<0.010	mg/kg	0.27	35		
8855761	Total Thallium (Tl)	2017/12/12	106	75 - 125	102	75 - 125	<0.00040	mg/kg	3.6	35		
8855761	Total Tin (Sn)	2017/12/12	113	75 - 125	112	75 - 125	<0.020	mg/kg	NC	35		
8855761	Total Titanium (Ti)	2017/12/12	116	75 - 125	125	75 - 125	<0.050	mg/kg	NC	35		
8855761	Total Uranium (U)	2017/12/12	103	75 - 125	99	75 - 125	<0.00040	mg/kg	NC	35		
8855761	Total Vanadium (V)	2017/12/12	110	75 - 125	110	75 - 125	<0.020	mg/kg	NC	35		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8855761	Total Zinc (Zn)	2017/12/12	NC	75 - 125	103	75 - 125	<0.040	mg/kg	0.63	35	107	75 - 125

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Reference outside acceptance criteria due to digestion limitation. (10% of analytes failure allowed).

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Maxxam Job #: B7A0106
Report Date: 2017/12/12

Biologica Environmental Services, Ltd.
Site Location: MISA REI

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, B.Sc., Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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V 020778

Maxxam
A Bureau Veritas Group Company

CHAIN OF CUSTODY RECORD

Victoria: 460 Tennyson Place, Unit 1, Victoria, BC V8Z 6S8. Toll Free (866) 385-6112

COC #:

Page _____ of _____

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)	
Company Name:	BIOLOGICA	Company Name:		Quotation #:	
Contact Name:	DAVE HASEK	Contact Name:		P.O. #/ AFE#:	
Address:	488-F Bay Street	Address:		Project #:	
PC:		PC:		Site Location:	
Phone:	(250) 479-3868	Phone:		Site #:	
Email:	dave@biologica.ca	Email:		Sampled By:	

Turnaround Time (TAT) Required

☑ Regular TAT 5 days (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days
☐ 1 Day ☐ 3 Days

Date Required:

Rush Confirmation #:

Regulatory Criteria

☐ BC CSR Soil ☐ BC CSR Water
☐ CCME (Specify) ☐ Other (Specify)
☐ Drinking Water ☐ BC Water Quality

Special Instructions

☐ Return Cooler
☐ Ship Sample Bottles (Please Specify)

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested: BTEX/VPH ☐ VOC/VPH ☐; MTBE ☐; EPH ☐ TEH ☐; PAH ☐ LEPH/HEPH ☐; CCME-PHC BTEX/F1 ☐ F2-F4 ☐; Dissolved Metals Filtered? ☐ Preserved? ☐; Dissolved Mercury Filtered? ☐ Preserved? ☐; Total Metals Field Preserved? ☐; Total Mercury Field Preserved? ☐; Chloride ☐ Fluoride ☐ Sulphate ☐; TSS ☐ TDS ☐; BOD ☐ CBOD ☐; pH ☐ Conductivity ☐ Alkalinity ☐; Nitrite ☐ Nitrate ☐ Ammonia ☐; E. coli ☐ Coliform: Total ☐ Fecal ☐; # OF CONTAINERS SUBMITTED; HOLD - DO NOT ANALYZE

#	Sample Identification	Lab Identification	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	Total Metals	# of Containers Submitted	Hold - Do Not Analyze	Comments
1	BAF05		2017/08/27	—		✓			
2	BAF11		2017/08/29	—		✓			
3									
4									
5									
6									
7									
8									
9									
10									

LABORATORY USE ONLY

CUSTODY SEAL Y / N: N/A

Present	Intact	COOLER TEMPERATURES
		-11, -10, -10
SEC	AGR	

COOLING MEDIA PRESENT (Y) / N

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Dave Hasek	2017/11/08	10:45	S. Hudson-Gray	2017/11/08	10:47
S. Hudson-Gray	2017/11/08	16:00	EVA SYKORA	2017/11/09	10:05

*Matrix: DW = Drinking Water, E = Environmental Water, M = Marine Water, S = Storm Water, W = Waste Water; SO = Soil, SL = Sludge

B7A0106_COC

COC-1034

APPENDIX E-6
DATA METALS ANALYSIS RESULTS

Biologica Environmental Services, Ltd.

Maxxam Job Number: B7A0106

Report Date: 2017/12/12 Site Location: MISA REI

ELEMENTS BY ATOMIC SPECTROSCOPY - WET WT (TISSUE)

Maxxam ID		SL3356	SL3357		
Sampling Date		8/27/2017	8/29/2017		
COC Number		V020778	V020778		
	UNITS	**BAF05**	**BAF11**	**RDL**	**QC Batch**
Total Metals by ICPMS					
Total Aluminum (Al)	mg/kg	<0.20	<0.20	0.20	8855761
Total Antimony (Sb)	mg/kg	<0.0010	<0.0010	0.0010	8855761
Total Arsenic (As)	mg/kg	1.09	0.523	0.0050	8855761
Total Barium (Ba)	mg/kg	<0.010	<0.010	0.010	8855761
Total Beryllium (Be)	mg/kg	<0.0020	<0.0020	0.0020	8855761
Total Bismuth (Bi)	mg/kg	<0.020	<0.020	0.020	8855761
Total Boron (B)	mg/kg	<0.40	<0.40	0.40	8855761
Total Cadmium (Cd)	mg/kg	0.0091	0.0084	0.0020	8855761
Total Calcium (Ca)	mg/kg	132	222	2.0	8855761
Total Chromium (Cr)	mg/kg	<0.010	<0.010	0.010	8855761
Total Cobalt (Co)	mg/kg	<0.0040	0.0074	0.0040	8855761
Total Copper (Cu)	mg/kg	0.473	0.648	0.010	8855761
Total Iron (Fe)	mg/kg	5.9	6.1	1.0	8855761
Total Lead (Pb)	mg/kg	<0.0020	0.0027	0.0020	8855761
Total Magnesium (Mg)	mg/kg	311	303	2.0	8855761
Total Manganese (Mn)	mg/kg	0.081	0.103	0.020	8855761
Total Mercury (Hg)	mg/kg	0.0860	0.0348	0.0020	8855761
Total Molybdenum (Mo)	mg/kg	<0.010	<0.010	0.010	8855761
Total Nickel (Ni)	mg/kg	<0.010	0.012	0.010	8855761
Total Phosphorus (P)	mg/kg	2990	2940	2.0	8855761
Total Potassium (K)	mg/kg	4390	4550	2.0	8855761
Total Selenium (Se)	mg/kg	0.444	0.449	0.010	8855761
Total Silver (Ag)	mg/kg	<0.0040	<0.0040	0.0040	8855761
Total Sodium (Na)	mg/kg	622	551	2.0	8855761
Total Strontium (Sr)	mg/kg	0.259 (1)	0.490	0.010	8855761
Total Thallium (Tl)	mg/kg	0.00218	0.00331	0.00040	8855761
Total Tin (Sn)	mg/kg	<0.020	<0.020	0.020	8855761
Total Titanium (Ti)	mg/kg	0.072	<0.050	0.050	8855761
Total Uranium (U)	mg/kg	<0.00040	<0.00040	0.00040	8855761
Total Vanadium (V)	mg/kg	<0.020	<0.020	0.020	8855761
Total Zinc (Zn)	mg/kg	5.45	6.22	0.040	8855761

RDL = Reportable Detection Limit

(1) Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

Results relate only to the items tested.

APPENDIX E-6
DATA METALS ANALYSIS - QAQC

Biologica Environmental Services, Ltd.
Attention: Dave Hasek

Report Date: 2017/12/12

Site Location: MISA REI

Quality Assurance Report
Maxxam Job Number: B7A0106

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8855761	JC8	Matrix Spike [SL3356-01]	Total Antimony (Sb)	12/12/2017		119	%	75 - 125
			Total Arsenic (As)	12/12/2017		NC	%	75 - 125
			Total Barium (Ba)	12/12/2017		120	%	75 - 125
			Total Beryllium (Be)	12/12/2017		98	%	75 - 125
			Total Cadmium (Cd)	12/12/2017		107	%	75 - 125
			Total Chromium (Cr)	12/12/2017		107	%	75 - 125
			Total Cobalt (Co)	12/12/2017		107	%	75 - 125
			Total Copper (Cu)	12/12/2017		113	%	75 - 125
			Total Lead (Pb)	12/12/2017		105	%	75 - 125
			Total Manganese (Mn)	12/12/2017		110	%	75 - 125
			Total Mercury (Hg)	12/12/2017		NC	%	75 - 125
			Total Molybdenum (Mo)	12/12/2017		116	%	75 - 125
			Total Nickel (Ni)	12/12/2017		105	%	75 - 125
			Total Selenium (Se)	12/12/2017		104	%	75 - 125
			Total Silver (Ag)	12/12/2017		101	%	75 - 125
			Total Strontium (Sr)	12/12/2017		160 (1)	%	75 - 125
			Total Thallium (Tl)	12/12/2017		106	%	75 - 125
			Total Tin (Sn)	12/12/2017		113	%	75 - 125
			Total Titanium (Ti)	12/12/2017		116	%	75 - 125
			Total Uranium (U)	12/12/2017		103	%	75 - 125
			Total Vanadium (V)	12/12/2017		110	%	75 - 125
			Total Zinc (Zn)	12/12/2017		NC	%	75 - 125
8855761	JC8	QC Standard	Total Arsenic (As)	12/12/2017		102	%	75 - 125
			Total Cadmium (Cd)	12/12/2017		109	%	75 - 125
			Total Chromium (Cr)	12/12/2017		94	%	75 - 125
			Total Copper (Cu)	12/12/2017		102	%	75 - 125
			Total Iron (Fe)	12/12/2017		113	%	75 - 125
			Total Lead (Pb)	12/12/2017		59 (2)	%	75 - 125
			Total Mercury (Hg)	12/12/2017		99	%	75 - 125
			Total Nickel (Ni)	12/12/2017		102	%	75 - 125
			Total Selenium (Se)	12/12/2017		108	%	75 - 125
			Total Zinc (Zn)	12/12/2017		107	%	75 - 125
8855761	JC8	Spiked Blank	Total Antimony (Sb)	12/12/2017		119	%	75 - 125
			Total Arsenic (As)	12/12/2017		97	%	75 - 125
			Total Barium (Ba)	12/12/2017		119	%	75 - 125
			Total Beryllium (Be)	12/12/2017		97	%	75 - 125
			Total Cadmium (Cd)	12/12/2017		104	%	75 - 125
			Total Chromium (Cr)	12/12/2017		106	%	75 - 125
			Total Cobalt (Co)	12/12/2017		106	%	75 - 125
			Total Copper (Cu)	12/12/2017		104	%	75 - 125
			Total Lead (Pb)	12/12/2017		102	%	75 - 125
			Total Manganese (Mn)	12/12/2017		107	%	75 - 125
			Total Mercury (Hg)	12/12/2017		118	%	75 - 125
			Total Molybdenum (Mo)	12/12/2017		116	%	75 - 125
			Total Nickel (Ni)	12/12/2017		104	%	75 - 125
			Total Selenium (Se)	12/12/2017		106	%	75 - 125
			Total Silver (Ag)	12/12/2017		102	%	75 - 125
			Total Strontium (Sr)	12/12/2017		103	%	75 - 125
			Total Thallium (Tl)	12/12/2017		102	%	75 - 125
			Total Tin (Sn)	12/12/2017		112	%	75 - 125
			Total Titanium (Ti)	12/12/2017		125	%	75 - 125
			Total Uranium (U)	12/12/2017		99	%	75 - 125
			Total Vanadium (V)	12/12/2017		110	%	75 - 125
			Total Zinc (Zn)	12/12/2017		103	%	75 - 125
8855761	JC8	Method Blank	Total Aluminum (Al)	12/12/2017	0.20, RDL=0.20		mg/kg	
			Total Antimony (Sb)	12/12/2017	<0.0010		mg/kg	
			Total Arsenic (As)	12/12/2017	<0.0050		mg/kg	
			Total Barium (Ba)	12/12/2017	<0.010		mg/kg	
			Total Beryllium (Be)	12/12/2017	<0.0020		mg/kg	
			Total Bismuth (Bi)	12/12/2017	<0.020		mg/kg	
			Total Boron (B)	12/12/2017	<0.40		mg/kg	
			Total Cadmium (Cd)	12/12/2017	<0.0020		mg/kg	
			Total Calcium (Ca)	12/12/2017	<2.0		mg/kg	
			Total Chromium (Cr)	12/12/2017	<0.010		mg/kg	
			Total Cobalt (Co)	12/12/2017	<0.0040		mg/kg	
			Total Copper (Cu)	12/12/2017	<0.010		mg/kg	
			Total Iron (Fe)	12/12/2017	<1.0		mg/kg	
			Total Lead (Pb)	12/12/2017	<0.0020		mg/kg	

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Magnesium (Mg)	12/12/2017	<2.0		mg/kg	
			Total Manganese (Mn)	12/12/2017	<0.020		mg/kg	
			Total Mercury (Hg)	12/12/2017	<0.0020		mg/kg	
			Total Molybdenum (Mo)	12/12/2017	<0.010		mg/kg	
			Total Nickel (Ni)	12/12/2017	<0.010		mg/kg	
			Total Phosphorus (P)	12/12/2017	<2.0		mg/kg	
			Total Potassium (K)	12/12/2017	<2.0		mg/kg	
			Total Selenium (Se)	12/12/2017	<0.010		mg/kg	
			Total Silver (Ag)	12/12/2017	<0.0040		mg/kg	
			Total Sodium (Na)	12/12/2017	<2.0		mg/kg	
			Total Strontium (Sr)	12/12/2017	<0.010		mg/kg	
			Total Thallium (Tl)	12/12/2017	<0.00040		mg/kg	
			Total Tin (Sn)	12/12/2017	<0.020		mg/kg	
			Total Titanium (Ti)	12/12/2017	<0.050		mg/kg	
			Total Uranium (U)	12/12/2017	<0.00040		mg/kg	
			Total Vanadium (V)	12/12/2017	<0.020		mg/kg	
			Total Zinc (Zn)	12/12/2017	<0.040		mg/kg	
8855761	JC8	RPD [SL3356-01]	Total Aluminum (Al)	12/12/2017	NC		%	35
			Total Antimony (Sb)	12/12/2017	NC		%	35
			Total Arsenic (As)	12/12/2017	0.12		%	35
			Total Barium (Ba)	12/12/2017	NC		%	35
			Total Beryllium (Be)	12/12/2017	NC		%	35
			Total Bismuth (Bi)	12/12/2017	NC		%	35
			Total Boron (B)	12/12/2017	NC		%	35
			Total Cadmium (Cd)	12/12/2017	6.8		%	35
			Total Calcium (Ca)	12/12/2017	3.0		%	35
			Total Chromium (Cr)	12/12/2017	NC		%	35
			Total Cobalt (Co)	12/12/2017	NC		%	35
			Total Copper (Cu)	12/12/2017	2.1		%	35
			Total Iron (Fe)	12/12/2017	4.0		%	35
			Total Lead (Pb)	12/12/2017	NC		%	35
			Total Magnesium (Mg)	12/12/2017	4.2		%	35
			Total Manganese (Mn)	12/12/2017	0.62		%	35
			Total Mercury (Hg)	12/12/2017	12		%	35
			Total Molybdenum (Mo)	12/12/2017	NC		%	35
			Total Nickel (Ni)	12/12/2017	14		%	35
			Total Phosphorus (P)	12/12/2017	3.4		%	35
			Total Potassium (K)	12/12/2017	5.7		%	35
			Total Selenium (Se)	12/12/2017	3.0		%	35
			Total Silver (Ag)	12/12/2017	NC		%	35
			Total Sodium (Na)	12/12/2017	4.8		%	35
			Total Strontium (Sr)	12/12/2017	0.27		%	35
			Total Thallium (Tl)	12/12/2017	3.6		%	35
			Total Tin (Sn)	12/12/2017	NC		%	35
			Total Titanium (Ti)	12/12/2017	NC		%	35
			Total Uranium (U)	12/12/2017	NC		%	35
			Total Vanadium (V)	12/12/2017	NC		%	35
			Total Zinc (Zn)	12/12/2017	0.63		%	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration).
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
(2) Reference outside acceptance criteria due to digestion limitation. (10% of analytes failure allowed).

Appendix E-7

2017 MEEMP Fish Data

Fishing Method	Site #	Date	Species[1]	Weight (g)[2]	Length (mm)[2]	Life Stage[2]
Angling	AN01	25-Aug-17	NFC	-	-	-
	AN02	27-Aug-17	NFC	-	-	-
	AN03	29-Aug-17	FHSC	200	274	Unknown
	AN03	29-Aug-17	FHSC	112	234	Unknown
	AN03	29-Aug-17	FHSC	223	273	Unknown
	AN03	29-Aug-17	SHSC	56	179	Unknown
	AN04	1-Sep-17	ARSC	74	185	Unknown
	AN04	1-Sep-17	FHSC	124	230	Unknown
	AN04	1-Sep-17	FHSC	83	220	Unknown
	AN04	1-Sep-17	SHSC	-	280	Unknown
	AN04	1-Sep-17	SHSC	440	310	Unknown
	AN04	1-Sep-17	SHSC	212	265	Unknown
	AN04	1-Sep-17	SHSC	261	300	Unknown
	AN05	2-Sep-17	SHSC	342	290	Adult
	AN06	3-Sep-17	FHSC	57	201	Unknown
	AN06	3-Sep-17	FHSC	71	205	Unknown
	AN06	3-Sep-17	FHSC	50	118	Unknown
	AN06	3-Sep-17	FHSC	170	265	Unknown
	AN07	3-Sep-17	ARSC	126	221	Unknown
	AN07	3-Sep-17	ARSC	87	195	Unknown
	AN07	3-Sep-17	ARSC	127	223	Unknown
	AN07	3-Sep-17	ARSC	103	225	Unknown
	AN07	3-Sep-17	ARSC	78	172	Unknown
	AN07	3-Sep-17	FHSC	223	227	Unknown
	AN07	3-Sep-17	SHSC	417	335	Unknown
	AN07	3-Sep-17	SHSC	155	225	Unknown
	AN07	3-Sep-17	SHSC	155	224	Unknown
	AN07	3-Sep-17	SHSC	221	227	Unknown
	AN07	3-Sep-17	SHSC	281	228	Unknown
	AN07	3-Sep-17	SHSC	286	229	Unknown
	AN07	3-Sep-17	SHSC	177	225	Unknown
	AN07	3-Sep-17	SHSC	323	331	Unknown
	AN07	3-Sep-17	SHSC	93	220	Unknown
	AN07	3-Sep-17	SHSC	149	233	Unknown
	AN07	3-Sep-17	SHSC	344	335	Unknown
	AN08	4-Sep-17	NFC	-	-	-
Fukui Trap	FT01	25-Aug-17	NFC	-	-	-
	FT02	25-Aug-17	NFC	-	-	-
	FT03	26-Aug-17	FHSC	550	308	Unknown
	FT04	26-Aug-17	FHSC	-	92	Unknown
	FT04	26-Aug-17	FHSC	-	105	Unknown
	FT04	26-Aug-17	FHSC	-	86	Unknown
	FT05	26-Aug-17	NFC	-	-	-
	FT06	26-Aug-17	FHSC	-	109	Unknown
	FT07	26-Aug-17	NFC	-	-	-
	FT08	30-Aug-17	SHSC	41	175	Unknown
	FT09	30-Aug-17	NFC	-	-	-
	FT10	30-Aug-17	NFC	-	-	-
	FT11	30-Aug-17	NFC	-	-	-
	FT12	30-Aug-17	NFC	-	-	-
	FT13	30-Aug-17	NFC	-	-	-
	FT14	30-Aug-17	NFC	-	-	-
	FT15	30-Aug-17	NRSL	19	170	Unknown
	FT16	30-Aug-17	NFC	-	-	-
	FT17	30-Aug-17	SHSC	41	175	Unknown

Appendix E-7
2017 MEEMP Fish Data

Fishing Method	Site #	Date	Species[1]	Weight (g)[2]	Length (mm)[2]	Life Stage[2]
Gill Net	GN01	26-Aug-17	ARCH	7750	810	Adult
	GN02	26-Aug-17	ARCH	400	345	Juvenile
	GN02	26-Aug-17	ARCH	400	340	Juvenile
	GN02	26-Aug-17	FHSC	150	255	Unknown
	GN02	26-Aug-17	FHSC	175	260	Unknown
	GN02	26-Aug-17	FHSC	200	292	Unknown
	GN02	26-Aug-17	FHSC	175	257	Unknown
	GN02	26-Aug-17	FHSC	150	260	Unknown
	GN02	26-Aug-17	FHSC	275	285	Unknown
	GN02	26-Aug-17	SHSC	350	290	Unknown
	GN02	26-Aug-17	SHSC	425	306	Unknown
	GN03	27-Aug-17	NFC	-	-	-
	GN04	27-Aug-17	ARCH	1150	408	Juvenile
	GN04	27-Aug-17	ARCH	115	255	Juvenile
	GN04	27-Aug-17	ARCH	725	397	Juvenile
	GN04	27-Aug-17	ARCH	925	428	Juvenile
	GN04	27-Aug-17	FHSC	250	285	Adult
	GN04	27-Aug-17	FHSC	225	264	Adult
	GN05	27-Aug-17	ARCH	3400	672	Adult
	GN05	27-Aug-17	ARCH	2700	648	Adult
	GN05	27-Aug-17	ARCH	2400	610	Adult
	GN05	27-Aug-17	ARCH	3000	690	Adult
	GN05	27-Aug-17	ARCH	3450	698	Adult
	GN05	27-Aug-17	ARCH	4350	740	Adult
	GN05	27-Aug-17	ARCH	4950	735	Adult
	GN05	27-Aug-17	ARCH	4600	725	Adult
	GN05	27-Aug-17	ARCH	3700	681	Adult
	GN05	27-Aug-17	ARCH	2950	630	Adult
	GN06	28-Aug-17	NFC	-	-	-
	GN07	28-Aug-17	FHSC	90	219	Unknown
	GN08	29-Aug-17	ARCH	7159	825	Adult
	GN09	29-Aug-17	NFC	-	-	-
	GN10	29-Aug-17	NFC	-	-	-
	GN11	29-Aug-17	ARCH	500	359	Juvenile
	GN11	29-Aug-17	ARCH	600	395	Juvenile
	GN11	29-Aug-17	FHSC	175	266	Unknown
	GN12	2-Sep-17	ARCH	3725	685	Adult
	GN12	2-Sep-17	FHSC	88	210	Unknown
	GN12	2-Sep-17	FHSC	102	243	Unknown
	GN13	2-Aug-17	NFC	-	-	-
	GN14	3-Sep-17	FHSC	175	223	Unknown
	GN15	3-Sep-17	ARCH	-	795	Adult
	GN15	3-Sep-17	ARCH	4600	810	Adult
	GN16	3-Sep-17	NFC	-	-	-

Notes:
[1] Species codes: NFC = no fish captured; ARCH = Arctic char; ARSC = Arctic sculpin; FHSC = Fourhorn sculpin; SHSC = Shorthorn sculpin; NRSL = Northern sand lance
[2] (-) = no data

APPENDIX F

Zooplankton

Marine Zooplankton Enumeration and Identification Methods
Client: Golder
Project: Baffinlands Iron Mine 2017

Sample Inventory

Sample arrival: Oct 16, 2017
Number of samples: 17
Number of jars: 17
Screen size: 250µm
Biologica project number: mz17-039

Upon arrival, the samples were examined and double-checked against the chain of custody to ensure (1) all samples were accounted for, (2) each sample had the appropriate number of jars as indicated on the COC. Any discrepancies were reported to the client and were resolved before further sample handling. Samples were transferred from formalin into 70% ethanol and assigned a unique identification number.

Sample Processing

Marine zooplankton samples were analyzed in 2 fractions as follows:

(1) A 'Fine' fraction (<0.5mm), in which all other organisms were identified and enumerated. Processing of the fine fraction was completed to a 300 count as specified by the client;

(2) A 'Coarse' fraction comprised of large organisms (>0.5mm) in the sample.

The Coarse fraction was analyzed through a stereo microscope at 10-40x magnification. All organisms were identified by taxonomic experts to the lowest taxonomic level using a compound microscope (100-400x magnification), appropriate dissection tools, and standard taxonomic references. For copepods, the stage of development was also recorded (copepodite stages I-V) as is the sex for mature individuals (copepod stage VI).

Subsampling for all fractions was performed using a Folsom plankton splitter. The total numbers of organisms counted in each sample are listed in Table 1.

Zooplankton were identified to species wherever possible, although immature copepods lack differentiating features required for identification beyond order (e.g. Calanoida, Cyclopoida, or Harpacticoida). All identifications were performed using taxonomic references and collaborations with external experts, where necessary.

During the identification process, taxonomists recorded if the identified taxa were beyond their recorded range and/or potentially introduced (originating from another location) or invasive (both introduced and appearing to proliferate with possible detrimental effects to the ecosystem and/or industry). Within the constraints of available literature and historical data, no taxa observed were considered to be introduced or invasive.

Table 1. Summary of zooplankton samples processed for Golder Baffinlands Iron Mine, 2017.

Client Sample #	Date Sampled	Biologica Sample #	Fraction	Split	Specimens Counted
ZH-1	8/28/2017	mz17-039-001	Fine	5/256	271
			Coarse	Whole	27
ZH-2	8/28/2017	mz17-039-002	Fine	1/32	273
			Coarse	Whole	43
ZH-3	8/28/2017	mz17-039-003	Fine	3/64	272
			Coarse	Whole	52
ZH-4	8/28/2017	mz17-039-004	Fine	1/4	362
			Coarse	Whole	82
ZH-5	8/29/2017	mz17-039-005	Fine	1/32	288
			Coarse 1	1/4	33
			Coarse 2	Whole	44
ZH-6	9/8/2017	mz17-039-006	Fine	1/16	397
			Coarse	Whole	14
ZR-1	9/11/2017	mz17-039-007	Fine	1/64	436
			Coarse 1	1/8	45
			Coarse 2	Whole	4
ZR-2	9/11/2017	mz17-039-008	Fine	1/64	437
			Coarse 1	1/8	2
			Coarse 2	Whole	5
ZR-3	9/11/2017	mz17-039-009	Fine	1/64	339
			Coarse	1/8	4
ZR-4	9/11/2017	mz17-039-010	Fine	3/128	358
			Coarse	Whole	2
ZV-1	8/7/2017	mz17-039-011	Fine	5/256	310
			Coarse	Whole	11
ZV-2	8/7/2017	mz17-039-012	Fine	1/32	358
			Coarse	Whole	13
ZV-3	8/7/2017	mz17-039-013	Fine	1/32	335
			Coarse	Whole	14
ZV-4	8/8/2017	mz17-039-014	Fine	1/64	364
			Coarse	Whole	37
ZV-5	8/8/2017	mz17-039-015	Fine	1/32	390
			Coarse	Whole	20
ZV-6	8/7/2017	mz17-039-016	Fine	5/256	344
			Coarse	Whole	15
ZV-7	9/8/2017	mz17-039-017	Fine	1/8	303
			Coarse	Whole	3

QA/QC

Ten percent (10%) of samples were reanalyzed to assess subsampling accuracy and taxonomic consistency. The sample(s) were chosen at random and processed at different times to reduce counting and identification bias. The percent agreement between QA samples is reported in Table 2.

Table 2. Summary of taxonomic QA/QC results for Golder Baffinlands Iron Mine, 2017.

Biologica Sample #	Client Sample #	Original Count	QA Count	Percent Agreement
mz17-039-002	ZH-2	316	290	91.77%
mz17-039-013	ZV-3	349	340	97.42%
			Average:	**94.60%**

Percent Agreement:
{100 – [(difference in abundance between samples/total abundance of original sample) x 100]} %

Data

Taxonomic data were recorded in Biologica's custom database. Results were provided to the Golder project manager in Excel spreadsheets via email.

Methodological and Taxonomic References

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APPENDIX F-2
MARINE-ZOOPLANKTON DATA

Abundance data in matrix format, including total taxa (species richness) count per sample, and total abundance per sample for Golder Baffinlands Iron Mine, 2017.

							Sample Name	**ZH-1**	**ZH-2**	**ZH-3**	**ZH-4**	**ZH-5**	**ZH-6**	**ZR-1**	**ZR-2**	**ZR-3**	**ZR-4**	**ZV-1**	**ZV-2**	**ZV-3**	**ZV-4**	**ZV-5**	**ZV-6**	**ZV-7**
							Date Sampled	**8/28/2017**	**8/28/2017**	**8/28/2017**	**8/28/2017**	**8/29/2017**	**9/8/2017**	**9/11/2017**	**9/11/2017**	**9/11/2017**	**9/11/2017**	**8/7/2017**	**8/7/2017**	**8/7/2017**	**8/8/2017**	**8/8/2017**	**8/7/2017**	**9/8/2017**
Phylum	**Subphylum**	**Class**	**Subclass**	**Order**	**Family**	**Taxon**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**	**Total Abundance**
Annelida		Polychaeta	Sedentaria		Sabellariidae	Sabellariidae indet.	4,493												960	736	1,216	832	717	32
Annelida		Polychaeta				Polychaeta indet.	4,999		32				16	1,088	1,856	256	341	205	288	256	192	256	205	8
Arthropoda	Crustacea	Branchiopoda	Diplostraca	Anomopoda	Bosminidae	Bosminidae indet.	4				4													
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Hyperiidae	Hyperia medusarum	2		1			1												
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Hyperiidae	Hyperoche medusarum	1		1															
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Hyperiidae	Themisto abyssorum	4											2	2					
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Hyperiidae	Themisto libellula	62	10	10	6	7	23	6											
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Hyperiidae	Themisto sp.	51																51	
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda		Amphipoda indet.	1					1												
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Crangonidae	Sabinea septemcarinata	29	9	5	7	5	2												1
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda		Isopoda indet.	147			43	8	64										32		
Arthropoda	Crustacea		Copepoda	Calanoida	Acartiidae	Acartia longiremis	1,528	154	64	21	36	352	48	384	192	192	85							
Arthropoda	Crustacea		Copepoda	Calanoida	Acartiidae	Acartia sp.	9,985	1,741	1,088	299	112	4,256	720	256	256	256	427	256	32	64		64	102	56
Arthropoda	Crustacea		Copepoda	Calanoida	Calanidae	Calanus finmarchicus	1,629	307	224	213		32		8	16	8		154	352	96	128	32	51	8
Arthropoda	Crustacea		Copepoda	Calanoida	Calanidae	Calanus glacialis	3,769	1,229	992	661	16	172		8				154	64	64	192	64	154	
Arthropoda	Crustacea		Copepoda	Calanoida	Calanidae	Calanus hyperboreus	3															1	2	
Arthropoda	Crustacea		Copepoda	Calanoida	Calanidae	Calanus sp.	4,439	154	448	299	260	224	80	128	320	192		614	256	224	384	320	512	24
Arthropoda	Crustacea		Copepoda	Calanoida	Clausocalanidae	Ctenocalanus vanus	618	307	96	171	12	32												
Arthropoda	Crustacea		Copepoda	Calanoida	Clausocalanidae	Microcalanus sp.	36				4	32												
Arthropoda	Crustacea		Copepoda	Calanoida	Clausocalanidae	Pseudocalanus sp. complex	5,309	2,048	736	725	148	608	352					51	128		64	128	256	64
Arthropoda	Crustacea		Copepoda	Calanoida	Metridinidae	Metridia sp.	8				8													
Arthropoda	Crustacea		Copepoda	Calanoida	Scolecitrichidae	Scolecithricella sp.	1,031	51	128	64	4							256	64	64	256	128		16
Arthropoda	Crustacea		Copepoda	Calanoida		Calanoida indet.	56,806	4,096	1,792	1,493	20	1,952	512	10,048	9,216	6,336	5,163	3,430	1,632	1,600	4,416	2,080	2,867	152
Arthropoda	Crustacea		Copepoda	Cyclopoida	Oithonidae	Oithona atlantica	211	51					96	64										
Arthropoda	Crustacea		Copepoda	Cyclopoida	Oithonidae	Oithona similis	7,725	154	32	43	12	64	960	1,792	1,344	448	256	717	384	288	320	544	256	112
Arthropoda	Crustacea		Copepoda	Cyclopoida	Oithonidae	Oithona sp.	17,207				4	32	80	1,472	3,264	2,368	1,579	2,458	1,184	608	1,472	1,248	1,382	56
Arthropoda	Crustacea		Copepoda	Cyclopoida		Cyclopoida indet.	9,562							1,984	1,600	640	512	666	384	736	1,088	928	1,024	
Arthropoda	Crustacea		Copepoda	Harpacticoida	Ectinosomatidae	Microsetella norvegica	883		32	21	4			128				154	160	192	192			
Arthropoda	Crustacea		Copepoda	Harpacticoida	Ectinosomatidae	Microsetella sp.	250															96	154	
Arthropoda	Crustacea		Copepoda	Harpacticoida	Tachidiidae	Euterpina acutifrons	83											51		32				
Arthropoda	Crustacea		Copepoda	Poecilostomatoida	Oncaeidae	Oncaea sp.	134												32				102	
Arthropoda	Crustacea		Copepoda	Poecilostomatoida	Oncaeidae	Oncaeidae indet.	32													32				
Arthropoda	Crustacea		Copepoda	Poecilostomatoida	Oncaeidae	Triconia borealis	43										43							
Arthropoda	Crustacea		Copepoda	Poecilostomatoida	Sapphirinidae	Sapphirina sp.	1,081	256	256	85	20	352	112											
Arthropoda	Crustacea		Eumalacostraca	Mysida	Mysidae	Mysis litoralis	5							4	1									
Arthropoda	Crustacea		Thecostraca	Sessilia		Balanomorpha indet.	1,744		64	21	12	512	64	128	64	64		307	96	192		160	51	8
Arthropoda	Crustacea					Crustacea indet.	65,184							9,472	8,768	8,704	5,248	3,994	4,128	3,648	10,176	3,776	7,270	
Arthropoda			Copepoda	Harpacticoida	Peltidiidae	Clytemnestra sp.	491							128	64	256	43							
Chaetognatha		Sagittoidea	Aphragmophora		Sagittidae	Parasagitta elegans	12,899	2,714	2,272	1,259	348	56	3,024					1,442	11	12	35	18	13	1,696
Chaetognatha		Sagittoidea	Aphragmophora		Sagittidae	Parasagitta sp.	5,142					448			3				960	736	1,088	832	1,075	
Chordata	Tunicata	Appendicularia		Copelata	Oikopleuridae	Oikopleura sp.	181									128	43			1	1			8
Chordata	Vertebrata	Actinopterygii		Gadiformes	Gadidae	Gadidae indet.	6	1	1		1	3												
Chordata	Vertebrata	Actinopterygii		Perciformes	Ammodytidae	Ammodytes personatus	2				1		1											
Chordata	Vertebrata	Actinopterygii		Perciformes	Pholidae	Apodichthys flavidus	3		2												1			
Chordata	Vertebrata	Actinopterygii		Scorpaeniformes	Cottidae	Cottidae indet.	1				1													
Chordata	Vertebrata	Actinopterygii		Scorpaeniformes	Cottidae	Myoxocephalus polyacanthocephalus	1			1														
Chordata	Vertebrata	Actinopterygii			Pholididae	Apodichthys flavidus	10					10												
Cnidaria		Hydrozoa	Hydroidolina	Anthoathecata	Pandeidae	Catablema vesicarium	8	1	1	1	4		1											
Cnidaria		Hydrozoa	Hydroidolina	Anthoathecata	Rathkeidae	Rathkea sp.	1																	1
Cnidaria		Hydrozoa	Trachylinae	Narcomedusae	Solmundaeginidae	Aeginopsis laurentii	884			85	172	32	16	216	192	24	43							104
Cnidaria		Hydrozoa	Trachylinae	Trachymedusae	Rhopalonematidae	Aglantha digitale	89			1	40													48
Cnidaria		Hydrozoa	Trachylinae	Trachymedusae	Rhopalonematidae	Aglantha sp.	272						240							32				
Cnidaria						Cnidaria indet.	1,601	51	65	85	140	32	17	192	64	320	256	51	64	64		65	102	32
Echinodermata	Echinozoa	Echinoidea				Echinoidea indet.	1,062											154	32	160	384	128	205	
Mollusca		Bivalvia				Bivalvia indet.	5,037	51		21	4			320	384	512	384	102	32	576	1,472	512	666	
Mollusca		Gastropoda	Heterobranchia	Gymnosomata	Clionidae	Clione limacina	350	57	83	76	93	36	3		1			1						
Mollusca		Gastropoda	Heterobranchia	Thecosomata	Limacinidae	Limacina helicina	58			2	21	32	1				1			1				
Mollusca		Gastropoda	Heterobranchia	Thecosomata	Limacinidae	Limacina sp.	83											51	32					
Mollusca		Gastropoda				Gastropoda indet.	4,041	410	192	128	4	32	16	320	128	960	725	51	96	320	128	224	307	
Nemertea						Nemertea indet	64							64										
Rotifera		Eurotatoria	Monogononta	Ploima	Synchaetidae	Synchaeta sp.	896								128	64	128	512	32			32		
Rotifera						Rotifera indet.	51	51																
Unknown						Unidentified (eggs)	604		160	21				64	128				64		64		102	
						Total Abundance	**232,933**	**13,902**	**8,777**	**5,854**	**1,525**	**9,392**	**6,365**	**28,268**	**27,989**	**21,728**	**15,276**	**15,832**	**11,469**	**10,734**	**23,269**	**12,500**	**17,628**	**2,426**
						Total Unique Taxa	**44**	**17**	**20**	**21**	**25**	**19**	**16**	**14**	**12**	**11**	**10**	**18**	**17**	**16**	**13**	**18**	**16**	**13**

APPENDIX G

Benthic Infauna

Appendix G-1: Compiled Taxa list of Benthic Infauna from Surveys in Milne Inlet and Ragged Island from 2010 to 2017.

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Hirudinea	Piscicolidae	*Mysidobdella* sp.					X
Annelida	Oligochaeta	Enchytraeidae	Enchytraeidae indet.	X				X
Annelida	Oligochaeta		Oligochaete indet.		X			
Annelida	Polychaeta	Ampharetidae	*Ampharete oculata*			X		
Annelida	Polychaeta	Ampharetidae	*Ampharete* sp.*		X		X	X
Annelida	Polychaeta	Ampharetidae	*Ampharete vega*					X
Annelida	Polychaeta	Ampharetidae	Ampharetid sp. B				X	
Annelida	Polychaeta	Ampharetidae	Ampharetid sp. E				X	
Annelida	Polychaeta	Ampharetidae	*Amphicteis gunneri*		X	X	X	
Annelida	Polychaeta	Ampharetidae	*Amphicteis sundevalli*	X				X
Annelida	Polychaeta	Ampharetidae	*Anobothrus gracilis*				X	
Annelida	Polychaeta	Ampharetidae	*Lysippe labiata*			X	X	X
Annelida	Polychaeta	Ampharetidae	*Melinna elisabethae*	X	X	X	X	X
Annelida	Polychaeta	Ampharetidae	*Melinna* sp.	X				
Annelida	Polychaeta	Ampharetidae	*Samytha* sp.				X	
Annelida	Polychaeta	Ampharetidae indet.	Ampharetidae indet.	X	X	X	X	X
Annelida	Polychaeta	Aphroditidae	Aphroditidae indet.		X			
Annelida	Polychaeta	Apistobranchidae	*Apistobranchus* sp.					X
Annelida	Polychaeta	Capitellidae	Capitellidae indet.				X	X
Annelida	Polychaeta	Capitellidae	*Mediomastus ambiseta*		X		X	X
Annelida	Polychaeta	Capitellidae	*Mediomastus* sp.*	X				X
Annelida	Polychaeta	Capitellidae	*Notomastus latericeus*					X
Annelida	Polychaeta	Capitellidae	*Capitella capitata complex**	X	X			X
Annelida	Polychaeta	Cirratulidae	*Aphelochaeta marioni*		X			

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Cirratulidae	*Aphelochaeta* sp.					X
Annelida	Polychaeta	Cirratulidae	*Chaetozone bathyala*					X
Annelida	Polychaeta	Cirratulidae	*Chaetozone careyi*					X
Annelida	Polychaeta	Cirratulidae	*Chaetozone pigmentata*					X
Annelida	Polychaeta	Cirratulidae	*Chaetozone setosa complex*		X	X	X	X
Annelida	Polychaeta	Cirratulidae	*Chaetozone* sp.*					X
Annelida	Polychaeta	Cirratulidae	Cirratulidae indet.*	X	X	X	X	X
Annelida	Polychaeta	Cirratulidae	Cirratulidae sp. A				X	
Annelida	Polychaeta	Cirratulidae	*Tharyx* sp.					X
Annelida	Polychaeta	Cossuridae	*Cossura longocirrata*		X			
Annelida	Polychaeta	Cossuridae	*Cossura* sp.*	X		X	X	X
Annelida	Polychaeta	Dorvilleidae	*Parougia caeca*		X	X		X
Annelida	Polychaeta	Fabriciidae	Fabriciidae indet.					X
Annelida	Polychaeta	Flabelligeridae	*Brada villosa*		X			
Annelida	Polychaeta	Flabelligeridae	*Diplocirrus hirsutus*			X	X	
Annelida	Polychaeta	Flabelligeridae	*Flabelligera affinis*				X	
Annelida	Polychaeta	Flabelligeridae	*Flabelligeridae*			X		
Annelida	Polychaeta	Glyceridae	*Glycera capitata*					X
Annelida	Polychaeta	Glyceridae	Glycera sp.					X
Annelida	Polychaeta	Hesionidae	Hesionidae indet.					X
Annelida	Polychaeta	Hesionidae	*Nereimyra punctata**				X	X
Annelida	Polychaeta	Lumbrineridae	*Lumbrineris* sp.	X	X	X	X	
Annelida	Polychaeta	Lumbrineridae	*Scoletoma fragilis*	X		X	X	X
Annelida	Polychaeta	Lumbrineridae	*Scoletoma impatiens**				X	X
Annelida	Polychaeta	Lumbrineridae	*Scoletoma tenuis*		X		X	
Annelida	Polychaeta	Maldanidae	*Clymenura* sp.					X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Maldanidae	*Euclymene* sp.					X
Annelida	Polychaeta	Maldanidae	Euclymeninae indet.*					X
Annelida	Polychaeta	Maldanidae	*Heteroclymene robusta*			X		
Annelida	Polychaeta	Maldanidae	*Maldane sarsi**	X	X	X	X	X
Annelida	Polychaeta	Maldanidae	Maldanidae indet.	X	X	X	X	X
Annelida	Polychaeta	Maldanidae	Maldanidae sp. A				X	
Annelida	Polychaeta	Maldanidae	Maldanidae sp. B				X	
Annelida	Polychaeta	Maldanidae	Maldanidae sp. C				X	
Annelida	Polychaeta	Maldanidae	Microclymene sp.*					X
Annelida	Polychaeta	Maldanidae	*Nicomache lumbricalis*			X	X	X
Annelida	Polychaeta	Maldanidae	*Praxillella praetermissa*					X
Annelida	Polychaeta	Maldanidae	*Rhodine loveni*					X
Annelida	Polychaeta	Nephtyidae	*Bipalponephtys cornuta**					X
Annelida	Polychaeta	Nephtyidae	*Nephtys ciliata*	X		X	X	X
Annelida	Polychaeta	Nephtyidae	*Nephtys* sp.	X	X	X	X	
Annelida	Polychaeta	Nereididae	Nereididae indet.	X				X
Annelida	Polychaeta	Nereididae	*Nereis* sp.				X	X
Annelida	Polychaeta	Nereididae	*Nereis zonata*		X	X	X	X
Annelida	Polychaeta	Onuphidae	*Nothria conchylega*	X				
Annelida	Polychaeta	Opheliidae	*Ophelia limacina*	X	X	X	X	X
Annelida	Polychaeta	Opheliidae	Opheliidae	X				
Annelida	Polychaeta	Opheliidae	*Ophelina acuminata*	X		X	X	X
Annelida	Polychaeta	Opheliidae	*Ophelina* sp.*					X
Annelida	Polychaeta	Orbiniidae	*Leitoscoloplos* sp.	X				X
Annelida	Polychaeta	Orbiniidae	Orbiniidae indet.					X
Annelida	Polychaeta	Orbiniidae	*Scoloplos acutus*		X	X	X	X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Orbiniidae	*Scoloplos armiger*	X				X
Annelida	Polychaeta	Orbiniidae	*Scoloplos* sp.		X	X		X
Annelida	Polychaeta	Oweniidae	*Galathowenia oculata**			X		X
Annelida	Polychaeta	Oweniidae	*Myriochele danielsseni*					X
Annelida	Polychaeta	Oweniidae	*Myriochele heeri*					X
Annelida	Polychaeta	Oweniidae	*Myriochele* sp.					X
Annelida	Polychaeta	Oweniidae	*Owenia fusiformis**	X	X	X	X	X
Annelida	Polychaeta	Oweniidae	Oweniidae indet.			X	X	
Annelida	Polychaeta	Paraoidae	*Paraonis* sp.	X				
Annelida	Polychaeta	Paraonidae	*Aricidea catherinae**		X			X
Annelida	Polychaeta	Paraonidae	*Aricidea hartmanae*					X
Annelida	Polychaeta	Paraonidae	*Aricidea minuta*					X
Annelida	Polychaeta	Paraonidae	*Aricidea nolani**		X			X
Annelida	Polychaeta	Paraonidae	Aricidea sp.	X	X		X	X
Annelida	Polychaeta	Paraonidae	Aricidea sp. A				X	
Annelida	Polychaeta	Paraonidae	Paraonidae indet.		X	X	X	X
Annelida	Polychaeta	Pectinariidae	*Cistenides granulata**	X	X	X	X	X
Annelida	Polychaeta	Pectinariidae	*Cistenides hyperborea*	X				
Annelida	Polychaeta	Pectinariidae	*Pectinaria* sp.	X	X			
Annelida	Polychaeta	Pholoidae	*Pholoe longa*	X	X			
Annelida	Polychaeta	Pholoidae	*Pholoe minuta**			X	X	X
Annelida	Polychaeta	Pholoidae	*Pholoe* sp.*	X	X	X	X	X
Annelida	Polychaeta	Pholoidae	*Pholoe tecta**	X	X	X	X	X
Annelida	Polychaeta	Phyllidae	*Phyllodoce groenlandica*	X		X	X	X
Annelida	Polychaeta	Phyllidae	*Phyllodoce mucosa*			X	X	X
Annelida	Polychaeta	Phyllodocidae	*Eteone barbata*	X				X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Phyllodocidae	*Eteone flava*					X
Annelida	Polychaeta	Phyllodocidae	*Eteone longa complex**		X	X	X	X
Annelida	Polychaeta	Phyllodocidae	*Eteone* sp.*	X	X	X	X	X
Annelida	Polychaeta	Phyllodocidae	*Hypereteone sp. **					X
Annelida	Polychaeta	Phyllodocidae	*Phyllodoce* sp.					X
Annelida	Polychaeta	Phyllodocidae	Phyllodocidae indet.			X	X	X
Annelida	Polychaeta	Polycidae	Polychaeta indet.		X	X	X	X
Annelida	Polychaeta	Polycidae	*Polycirrus* sp. complex	X	X		X	X
Annelida	Polychaeta	Polydidae	*Polydora* sp. complex	X	X			X
Annelida	Polychaeta	Polynoidae	*Bylgides groenlandicus*	X				
Annelida	Polychaeta	Polynoidae	*Bylgides sarsi*		X	X	X	X
Annelida	Polychaeta	Polynoidae	*Bylgides* sp. A				X	
Annelida	Polychaeta	Polynoidae	*Gattyana cirrhosa**	X	X	X		X
Annelida	Polychaeta	Polynoidae	*Harmothoe extenuata*		X	X	X	X
Annelida	Polychaeta	Polynoidae	*Harmothoe fragilis*		X			
Annelida	Polychaeta	Polynoidae	*Harmothoe imbricata**	X	X	X	X	X
Annelida	Polychaeta	Polynoidae	*Harmothoe* sp.*	X	X	X	X	X
Annelida	Polychaeta	Polynoidae	*Hartmania moorei*					X
Annelida	Polychaeta	Polynoidae	*Hartmania* sp.		X			
Annelida	Polychaeta	Polynoidae	*Neobylgides sp.*				X	
Annelida	Polychaeta	Polynoidae	Polynoidae indet.*	X	X	X	X	X
Annelida	Polychaeta	Polynoidae	Polynoinae indet.					X
Annelida	Polychaeta	Praxiidae	*Praxilella* sp.				X	X
Annelida	Polychaeta	Sabelidae	Sabellid sp. A				X	
Annelida	Polychaeta	Sabelidae	Sabellid sp. B				X	
Annelida	Polychaeta	Sabelidae	Sabellid sp. F				X	

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Sabelidae	Sabellid sp. G				X	
Annelida	Polychaeta	Sabellidae	*Branchiomma* sp.					X
Annelida	Polychaeta	Sabellidae	*Chone duneri*					X
Annelida	Polychaeta	Sabellidae	*Chone* sp.	X				
Annelida	Polychaeta	Sabellidae	*Dialychone* sp.*					X
Annelida	Polychaeta	Sabellidae	*Dialychone* sp. A					X
Annelida	Polychaeta	Sabellidae	*Dialychone* sp. B					X
Annelida	Polychaeta	Sabellidae	*Euchone incolor**		X			X
Annelida	Polychaeta	Sabellidae	*Euchone papillosa*	X				
Annelida	Polychaeta	Sabellidae	*Euchone rubrocincta*					X
Annelida	Polychaeta	Sabellidae	*Euchone* sp.			X	X	
Annelida	Polychaeta	Sabellidae	*Hypsicomus* sp.					X
Annelida	Polychaeta	Sabellidae	*Potamilla neglecta*			X	X	
Annelida	Polychaeta	Sabellidae	*Pseudopotamilla reniformis*				X	
Annelida	Polychaeta	Sabellidae	Sabellidae indet.*		X	X	X	X
Annelida	Polychaeta	Sabellidae	Sabellidae sp. H					X
Annelida	Polychaeta	Sabellidae	Sabellidae sp. I					X
Annelida	Polychaeta	Sabellidae	Sabellidae sp. J					X
Annelida	Polychaeta	Scalibregmatidae	*Polyphysia baffinensis*	X				
Annelida	Polychaeta	Scalibregmatidae	*Polyphysia crassa*					X
Annelida	Polychaeta	Scalibregmatidae	*Scalibregma inflatum*	X	X	X	X	X
Annelida	Polychaeta	Scalibregmatidae	Scalibregmatidae indet.					X
Annelida	Polychaeta	Serpulidae	*Bushiella (Jugaria) quadrangularis*					X
Annelida	Polychaeta	Serpulidae	*Pileolaria* sp.					X
Annelida	Polychaeta	Serpulidae	Serpulidae indet.	X				

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Serpulidae	Spirorbinae indet.*					X
Annelida	Polychaeta	Sphaerodoridae	*Sphaerodoropsis minuta*	X				X
Annelida	Polychaeta	Spionidae	*Dipolydora caulleryi*					X
Annelida	Polychaeta	Spionidae	*Dipolydora quadrilobata*					X
Annelida	Polychaeta	Spionidae	Dipolydora sp. *					X
Annelida	Polychaeta	Spionidae	*Marenzelleria* sp.				X	X
Annelida	Polychaeta	Spionidae	*Prionospio cirrifera*					X
Annelida	Polychaeta	Spionidae	*Prionospio* sp.					X
Annelida	Polychaeta	Spionidae	*Prionospio steenstrupi**		X	X	X	X
Annelida	Polychaeta	Spionidae	*Pygospio* sp.		X			X
Annelida	Polychaeta	Spionidae	*Spio filicornis**	X	X	X	X	X
Annelida	Polychaeta	Spionidae	Spionidae indet.	X	X	X	X	X
Annelida	Polychaeta	Spirorbidae	Spirorbidae indet.		X	X	X	
Annelida	Polychaeta	Syllidae	*Exogone hebes*		X			X
Annelida	Polychaeta	Syllidae	*Exogone* sp.	X	X			
Annelida	Polychaeta	Syllidae	*Exogone verugera*		X			
Annelida	Polychaeta	Syllidae	Syllidae indet.	X	X	X	X	X
Annelida	Polychaeta	Syllidae	*Syllides* sp.					X
Annelida	Polychaeta	Terebellidae	*Lanassa venusta venusta*					X
Annelida	Polychaeta	Terebellidae	*Laphania boecki*				X	X
Annelida	Polychaeta	Terebellidae	*Leaena abranchiata*					X
Annelida	Polychaeta	Terebellidae	*Neoamphitrite affinis*					X
Annelida	Polychaeta	Terebellidae	*Nicolea venustula*		X			
Annelida	Polychaeta	Terebellidae	*Pista cristata*				X	
Annelida	Polychaeta	Terebellidae	*Pista maculata*	X	X	X	X	X
Annelida	Polychaeta	Terebellidae	Terebellidae indet.		X	X	X	X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Annelida	Polychaeta	Terebellidae	Terebellidae sp.		X	X	X	
Annelida	Polychaeta	Terebellidae	*Terebellides* sp.*					X
Annelida	Polychaeta	Terebellidae	*Terebellides stroemi**	X	X	X	X	X
Annelida	Polychaeta	Trichidae	*Trichobranchus glacialis*	X				X
Annelida	Polychaeta	Trichobranchidae	*Terebellides reishi*					X
Annelida	Polychaeta	Trichobranchidae	Trichobranchidae indet.	X				
Annelida	Polychaeta	Trochochaetidae	*Trochochaeta watsoni*					X
Annelida	Polychaeta		Errantia indet.					X
Annelida	Polychaeta/Archiannelid a	Archiidae	Archiannelid indet.		X			
Arthropoda	Amphipoda	Ampelescidae	*Haploops* sp.			X	X	
Arthropoda	Amphipoda	Ampelescidae	*Haploops tubicola**	X	X		X	X
Arthropoda	Amphipoda	Ampeliscidae	*Ampelisca eschrichtii*			X	X	X
Arthropoda	Amphipoda	Ampeliscidae	*Ampelisca* sp.			X	X	
Arthropoda	Amphipoda	Ampeliscidae	Ampeliscidae indet.				X	
Arthropoda	Amphipoda	Ampeliscidae	*Byblis gaimardii*	X				
Arthropoda	Amphipoda	Ampeliscidae	*Byblis* sp.			X	X	X
Arthropoda	Amphipoda	Amphilochidae	Amphilochidae indet.					X
Arthropoda	Amphipoda	Amphilochidae	*Amphilochopsis hamatus*					X
Arthropoda	Amphipoda	Atylidae	*Atylus carinatus**	X	X	X	X	X
Arthropoda	Amphipoda	Atylidae	*Nototropis* sp.			X		
Arthropoda	Amphipoda	Calliopiidae	*Apherusa jurinei*		X			
Arthropoda	Amphipoda	Calliopiidae	*Apherusa megalops*		X			
Arthropoda	Amphipoda	Calliopiidae	Calliopiidae indet.					X
Arthropoda	Amphipoda	Corophiidae	Corophiidae indet.				X	
Arthropoda	Amphipoda	Corophiidae	*Corophium* sp.	X	X			

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Arthropoda	Amphipoda	Corophiidae	*Crassicorophium bonellii**		X			X
Arthropoda	Amphipoda	Corophiidae	*Monocorophium insidiosum*		X			X
Arthropoda	Amphipoda	Corophiidae	*Monocorophium* sp.					X
Arthropoda	Amphipoda	Dexaminidae	*Dexamine* sp.					X
Arthropoda	Amphipoda	Dexaminidae	*Guernea nordenskioldi**	X	X	X	X	X
Arthropoda	Amphipoda	Eusiridae	*Rhachotropis helleri*					X
Arthropoda	Amphipoda	Eusiridae	*Rhachotropis oculata*		X			
Arthropoda	Amphipoda	Eusiridae	*Rhachotropis* sp. *					X
Arthropoda	Amphipoda	Gammaridae	*Gammarus oceanicus*		X			X
Arthropoda	Amphipoda	Gammaridae	*Gammarus setosus*				X	
Arthropoda	Amphipoda	Gammaridae	*Gammarus* sp.		X	X	X	
Arthropoda	Amphipoda	Hyperiidae	*Themisto* sp.				X	
Arthropoda	Amphipoda	Isaeidae	*Protomedeia fasciata*		X		X	
Arthropoda	Amphipoda	Isaeidae	*Protomedeia* sp.*					X
Arthropoda	Amphipoda	Isaeidae	*Rhachotropis aculeata*	X				
Arthropoda	Amphipoda	Ischyroceridae	Ischyroceridae indet.	X				
Arthropoda	Amphipoda	Ischyroceridae	*Ischyrocerus anguipes*		X	X		
Arthropoda	Amphipoda	Ischyroceridae	*Ischyrocerus* sp.			X		
Arthropoda	Amphipoda	Lysianassidae	*Gronella groenlandica*		X		X	X
Arthropoda	Amphipoda	Lysianassidae	Lysianassidae indet.	X		X		X
Arthropoda	Amphipoda	Lysianassidae	Lysianassoidea indet.					X
Arthropoda	Amphipoda	Lysianassidae	*Scopelocheirus hopei*				X	
Arthropoda	Amphipoda	Oedicerotidae	*Bathymedon obtusifrons**				X	X
Arthropoda	Amphipoda	Oedicerotidae	*Deflexilodes tesselatus*		X			
Arthropoda	Amphipoda	Oedicerotidae	*Monoculodes latimanus*		X			X
Arthropoda	Amphipoda	Oedicerotidae	*Monoculodes* sp.*	X	X	X	X	X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Arthropoda	Amphipoda	Oedicerotidae	*Monoculopsis longicornis**		X		X	X
Arthropoda	Amphipoda	Oedicerotidae	*Oediceros borealis*		X	X	X	
Arthropoda	Amphipoda	Oedicerotidae	Oedicerotidae indet.*	X	X	X	X	X
Arthropoda	Amphipoda	Oedicerotidae	*Paroediceros lynceus**	X	X	X	X	X
Arthropoda	Amphipoda	Oedicerotidae	*Paroediceros* sp.		X			
Arthropoda	Amphipoda	Oedicerotidae	*Rostroculodes borealis*			X		X
Arthropoda	Amphipoda	Oedicerotidae	*Rostroculodes longirostris*					X
Arthropoda	Amphipoda	Oedicerotidae	*Rostroculodes* sp.					X
Arthropoda	Amphipoda	Oedicerotidae	*Rostroculodes kroyeri*			X	X	
Arthropoda	Amphipoda	Oedicerotidae	*Westwoodilla caecula*			X		
Arthropoda	Amphipoda	Oedicerotidae	*Westwoodilla* sp.		X		X	X
Arthropoda	Amphipoda	Opisidae	*Opisa eschrichti*				X	
Arthropoda	Amphipoda	Phoxocephalidae	*Harpinia serrata*	X		X	X	X
Arthropoda	Amphipoda	Phoxocephalidae	*Harpinia* sp.			X	X	X
Arthropoda	Amphipoda	Phoxocephalidae	*Phoxocephalus holbolli*				X	
Arthropoda	Amphipoda	Podoceridae	*Dyopedos* sp.					X
Arthropoda	Amphipoda	Pontoporeiidae	*Monoporeia affinis*	X	X	X	X	X
Arthropoda	Amphipoda	Pontoporeiidae	*Pontoporeia femorata**	X	X	X	X	X
Arthropoda	Amphipoda	Pontoporeiidae	Pontoporeiidae indet.					X
Arthropoda	Amphipoda	Stenothoidae	*Hardametopa nasuta*					X
Arthropoda	Amphipoda	Stenothoidae	*Metopa* sp.		X			
Arthropoda	Amphipoda	Stenothoidae	Stenothoidae indet.	X			X	X
Arthropoda	Amphipoda	Tryphosidae	*Hippomedon denticulatus*			X		
Arthropoda	Amphipoda	Tryphosidae	*Hippomedon serratus*				X	
Arthropoda	Amphipoda	Tryphosidae	*Orchomene macroserratus*	X				
Arthropoda	Amphipoda	Tryphosidae	*Orchomene* sp.					X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Arthropoda	Amphipoda	Tryphosidae	*Orchomenella minuta*		X		X	
Arthropoda	Amphipoda	Tryphosidae	*Orchomenella pinguis*				X	X
Arthropoda	Amphipoda	Tryphosidae	*Orchomenella* sp.		X		X	
Arthropoda	Amphipoda	Uristidae	*Anonyx nugax*	X	X	X	X	X
Arthropoda	Amphipoda	Uristidae	*Anonyx ochoticus*				X	
Arthropoda	Amphipoda	Uristidae	*Anonyx pacificus*				X	
Arthropoda	Amphipoda	Uristidae	*Anonyx sarsi*			X	X	X
Arthropoda	Amphipoda	Uristidae	Anonyx sp.*		X	X	X	X
Arthropoda	Amphipoda	Uristidae	*Menigrates obtusifrons*					X
Arthropoda	Amphipoda	Uristidae	*Onisimus barentsi Group*					X
Arthropoda	Amphipoda	Uristidae	*Onisimus litoralis*			X		
Arthropoda	Amphipoda	Uristidae	*Onisimus normani*			X		
Arthropoda	Amphipoda	Uristidae	*Onisimus plautus*				X	
Arthropoda	Amphipoda	Uristidae	*Onisimus* sp.	X				X
Arthropoda	Amphipoda	Uristidae	Uristidae indet.					X
Arthropoda	Amphipoda		Amphipoda indet.*	X	X	X	X	X
Arthropoda	Arachnida	Acariopodae	Acari indet.	X	X			
Arthropoda	Cirripedia	Balanidae	*Balanus* sp.	X			X	
Arthropoda	Cirripedia		Balanomorpha indet.*					X
Arthropoda	Cirripedia		Cirripedia indet.			X	X	
Arthropoda	Cirripedia	Archaeobalanidae	*Semibalanus balanoides*	X				
Arthropoda	Cumacea	Bodotriidae	*Cyclaspis longicaudata*	X				
Arthropoda	Cumacea	Diastylidae	*Brachydiastylis resima**	X	X	X	X	X
Arthropoda	Cumacea	Diastylidae	Diastylidae indet.					X
Arthropoda	Cumacea	Diastylidae	*Diastylis alaskensis*					X
Arthropoda	Cumacea	Diastylidae	*Diastylis bradyi*					X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Arthropoda	Cumacea	Diastylidae	*Diastylis echinata*			X	X	
Arthropoda	Cumacea	Diastylidae	*Diastylis goodsiri*	X		X		X
Arthropoda	Cumacea	Diastylidae	*Diastylis lucifera*			X		X
Arthropoda	Cumacea	Diastylidae	*Diastylis rathkei*	X	X	X		X
Arthropoda	Cumacea	Diastylidae	*Diastylis scorpiodes*	X		X	X	X
Arthropoda	Cumacea	Diastylidae	*Diastylis sculpta*		X			
Arthropoda	Cumacea	Diastylidae	*Diastylis* sp.		X		X	X
Arthropoda	Cumacea	Diastylidae	*Diastylis spinulosa*	X		X		X
Arthropoda	Cumacea	Diastylidae	*Diastyloides biplicatus*					X
Arthropoda	Cumacea	Lampropidae	*Hemilamprops cristatus*					X
Arthropoda	Cumacea	Lampropidae	Lampropidae indet.			X		X
Arthropoda	Cumacea	Lampropidae	*Lamprops fuscatus**	X	X	X	X	X
Arthropoda	Cumacea	Lampropidae	*Lamprops* sp.			X	X	
Arthropoda	Cumacea	Leuconidae	*Eudorella emarginata*			X	X	
Arthropoda	Cumacea	Leuconidae	*Eudorella* sp.	X		X	X	X
Arthropoda	Cumacea	Leuconidae	*Eudorella truncatula*			X	X	X
Arthropoda	Cumacea	Leuconidae	*Eudorellopsis* sp.	X				
Arthropoda	Cumacea	Leuconidae	*Leucon nasicoides*	X	X	X	X	X
Arthropoda	Cumacea	Leuconidae	*Leucon* sp.			X		X
Arthropoda	Cumacea	Leuconidae	Leuconidae indet.					X
Arthropoda	Cumacea	Nannastacidae	*Campylaspis rubicunda*					X
Arthropoda	Cumacea	Nannastacidae	*Campylaspis* sp.					X
Arthropoda	Cumacea		Cumacea indet.*		X	X	X	X
Arthropoda	Cyclopoida		Cyclopoida indet.*					X
Arthropoda	Decapoda	Crangonidae	*Sabinea septemcarinata*	X		X		X
Arthropoda	Decapoda	Crangonidae	*Sclerocrangon boreas**				X	X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Arthropoda	Decapoda	Thoridae	*Lebbeus polaris*	X				
Arthropoda	Harpacticoida		Harpacticoida indet.	X	X		X	X
Arthropoda	Insecta	Chironomidae	Chironomidae indet.	X				
Arthropoda	Insecta	Chironomidae	Chironominae indet.	X				
Arthropoda	Insecta		Diptera indet.					X
Arthropoda	Insecta	Orthocladiinae	*Orthocladiinae*	X				X
Arthropoda	Isopoda		Asellota indet.					X
Arthropoda	Isopoda	Desmosomatidae	*Desmosoma* sp.		X			
Arthropoda	Isopoda	Desmosomatidae	Desmosomatidae indet.					X
Arthropoda	Isopoda	Desmosomatidae	*Eugerda* sp.	X				
Arthropoda	Isopoda	Gnathiidae	*Gnathia maxillaris*				X	
Arthropoda	Isopoda	Gnathiidae	*Gnathia* sp.	X	X			X
Arthropoda	Isopoda	Gnathiidae	Gnathiidae indet.					X
Arthropoda	Isopoda		Isopoda sp. A				X	
Arthropoda	Isopoda	Paramunnidae	*Pleurogonium rubicundum*					X
Arthropoda	Isopoda	Paramunnidae	*Pleurogonium* sp.					X
Arthropoda	Isopoda	Paramunnidae	*Pleurogonium spinosissimum*	X				X
Arthropoda	Myodocopa		Myodocopa indet.	X	X	X	X	
Arthropoda	Mysida	Mysidae	*Mysis mixta*		X		X	X
Arthropoda	Mysida	Mysidae	*Mysis* sp.		X			
Arthropoda	Mysida		Mysida indet.					X
Arthropoda	Ostracoda		Ostracoda indet.					X
Arthropoda	Ostracoda	Philomedidae	*Philomedes* sp.*					X
Arthropoda	Ostracoda	TrachyleneridAfter	*Robertsonites tuberculatus**					X
Arthropoda	Pycnogonida	Ammotheidae	*Achelia spinosa*				X	
Arthropoda	Pycnogonida		Pycnogonida indet.	X		X		X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Arthropoda	Pycnogonida	Ammotheidae	*Achelia* sp.					X
Arthropoda	Pycnogonida	Numphonidae	*Nymphon* sp.					X
Arthropoda	Tanaidacea	Akanthophoreidae	*Akanthophoreus gracilis*					X
Arthropoda	Tanaidacea	Akanthophoreidae	*Akanthophoreus* sp.*					X
Arthropoda	Tanaidacea	Pseudotanaidae	*Pseudotanais* sp.*					X
Arthropoda	Tanaidacea	Sphyrapodidae	*Pseudosphyrapus anomalus*	X			X	X
Arthropoda	Tanaidacea		Tanaidacea indet.*	X	X	X	X	X
Arthropoda	Tanaidacea	Typhlotanaidae	*Typhlotanais* sp.*					X
Arthropoda	Trombidiformes	Halacaridae	Halacaridae indet.*					X
Bryozoa	Ctenostomata		Ctenostomata indet.					X
Bryozoa	Ctenostomata	Vesiculariidae	*Bowerbankia* sp.					X
Bryozoa			Bryozoa indet.*					X
Bryozoa		Crisiidae	*Crisia* sp.					X
Bryozoa		Epistomiidae	*Synnotum* sp.					X
Bryozoa		Hippothoidae	*Celleporella hyalina**					X
Cephalorhyncha	Priapulida		Priapulid indet.		X			
Cephalorhyncha	Priapulida	Priapulidae	*Priapulus caudatus*	X		X	X	X
Cephalorhyncha	Priapulida	Priapulidae	*Priapulus* sp.					X
Chordata	Ascidiacea		Ascidiacea indet.					X
Chordata	Ascidiacea	Ascidiidae	*Ascidia callosa*		X			
Chordata	Ascidiacea	Ascidiidae	*Ascidia* sp.		X	X		X
Chordata	Ascidiacea		*Molgula* sp.		X			
Chordata	Ascidiacea	Pyuridae	*Boltenia echinata*			X		X
Chordata	Ascidiacea	Styelidae	*Polycarpa fibrosa*					X
Chordata	Ascidiacea		Tunicate sp.				X	
Chordata			Pisces indet.					X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Cnidaria	Anthozoa	Actiniidae	*Urticina* sp.*					X
Cnidaria	Anthozoa	Hormathiidae	*Hormathia digitata* *					X
Cnidaria	Anthozoa	Parazoanthidae	*Parazoanthus* sp.					X
Cnidaria	Hydrozoa	Bougainvilliidae	Bougainvilliidae indet.					X
Cnidaria	Hydrozoa		Hydrozoa					X
Cnidaria	Hydrozoa	Olindiidae	*Monobrachium parasitum*					X
Echinodermata	Echinoidea	Strongylocentrotidae	*Strongylocentrotus droebachiensis*	X		X	X	X
Echinodermata	Echinoidea	Strongylocentrotidae	*Strongylocentrotus* sp.*		X			X
Echinodermata	Holothuroidea	Asteriidae	Asteriidae indet.			X		
Echinodermata	Holothuroidea		Holothuroidea sp. A				X	
Echinodermata	Holothuroidea	Myriotrochidae	*Myriotrochus rinkii*					X
Echinodermata	Holothuroidea	Psolidae	*Psolus phantapus*					X
Echinodermata	Molpadida		Molpadida indet.					X
Echinodermata	Ophiuroidea	Ophiuridae	*Ophiocten sericeum*	X	X			
Echinodermata	Ophiuroidea	Ophiuridae	*Ophiura robusta*	X		X	X	X
Echinodermata	Ophiuroidea	Ophiuridae	*Ophiura sarsi*	X	X	X	X	X
Echinodermata	Ophiuroidea	Ophiuridae	*Ophiura* sp.*			X		X
Echinodermata	Ophiuroidea		Ophiuroidea indet.			X		
Mollusca	Aplacophora		Aplacophora indet.					X
Mollusca	Bivaliva	Astartidae	*Astarte borealis**	X	X	X	X	X
Mollusca	Bivaliva	Astartidae	*Astarte montagui**	X		X	X	X
Mollusca	Bivaliva	Astartidae	*Astarte* sp.*	X	X	X	X	X
Mollusca	Bivaliva	Bivalscae	Bivalve indet.*		X	X	X	X
Mollusca	Bivaliva	Bivalscae	Bivalve sp. A				X	

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Mollusca	Bivaliva	Cardiidae	*Ciliatocardium ciliatum* *	X		X	X	X
Mollusca	Bivaliva	Cardiidae	*Serripes groenlandicus**		X	X	X	X
Mollusca	Bivaliva	Cardiidae	*Serripes* sp.		X			
Mollusca	Bivaliva	Cardiidae	Cardiidae indet.					X
Mollusca	Bivaliva	Cuspidariidae	*Cuspidaria arctica*			X		
Mollusca	Bivaliva	Cuspidariidae	*Cuspidaria* sp.	X				
Mollusca	Bivaliva	Hiatellidae	*Hiatella arctica*	X	X	X	X	X
Mollusca	Bivaliva	Lyonsiidae	*Lyonsia arenosa*					X
Mollusca	Bivaliva	Margaritidae	*Margarites groenlandicus*		X	X	X	X
Mollusca	Bivaliva	Margaritidae	*Margarites helicinus*					X
Mollusca	Bivaliva	Margaritidae	*Margarites olivaceus*	X				
Mollusca	Bivaliva	Margaritidae	*Margarites* sp.					X
Mollusca	Bivaliva	Myidae	*Mya* sp.*					X
Mollusca	Bivaliva	Myidae	*Mya truncata**	X	X	X	X	X
Mollusca	Bivaliva	Mytilidae	*Crenella faba*	X	X	X	X	X
Mollusca	Bivaliva	Mytilidae	*Crenella* sp.		X			
Mollusca	Bivaliva	Mytilidae	*Dacrydium vitreum*	X				
Mollusca	Bivaliva	Mytilidae	*Musculus discors**	X	X	X	X	X
Mollusca	Bivaliva	Mytilidae	*Musculus niger**		X			X
Mollusca	Bivaliva	Mytilidae	*Musculus* sp.	X				X
Mollusca	Bivaliva	Mytilidae	*Mya arenaria*			X	X	
Mollusca	Bivaliva	Mytilidae	Mytilidae indet.*	X				X
Mollusca	Bivaliva	Mytilidae	*Mytilus edulis*		X			
Mollusca	Bivaliva	Mytilidae	*Mytilus* sp.					X
Mollusca	Bivaliva	Nuculanidae	*Nuculana minuta**		X	X	X	X
Mollusca	Bivaliva	Nuculanidae	*Nuculana pernula**	X	X	X	X	X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Mollusca	Bivaliva	Nuculanidae	*Nuculana* sp.*			X		X
Mollusca	Bivaliva	Nuculanoidea	Nuculanoidea indet.*					X
Mollusca	Bivaliva	Nuculidae	*Ennucula tenuis*	X				X
Mollusca	Bivaliva	Nuculidae	*Nucula* sp.			X		
Mollusca	Bivaliva	Nuculidae	*Pronucula tenuis*		X	X	X	
Mollusca	Bivaliva	Pectinidae	*Chlamys islandica*			X	X	X
Mollusca	Bivaliva	Pectinidae	Pectinidae indet.					X
Mollusca	Bivaliva	Pectinidae	*Similipecten greenlandicus*	X		X	X	
Mollusca	Bivaliva	Pectinoidea	Pectinoidea indet.					X
Mollusca	Bivaliva	Periplomatidae	*Periploma aleuticum*	X				X
Mollusca	Bivaliva	Propeamussiidae	*Similipecten greenlandicus*					X
Mollusca	Bivaliva	Propeamussiidae	Propeamussiidae indet.					X
Mollusca	Bivaliva	Tellinidae	*Macoma balthica*			X	X	X
Mollusca	Bivaliva	Tellinidae	*Macoma calcarea**	X	X	X	X	X
Mollusca	Bivaliva	Tellinidae	*Macoma moesta*					X
Mollusca	Bivaliva	Tellinidae	*Macoma* sp.*					X
Mollusca	Bivaliva	Thraciidae	*Thracia myopsis*			X	X	X
Mollusca	Bivaliva	Thraciidae	*Thracia* sp.					X
Mollusca	Bivaliva	Thyasiridae	*Axinopsida serricata**					X
Mollusca	Bivaliva	Thyasiridae	*Thyasira flexuosa*		X	X	X	
Mollusca	Bivaliva	Thyasiridae	*Thyasira gouldi*	X				
Mollusca	Bivaliva	Thyasiridae	*Thyasira* sp.*					X
Mollusca	Bivaliva	Thyasiridae	Thyasiridae indet.*					X
Mollusca	Bivaliva	Yoldiidae	*Portlandia arctica*	X	X	X	X	X
Mollusca	Bivaliva	Yoldiidae	*Yoldiella lenticula*	X				
Mollusca	Bivaliva	Yoldiidae	*Yoldiella nana*	X				

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Mollusca	Bivaliva	Yoldiidae	Yoldiidae indet.					X
Mollusca	Chaetodermatida	Chaetodermatidae	*Chaetoderma* sp.			X	X	X
Mollusca	Gastropoda	Buccinidae	Buccinidae indet.*					X
Mollusca	Gastropoda	Buccinidae	*Colus* sp.					X
Mollusca	Gastropoda	Buccinidae	*Volutopsius norwegicus*					X
Mollusca	Gastropoda	Cancellariidae	*Admete viridula*				X	
Mollusca	Gastropoda	Capulidae	*Ariadnaria borealis**			X	X	X
Mollusca	Gastropoda	Cephalaspidea	Cephalaspidea indet.*					X
Mollusca	Gastropoda	Colloniidae	*Moelleria costulata* *					X
Mollusca	Gastropoda	Cylichnidae	*Acteocina canaliculata*	X				
Mollusca	Gastropoda	Cylichnidae	Acteocina sp.					X
Mollusca	Gastropoda	Cylichnidae	*Cylichna alba*	X		X	X	
Mollusca	Gastropoda	Cylichnidae	*Cylichna gouldi*			X	X	
Mollusca	Gastropoda	Cylichnidae	*Cylichna* sp.					X
Mollusca	Gastropoda	Cylichnidae	Cylichnidae indet.					X
Mollusca	Gastropoda	Cylichnidae	*Cylichnoides occultus*	X				X
Mollusca	Gastropoda	Gastrscae	Gastropod sp. A				X	
Mollusca	Gastropoda	Lepetidae	*Lepeta caeca*	X	X	X	X	X
Mollusca	Gastropoda	Lottiidae	Lottiidae indet.*					X
Mollusca	Gastropoda	Lottiidae	*Testudinalia testudinalis*	X	X	X		
Mollusca	Gastropoda	Mangeliidae	*Oenopota* sp.				X	
Mollusca	Gastropoda	Mangeliidae	*Oenopota violacea*		X	X	X	
Mollusca	Gastropoda	Mangeliidae	*Propebela* sp.					X
Mollusca	Gastropoda	Mangeliidae	*Propepela nobilis*				X	
Mollusca	Gastropoda	Naticidae	*Bulbus* sp.		X			
Mollusca	Gastropoda	Naticidae	*Cryptonatica affinis*			X	X	X

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
Mollusca	Gastropoda	Naticidae	*Euspira pallida*	X				X
Mollusca	Gastropoda	Naticidae	*Naticidae (juvenile)*			X		
Mollusca	Gastropoda		Patellogastropoda indet.		X	X		X
Mollusca	Gastropoda	Retusidae	*Retusa obtusa*		X			
Mollusca	Gastropoda	Retusidae	Retusidae indet.		X			
Mollusca	Gastropoda	Rissoidae	*Boreocingula castanea*		X		X	
Mollusca	Gastropoda	Rissoidae	Rissoidae indet.*					X
Mollusca	Gastropoda	Skeneopsidae	*Skeneopsis planorbis*		X			
Mollusca	Gastropoda	Trochidae	Trochidae indet.	X				X
Mollusca	Gastropoda	Turridae	Turridae indet.	X				X
Mollusca	Gastropoda	Velutinidae	Velutinidae indet.					X
Mollusca	Gastropoda		Gastropoda indet.*			X		X
Mollusca	Polyplacophora	Tonicellidae	*Tonicella marmorea*	X		X	X	X
Mollusca	Polyplacophora		Polyplacophora indet.*					X
Nemertea	Anopla		Anopla indet.					X
Nemertea	Anopla	Lineidae	*Cerebratulus* sp.		X	X		X
Nemertea	Enopla		*Enopla*					X
Nemertea	Enopla	Tetrastemmatidae	*Tetrastemma* sp.*					X
Nemertea	Palaeonemertea	Cephalothricidae	*Cephalothrix* sp.					X
Nemertea			Nemertean indet.		X	X	X	X
Nemertea			Nemertean sp.				X	
Platyhelminthes			Platyhelminthes indet.					X
Porifera	Calcarea		Calcarea indet.*					X
Sipuncula	Sipunculidea	Golfingiidae	*Golfingia* sp.					X
Sipuncula	Sipunculidea	Golfingiidae	*Nephasoma* sp.					X
Sipuncula			Sipunculid indet.			X	X	

Phylum	Class/Order	Family	Taxa	2010	2013	2015	2016	2017
TOTAL # Taxa (COUNT)				136	147	156	188	237
# Unique Taxa				136	84	53	50	113

Notes: taxa identified to the lowest practical taxonomic level; presence/absence for previous years taken from SEM 2017a. *=taxa identified only at Ragged Island; indet.= indeterminate (taxa which could not be identified beyond the taxonomic level listed); sp.=species. High taxonomic levels presented only for taxa not previously identified to a lower taxonomic level (e.g. Crustacea indet. omitted due to large numbers of crustacean taxa identified to species level, Porifera indet. presented due to lack of sponges identified to a lower level).

https://golderassociates.sharepoint.com/sites/11206g/technical/10000 marine environment/report/appendices/appendix g benthic invertebrates/g-1_taxa master list.docx

Marine Benthic Enumeration and Identification Methods
Client: Golder
Project: Baffinlands Iron Mine 2017

Sample Inventory

Sample arrival: October 16, 2017
Number of samples: 51
Number of jars: 142
Screen size: 500µm
Biologica project number: 17-039

The sample inventory was checked and approved with the client. Samples were screened and transferred from formalin into 70% ethanol. These were stained with Rose Bengal to aid in sorting. Each sample was provided a unique identification number and placed in the queue for analysis.

Table 1. Summary of benthic samples processed Baffinlands Iron Mine, 2017.

Client Sample	Replicate	Date Sampled	Biologica Sample	Split	Organisms Counted
BM-1	1	18/08/2017	17-039-001	1/8	441
				Whole	105
BM-1	2	18/08/2017	17-039-002	1/4	398
				Whole	85
BM-1	3	18/08/2017	17-039-003	11/48	403
				Whole	93
BM-2*	1*	18/08/2017	17-039-004*	1/4	366
				Whole	52
BM-2	2	18/08/2017	17-039-005	Whole	638
BM-2	3	18/08/2017	17-039-006	1/4	199
				Whole	66
BM-3	1	19/08/2017	17-039-007	1/4	279
				Whole	81
BM-3	2	19/08/2017	17-039-008	11/24	440
				Whole	62
BM-3	3	19/08/2017	17-039-009	9/24	406
				Whole	65
BM-4	1	19/08/2017	17-039-010	1/4	189
				Whole	52
BM-4	2	21/08/2017	17-039-011	11/48	398
				Whole	149
BM-4	3	21/08/2017	17-039-012	7/24	410
				Whole	144
BM-5	1	21/08/2017	17-039-013	1/4	482

				Whole	92
BM-5	2	21/08/2017	17-039-014	1/6	358
				Whole	114
BM-5	3	21/08/2017	17-039-015	7/24	488
				Whole	54
BM-6	1	21/08/2017	17-039-016	1/4	546
				Whole	122
BM-6	2	21/08/2017	17-039-017	3/24	285
				Whole	198
BM-6	3	21/08/2017	17-039-018	1/4	614
				Whole	93
BM-7	1	21/08/2017	17-039-019	1/4	253
				Whole	24
BM-7	2	21/08/2017	17-039-020	1/4	489
				Whole	186
BM-7	3	21/08/2017	17-039-021	4/24	476
				Whole	137
BM-8	1	22/08/2017	17-039-022	1/4	377
				Whole	46
BM-8	2	22/08/2017	17-039-023	1/4	398
				Whole	58
BM-8	3	22/08/2017	17-039-024	7/24	411
				Whole	73
BM-9	1	22/08/2017	17-039-025	1/4	512
				Whole	131
BM-9	2	22/08/2017	17-039-026	6/24	371
				Whole	165
BM-9	3	22/08/2017	17-039-027	5/12	484
				Whole	45
BM-10	1	16/08/2017	17-039-028	1/4	347
				Whole	224
BM-10	2	16/08/2017	17-039-029	1/6	107
				Whole	86
BM-10	3	16/08/2017	17-039-030	1/4	95
				Whole	47
BM-11	1	16/08/2017	17-039-031	1/4	245
				Whole	90
BM-11	2	16/08/2017	17-039-032	1/4	122
				Whole	97
BM-11	3	18/08/2017	17-039-033	1/2	364
				Whole	81
BM-12	1	18/08/2017	17-039-034	1/2	386
				Whole	32
BM-12	2	18/08/2017	17-039-035	11/24	202
				Whole	28
BM-12	3	18/08/2017	17-039-036	1/4	143

				Whole	59
BM-13	1	16/08/2017	17-039-037	1/4	362
				Whole	97
BM-13	2	16/08/2017	17-039-038	1/3	367
				Whole	72
BM-13	3	16/08/2017	17-039-039	1/6	442
				Whole	59
BM-14	1	16/08/2017	17-039-040	1/4	150
				Whole	64
BM-14	2	16/08/2017	17-039-041	13/24	332
				Whole	69
BM-14	3	16/08/2017	17-039-042	9/24	1
		16/08/2017	17-039-042	9/24	361
				Whole	43
BM-15	1	16/08/2017	17-039-043	1/2	483
				Whole	46
BM-15	2	16/08/2017	17-039-044	10/24	388
				Whole	49
BM-15	3	16/08/2017	17-039-045	25/48	385
				Whole	65
BR-1		11/09/2017	17-039-046	3/12	273
				Whole	67
BR-2		11/09/2017	17-039-047	1/4	412
				Whole	37
BR-3		11/09/2017	17-039-048	8/24	195
				Whole	28
BR-4		11/09/2017	17-039-049	1/4	199
				Whole	25
AN-05**	Miln Inlet**	NA	17-039-050	Whole	116
FT-16**	NA **	01/09/2017	17-039-051	Whole	1

*Field logs indicate the complete sample included 3 jars. Sample is incomplete as only 2 of the 3 jars were received for analysis.
** Macro organism samples.

Sample Processing

Sorting and Subsampling:
All samples were sorted using dissecting microscopes at 10-40x magnification by trained personnel. Microscopic sorting is the only way to ensure >90% of organisms are removed from the debris, which is required by EEM (Environment Canada; Environmental Effects Monitoring) guidelines for marine benthic analyses. This level of effort may be greater than previous studies (e.g., SEM Ltd., 2016), and the large observed increase in abundance is expected.

Due to the large volumes and high abundances in the samples, Biologica personnel developed a subsampling strategy that would maximize the detection of large and rare individuals while accurately enumerated smaller organisms. The sample was first sorted whole, with all large organisms (>1cm) removed from the sample. The abundances of these large organisms should be comparable to 2016 estimates. In addition, Biologica subsampled the remaining debris to ensure all smaller individuals were examined and identified. This smaller fraction was subsampled to a minimum count of 400 individuals as the budget allowed.

Subsampling was done with a Caton tray (Caton, 1991). After the whole sort for large/rare taxa, the remaining sample was spread evenly over a Caton grid, and sequential random quadrats were selected and sorted until the minimum target count was reached, or the budget was exhausted. Some samples (14 of 51) were not subsampled to a target 400 count due to overall low abundances and high debris volumes.

In addition, all large debris in the sample was checked microscopically, including rocks and other large debris. To minimize potential sorter bias, samples were distributed among technicians such that no person sorted all the replicates of a given sample.

Sorting QA/QC:

25% of all sorted debris was re-sorted during processing for training purposes (12.25% of sorted debris re-sorted). This effort exceed the minimum suggested re-sorting of 10% of debris. All sample debris was re-sorted if samples were below 95%. Sorting efficiency was therefore >95%.

Identification and Invasive species detection:

All organisms are identified using a combination of dissecting (10-40x) and compound microscopes (100-1000X) and standard taxonomic keys (see methodological and taxonomic references) to the lowest practicable level (species whenever possible). All specimens were archived in air-tight glass vials with glycerin and 70% ethanol for long-term storage. Taxonomic data were recorded in Biologica's custom database.

During the identification process, taxonomists recorded if the identified taxa were beyond their recorded range and/or potentially introduced (originating from another location) or invasive (both introduced and appearing to proliferate with possible detrimental effects to the ecosystem and/or industry). Within the constraints of available literature and historical data, no taxa observed were considered to be introduced or invasive.

Two samples (AN-05 and FT-16) included macrofauna only and were processed whole. All macrofauna were identified and enumerated to the lowest practicable level (species whenever possible).

Data Analysis

All data were recorded in Biologica's custom database. Results were provided to the Golder project manager in Excel spreadsheets via email.

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APPENDIX G-3
BIOLOGICA DATA SET

Abundance data in matrix format, including total taxa (species richness) count per sample, and total abundance per sample for Golder Baffinlands Iron Mine 2017.

				Sample Name		BM-1	BM-1	BM-1	BM-2	BM-2	BM-2	BM-3	BM-3	BM-3	BM-4	BM-4	BM-4	BM-5	BM-5	BM-5	BM-6	BM-6	BM-6
				Replicate		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
				Date Sampled		8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/19/2017	8/19/2017	8/19/2017	8/19/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ANNE	ANHI	Piscicolidae	Mysidobdella sp.	1	4																		
ANNE	ANOL	Enchytraeidae	Enchytraeidae indet.	1	42	8		9								4							
ANNE	POER	Dorvilleidae	Parougia caeca	1	3																		
ANNE	POER	Glyceridae	Glycera capitata	1	5							4											
ANNE	POER	Glyceridae	Glycera sp.		2																		
ANNE	POER	Hesionidae	Hesionidae indet.		6																		
ANNE	POER	Hesionidae	Nereimyra punctata	1	1,610	224	76	96	8	2		12		35		35	42	24	36	5		8	8
ANNE	POER	Lumbrineridae	Scoletoma fragilis	1	290				5	5	2	20	5	16	4	1		5	6	8	12	13	9
ANNE	POER	Lumbrineridae	Scoletoma impatiens	1	520				20	1	8	8	9	8			3	40	61	34	4		4
ANNE	POER	Nephtyidae	Bipalponephtys cornuta	1	1,241				33	8	44	40	24	21	28	4	3	68	66	24	72	81	80
ANNE	POER	Nephtyidae	Nephtys ciliata	1	2																		
ANNE	POER	Nereididae	Nereididae indet.		9									3									
ANNE	POER	Nereididae	Nereis sp.		21	8						1		8									
ANNE	POER	Nereididae	Nereis zonata	1	81	8	1								5		4	8	12	3			
ANNE	POER	Pholoidae	Pholoe minuta	1	2,395	170	33	100		11	23	8	7	4	44	241	42	32	109	58	24	13	12
ANNE	POER	Pholoidae	Pholoe sp.		3,169	128	40	65		4	4					17	41	20			12		
ANNE	POER	Pholoidae	Pholoe tecta	1	14,047	2,048	1,120	1,125	84	20	88	48	28	37	148	1,001	662	228	294	195	84	185	104
ANNE	POER	Phyllodocidae	Eteone barbata	1	11					1													
ANNE	POER	Phyllodocidae	Eteone flava	1	1																		
ANNE	POER	Phyllodocidae	Eteone longa complex	1	70		4	4	8			1	4									8	8
ANNE	POER	Phyllodocidae	Eteone sp.		76								2	5			1	4	6	3	8	2	
ANNE	POER	Phyllodocidae	Hypereteone sp.	1	80								2										
ANNE	POER	Phyllodocidae	Phyllodoce groenlandica	1	6														1				5
ANNE	POER	Phyllodocidae	Phyllodoce mucosa	1	1													1					
ANNE	POER	Phyllodocidae	Phyllodoce sp.		16					1													
ANNE	POER	Polynoidae	Bylgides sarsi	1	1							1											
ANNE	POER	Polynoidae	Gattyana cirrhosa	1	81				5		1				4		7	4		1		1	
ANNE	POER	Polynoidae	Harmothoe extenuata	1	11											2							
ANNE	POER	Polynoidae	Harmothoe imbricata	1	87	16	12	1						1		6	1						
ANNE	POER	Polynoidae	Harmothoe sp.		37																		
ANNE	POER	Polynoidae	Hartmania moorei	1	24																8		4
ANNE	POER	Polynoidae	Polynoidae indet.		4																		
ANNE	POER	Polynoidae	Polynoinae indet.		89	8		4	12							9				3			
ANNE	POER	Sphaerodoridae	Sphaerodoropsis minuta	1	18					2			5	3							4		
ANNE	POER	Syllidae	Exogone hebes	1	50																		
ANNE	POER	Syllidae	Syllidae indet.		4																		
ANNE	POER	Syllidae	Syllides sp.	1	4																		
ANNE	POER		Errantia indet.		4		4																
ANNE	PORI		Calcarea indet.	1	10																4		
ANNE	POSE	Ampharetidae	Ampharete sp.		259		8		18	2	9	29	4	9	12	4	10	8	18		18	8	12
ANNE	POSE	Ampharetidae	Ampharete vega	1	18																		
ANNE	POSE	Ampharetidae	Ampharetidae indet.		95					1			7	5							8	16	
ANNE	POSE	Ampharetidae	Amphicteis sundevalli	1	2																	1	1
ANNE	POSE	Ampharetidae	Lysippe labiata	1	31														6	7	4	8	
ANNE	POSE	Ampharetidae	Melinna elisabethae	1	44							4										2	
ANNE	POSE	Apistobranchidae	Apistobranchus sp.	1	17				12	1			2										
ANNE	POSE	Capitellidae	Capitella capitata complex	1	602	8	16	9			8		2					4		7			4
ANNE	POSE	Capitellidae	Capitellidae indet.		10								2										
ANNE	POSE	Capitellidae	Mediomastus ambiseta	1	5																		
ANNE	POSE	Capitellidae	Mediomastus sp.		1,090	272	116	105	8				13	5	8	79	82	4	6	10	8		12
ANNE	POSE	Capitellidae	Notomastus latericeus	1	2																		
ANNE	POSE	Cirratulidae	Aphelochaeta sp.	1	53				12											17			8
ANNE	POSE	Cirratulidae	Chaetozone bathyala	1	3,519			4	116	23	52	64	112	140	40			140	157	72	364	155	212
ANNE	POSE	Cirratulidae	Chaetozone careyi	1	1,249																		
ANNE	POSE	Cirratulidae	Chaetozone pigmentata	1	298				1			31	4		12	4		24	25	14	12		8
ANNE	POSE	Cirratulidae	Chaetozone setosa complex	1	341				25		8	36	39	8	4					17	16	92	12
ANNE	POSE	Cirratulidae	Chaetozone sp.		1,198	120	4	4	20	2		36	33	77	8	4		32	12	7		40	48
ANNE	POSE	Cirratulidae	Cirratulidae indet.		493	24				5			2		4	4	24	12		3			16
ANNE	POSE	Cirratulidae	Tharyx sp.	1	72	32	4	4							8						12		
ANNE	POSE	Cossuridae	Cossura sp.	1	507		4		12	1	4	8	26	5	8	13	3	12	18	31	36	48	84
ANNE	POSE	Fabriciidae	Fabriciidae indet.	1	9																	9	
ANNE	POSE	Maldanidae	Clymenura sp.	1	17							4								3			
ANNE	POSE	Maldanidae	Euclymene sp.	1	4																		
ANNE	POSE	Maldanidae	Euclymeninae indet.		87				12	1				3				4	6	27	13	8	
ANNE	POSE	Maldanidae	Maldane sarsi	1	501					4	4		2		24		1	37	30	41		26	32
ANNE	POSE	Maldanidae	Maldanidae indet.		9																		
ANNE	POSE	Maldanidae	Microclymene sp.	1	49					1								4	1	10		8	4
ANNE	POSE	Maldanidae	Nicomache lumbricalis	1	15																	8	
ANNE	POSE	Maldanidae	Praxillella praetermissa	1	40					3								4		7			
ANNE	POSE	Maldanidae	Rhodine loveni	1	4																		
ANNE	POSE	Opheliidae	Ophelia limacina	1	4																		
ANNE	POSE	Opheliidae	Ophelina acuminata	1	7				1														
ANNE	POSE	Opheliidae	Ophelina sp.		14																		
ANNE	POSE	Orbiniidae	Leitoscoloplos sp.	1	8													8					
ANNE	POSE	Orbiniidae	Orbiniidae indet.		9																		
ANNE	POSE	Orbiniidae	Scoloplos acutus	1	252				4	1	12		17				2	8			28	24	8
ANNE	POSE	Orbiniidae	Scoloplos armiger	1	46									3	12	4					4		
ANNE	POSE	Orbiniidae	Scoloplos sp.		25														6				
ANNE	POSE	Oweniidae	Galathowenia oculata	1	287				16	7	4	12	11	11							32	63	36
ANNE	POSE	Oweniidae	Myriochele danielsseni	1	4								4										
ANNE	POSE	Oweniidae	Myriochele heeri	1	25																	10	15

				Sample Name		BM-1	BM-1	BM-1	BM-2	BM-2	BM-2	BM-3	BM-3	BM-3	BM-4	BM-4	BM-4	BM-5	BM-5	BM-5	BM-6	BM-6	BM-6
				Replicate		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
				Date Sampled		8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/19/2017	8/19/2017	8/19/2017	8/19/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ANNE	POSE	Oweniidae	Myriochele sp.		2																		
ANNE	POSE	Oweniidae	Owenia fusiformis	1	765				12	12		11	23	6				32		27	85	114	157
ANNE	POSE	Paraonidae	Aricidea catherinae	1	64		8		4					5			3				4		
ANNE	POSE	Paraonidae	Aricidea hartmanae	1	113																4	8	
ANNE	POSE	Paraonidae	Aricidea minuta	1	51				4			4	4								8		16
ANNE	POSE	Paraonidae	Aricidea nolani	1	131								7		4	13				7	4	16	20
ANNE	POSE	Paraonidae	Aricidea sp.		19											4							
ANNE	POSE	Paraonidae	Paraonidae indet.		8																		
ANNE	POSE	Pectinariidae	Cistenides granulata	1	1,390	153	34	50	20	7	4	1	3	1	49	51	79	40	23	22	1	8	5
ANNE	POSE	Sabellidae	Branchiomma sp.	1	1																		
ANNE	POSE	Sabellidae	Chone duneri	1	4						4												
ANNE	POSE	Sabellidae	Dialychone sp.		31																		
ANNE	POSE	Sabellidae	Dialychone sp. 1	1	379				21	3	12	12	38	11	8			20	6	3	68	8	60
ANNE	POSE	Sabellidae	Dialychone sp. 2	1	29																		
ANNE	POSE	Sabellidae	Euchone incolor	1	1,902				184	66	60	40	85	117	24			120	179	158	168	107	136
ANNE	POSE	Sabellidae	Euchone rubrocincta	1	45		1		12			4	9	3						3	1	8	
ANNE	POSE	Sabellidae	Hypsicomus sp.	1	2																		
ANNE	POSE	Sabellidae	Sabellidae indet.		55							4		3					6	3			
ANNE	POSE	Sabellidae	Sabellidae sp. 2	1	2							2											
ANNE	POSE	Sabellidae	Sabellidae sp. 3	1	17							4									4		4
ANNE	POSE	Sabellidae	Sabellidae sp. 4	1	4							4											
ANNE	POSE	Scalibregmatidae	Polyphysia crassa	1	1																		
ANNE	POSE	Scalibregmatidae	Scalibregma inflatum	1	365		12	1	20	2		5	7	9	8		3	8	24	7	4	24	8
ANNE	POSE	Scalibregmatidae	Scalibregmatidae indet.		1					1													
ANNE	POSE	Serpulidae	Bushiella (Jugaria) quadrangularis	1	2							2											
ANNE	POSE	Serpulidae	Pileolaria sp.	1	4																		
ANNE	POSE	Serpulidae	Spirorbinae indet.		8																		
ANNE	POSE	Spionidae	Dipolydora caulleryi	1	6																		
ANNE	POSE	Spionidae	Dipolydora quadrilobata	1	4			4															
ANNE	POSE	Spionidae	Dipolydora sp.		28		4										3						
ANNE	POSE	Spionidae	Marenzelleria sp.	1	2																		
ANNE	POSE	Spionidae	Polydora sp. complex	1	8	8																	
ANNE	POSE	Spionidae	Prionospio cirrifera	1	2																		
ANNE	POSE	Spionidae	Prionospio sp.		70									3						7			16
ANNE	POSE	Spionidae	Prionospio steenstrupi	1	1,931				85	12	24	139	156	121				12		7	280	212	280
ANNE	POSE	Spionidae	Pygospio sp.	1	117				8		4			3				12		21	8		8
ANNE	POSE	Spionidae	Spio filicornis	1	73	8											7						
ANNE	POSE	Spionidae	Spionidae indet.		48					2									6				
ANNE	POSE	Terebellidae	Lanassa venusta venusta	1	3																		
ANNE	POSE	Terebellidae	Laphania boecki	1	80						4				8		10	12	6				
ANNE	POSE	Terebellidae	Leaena abranchiata	1	9		5									4							
ANNE	POSE	Terebellidae	Neoamphitrite affinis	1	15			4		1	1									1			
ANNE	POSE	Terebellidae	Pista maculata	1	134		8	5	1			3			1	1	5	11	5	6			
ANNE	POSE	Terebellidae	Polycirrus sp. complex	1	25		12													3			
ANNE	POSE	Terebellidae	Terebellidae indet.		15						4												
ANNE	POSE	Trichobranchidae	Terebellides reishi	1	8										8								
ANNE	POSE	Trichobranchidae	Terebellides sp.		209				4		4	4	5	8		1		4	36	27	8	9	12
ANNE	POSE	Trichobranchidae	Terebellides stroemi	1	37		5		1		1		2	4	1	1		8	1	1			
ANNE	POSE	Trichobranchidae	Trichobranchus glacialis	1	7																		
ANNE	POSE	Trochochaetidae	Trochochaeta watsoni	1	4																		4
ARTH	CHAR	Halacaridae	Halacaridae indet.	1	101	16	24									22							
ARTH	CHPY	Ammotheidae	Achelia sp.	1	8																	8	
ARTH	CHPY	Nymphonidae	Nymphon sp.	1	10				4	1			1										
ARTH	CHPY		Pycnogonida indet.	1	8																		4
ARTH	CRAM	Ampeliscidae	Ampelisca eschrichtii	1	13																		
ARTH	CRAM	Ampeliscidae	Byblis sp.	1	20									4									4
ARTH	CRAM	Ampeliscidae	Haploops tubicola	1	21																		8
ARTH	CRAM	Amphilochidae	Amphilochidae indet.		4																		
ARTH	CRAM	Amphilochidae	Amphilochopsis hamatus	1	4							4											
ARTH	CRAM	Atylidae	Atylus carinatus	1	17	10	4	1															
ARTH	CRAM	Calliopiidae	Calliopiidae indet.	1	4			4															
ARTH	CRAM	Corophiidae	Crassicorophium bonellii	1	12																		
ARTH	CRAM	Corophiidae	Monocorophium insidiosum	1	60																		
ARTH	CRAM	Corophiidae	Monocorophium sp.		4																		
ARTH	CRAM	Dexaminidae	Dexamine sp.	1	8																		8
ARTH	CRAM	Dexaminidae	Guernea nordenskioldi	1	1,557				36	8	60	4	11	16	96	9	86	92	96	86	28	16	12
ARTH	CRAM	Eusiridae	Rhachotropis helleri	1	2																		
ARTH	CRAM	Eusiridae	Rhachotropis sp.		3																		
ARTH	CRAM	Gammaridae	Gammarus oceanicus	1	16																		
ARTH	CRAM	Isaeidae	Protomedeia sp.	1	6																		
ARTH	CRAM	Lysianassidae	Gronella groenlandica	1	36		12																
ARTH	CRAM	Lysianassidae	Lysianassidae indet.		12	8																	
ARTH	CRAM	Lysianassidae	Orchomene sp.	1	8																		
ARTH	CRAM	Lysianassidae	Orchomenella pinguis	1	4																		
ARTH	CRAM	Oedicerotidae	Bathymedon obtusifrons	1	4																		
ARTH	CRAM	Oedicerotidae	Monoculodes latimanus	1	8					2				3									
ARTH	CRAM	Oedicerotidae	Monoculodes sp.		36					6													
ARTH	CRAM	Oedicerotidae	Monoculopsis longicornis	1	40													4		3			
ARTH	CRAM	Oedicerotidae	Oedicerotidae indet.		91				4		4		2	5				4					4
ARTH	CRAM	Oedicerotidae	Paroediceros lynceus	1	311	72		4	4	2	9		3	11					6		12		
ARTH	CRAM	Oedicerotidae	Rostroculodes borealis	1	27					1				3				4					4
ARTH	CRAM	Oedicerotidae	Rostroculodes longirostris	1	49				12	2						17		4					
ARTH	CRAM	Oedicerotidae	Rostroculodes sp.		14							4											
ARTH	CRAM	Oedicerotidae	Westwoodilla sp.	1	90				16				2	3				4	12	3			12

				Sample Name		BM-1	BM-1	BM-1	BM-2	BM-2	BM-2	BM-3	BM-3	BM-3	BM-4	BM-4	BM-4	BM-5	BM-5	BM-5	BM-6	BM-6	BM-6
				Replicate		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
				Date Sampled		8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/19/2017	8/19/2017	8/19/2017	8/19/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ARTH	CRAM	Phoxocephalidae	Harpinia serrata	1	25								13										
ARTH	CRAM	Phoxocephalidae	Harpinia sp.		5									5									
ARTH	CRAM	Podoceridae	Dyopedos sp.	1	3															3			
ARTH	CRAM	Pontoporeiidae	Monoporeia affinis	1	891										8								4
ARTH	CRAM	Pontoporeiidae	Pontoporeia femorata	1	120		4	4	4	1					8	7	9	24	6	21			
ARTH	CRAM	Pontoporeiidae	Pontoporeiidae indet.		4													4					
ARTH	CRAM	Stenothoidae	Hardametopa nasuta	1	16	16																	
ARTH	CRAM	Stenothoidae	Stenothoidae indet.		4			4															
ARTH	CRAM	Uristidae	Anonyx nugax	1	11					1													
ARTH	CRAM	Uristidae	Anonyx ochoticus	1	1																		
ARTH	CRAM	Uristidae	Anonyx sarsi	1	4								2										
ARTH	CRAM	Uristidae	Anonyx sp.		13																8		
ARTH	CRAM	Uristidae	Menigrates obtusifrons	1	28											4						8	
ARTH	CRAM	Uristidae	Onisimus barentsi Group	1	12																		
ARTH	CRAM	Uristidae	Onisimus sp.		5																		
ARTH	CRAM	Uristidae	Uristidae indet.		10												10						
ARTH	CRAM		Amphipoda indet.		13									3									
ARTH	CRAM		Lysianassoidea indet.		28								2										
ARTH	CRCI		Balanomorpha indet.	1	1,753	8				82		76	2			17		4	25	3	60	104	80
ARTH	CRCO		Cyclopoida indet.	1	11			4															
ARTH	CRCO		Harpacticoida indet.	1	79																4		4
ARTH	CRCU	Diastylidae	Brachydiastylis resima	1	300					8				3	16	48	75	48	36	14	4	8	4
ARTH	CRCU	Diastylidae	Diastylidae indet.		8													8					
ARTH	CRCU	Diastylidae	Diastylis alaskensis	1	2					2													
ARTH	CRCU	Diastylidae	Diastylis bradyi	1	18																		
ARTH	CRCU	Diastylidae	Diastylis goodsiri	1	13																4		
ARTH	CRCU	Diastylidae	Diastylis lucifera	1	3												3						
ARTH	CRCU	Diastylidae	Diastylis rathkei	1	110				8	2	4		4	19				4		3		8	4
ARTH	CRCU	Diastylidae	Diastylis scorpioides	1	376				20	4	4		15	6	8			8	30		4		
ARTH	CRCU	Diastylidae	Diastylis sp.		45							4	9								12		4
ARTH	CRCU	Diastylidae	Diastylis spinulosa	1	6																4		
ARTH	CRCU	Diastylidae	Diastyloides biplicatus	1	60					4		24										16	16
ARTH	CRCU	Lampropidae	Hemilamprops cristatus	1	94				36	2	4		2					16	12				
ARTH	CRCU	Lampropidae	Lampropidae indet.		12													4					
ARTH	CRCU	Lampropidae	Lamprops fuscatus	1	747				76	43	40	16	17	21	20	4	21	20	72	38	28		24
ARTH	CRCU	Leuconidae	Eudorella sp.		6						4												
ARTH	CRCU	Leuconidae	Eudorella truncatula	1	241					4			2	5				4	18	14	32	40	24
ARTH	CRCU	Leuconidae	Leucon nasicoides	1	257				20	7	12	8	4	3					12	10	8		
ARTH	CRCU	Leuconidae	Leucon sp.		158				8	5	20	4		3	4			24	30	10	12		
ARTH	CRCU	Leuconidae	Leuconidae indet.		8					1	4									3			
ARTH	CRCU	Nannastacidae	Campylaspis rubicunda	1	2								2										
ARTH	CRCU	Nannastacidae	Campylaspis sp.		4																4		
ARTH	CRCU		Cumacea indet.		30												3	12	6				
ARTH	CRDE	Crangonidae	Sabinea septemcarinata	1	2																		
ARTH	CRDE	Crangonidae	Sclerocrangon boreas	1	2																		
ARTH	CRIS	Desmosomatidae	Desmosomatidae indet.	1	8																		
ARTH	CRIS	Gnathiidae	Gnathia sp.	1	34							8		11				4					
ARTH	CRIS	Gnathiidae	Gnathiidae indet.		10																		
ARTH	CRIS	Paramunnidae	Pleurogonium rubicundum	1	4																		
ARTH	CRIS	Paramunnidae	Pleurogonium sp.		4																4		
ARTH	CRIS	Paramunnidae	Pleurogonium spinosissimum	1	18				4			4									8		
ARTH	CRIS		Asellota indet.		2																		
ARTH	CRMY	Mysidae	Mysis mixta	1	20		4		16														
ARTH	CRMY		Mysidacea indet.		88																		
ARTH	CROS	Philomedidae	Philomedes sp.	1	5,332				92	49	56	152	63	96	56		58	288	330	216	352	272	368
ARTH	CROS		Ostracoda indet.		99											9							
ARTH	CROS		Robertsonites tuberculatus	1	352		4																
ARTH	CRTA	Akanthophoreidae	Akanthophoreus gracilis	1	35					2				3				20					
ARTH	CRTA	Akanthophoreidae	Akanthophoreus sp.		76							4			4				24				
ARTH	CRTA	Pseudotanaidae	Pseudotanais sp.	1	32										4				6	3		8	
ARTH	CRTA	Sphyrapodidae	Pseudosphyrapus anomalus	1	452																4	16	56
ARTH	CRTA	Typhlotanaidae	Typhlotanais sp.	1	97					2				5						3	16	8	28
ARTH	CRTA		Tanaidacea indet.		4																		
ARTH	INDI	Chironomidae	Chironomidae indet.		2																		
ARTH	INDI	Chironomidae	Orthocladiinae indet.	1	6																		
ARTH	INDI		Diptera indet.		2																		
ECHI	ECEC	Strongylocentrotidae	Strongylocentrotus droebachiensis	1	14														1				
ECHI	ECEC	Strongylocentrotidae	Strongylocentrotus sp.		44														1	3			
ECHI	ECHO	Myriotrochidae	Myriotrochus rinkii	1	3							1	2										
ECHI	ECHO	Psolidae	Psolus phantapus	1	1																		
ECHI	ECHO		Molpadida indet.	1	16																		
ECHI	ECOP	Ophiuridae	Ophiura robusta	1	30							6						5	12	1			
ECHI	ECOP	Ophiuridae	Ophiura sarsii	1	7										4								
ECHI	ECOP	Ophiuridae	Ophiura sp.		75							12									4	8	
MISC	BRYO	Crisiidae	Crisia sp.	1	4																		4
MISC	BRYO	Epistomiidae	Synnotum sp.	1	12																		
MISC	BRYO	Hippothoidae	Celleporella hyalina	1	1																		
MISC	BRYO	Vesiculariidae	Bowerbankia sp.	1	5					1													
MISC	BRYO		Bryozoa indet.		7														1				
MISC	BRYO		Ctenostomata indet.	1	12													4					
MISC	CNAN	Actiniidae	Urticina sp.	1	1																		
MISC	CNAN	Hormathiidae	Hormathia digitata	1	3																		
MISC	CNAN	Parazoanthidae	Parazoanthus sp.	1	14															14			
MISC	CNHY	Bougainvilliidae	Bougainvilliidae indet.	1	3																		
MISC	CNHY	Olindiidae	Monobrachium parasitum	1	55				11	2	1	3	6	1	1			2	9	1	1	2	

APPENDIX G-3
BIOLOGICA DATA SET

				Sample Name		BM-1	BM-1	BM-1	BM-2	BM-2	BM-2	BM-3	BM-3	BM-3	BM-4	BM-4	BM-4	BM-5	BM-5	BM-5	BM-6	BM-6	BM-6
				Replicate		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
				Date Sampled		8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/19/2017	8/19/2017	8/19/2017	8/19/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
MISC	CNHY		Hydrozoa indet.		4						4												
MISC	NTEA	Cephalothricidae	Cephalothrix sp.	1	36				8	2							3	8					4
MISC	NTEA	Lineidae	Cerebratulus sp.	1	135				4	2		9		1		1		8		3	4	10	12
MISC	NTEA	Tetrastemmatidae	Tetrastemma sp.	1	4																		
MISC	NTEA		Anopla indet.		4								2										
MISC	NTEA		Enopla indet.		13													4					
MISC	NTEA		Nemertea indet.		64				4					3		4		12	6				4
MISC	PIXX	Ammodytidae	Ammodytes hexapterus	1	1																		
MISC	PIXX		Pisces indet.		2					1													
MISC	PLTY		Platyhelminthes indet.	1	4																		
MISC	PRIA	Priapulidae	Priapulus caudatus	1	22	1				1											4		
MISC	PRIA	Priapulidae	Priapulus sp.		6																		
MISC	SIPN	Golfingiidae	Golfingia sp.	1	5							5											
MISC	SIPN	Golfingiidae	Nephasoma sp.	1	3																		
MISC	URAS	Ascidiidae	Ascidia sp.	1	1	1																	
MISC	URAS	Pyuridae	Boltenia echinata	1	1																		
MISC	URAS	Styelidae	Polycarpa fibrosa	1	1															1			
MISC	URAS	Styelidae	Polycarpa pomaria	1	1																		
MISC	URAS		Ascidiacea indet.		1																		
MOLL	MOAP	Chaetodermatidae	Chaetoderma sp.	1	9									1								1	
MOLL	MOAP		Aplacophora indet.		4						4												
MOLL	MOBI	Astartidae	Astarte borealis	1	689		3	4	8	16	15	16	7	18	2	23	14	42	53	28	13	24	11
MOLL	MOBI	Astartidae	Astarte montagui	1	1,746				70	42	65	54	14	28	16	22	19	67	65	70	52	81	85
MOLL	MOBI	Astartidae	Astarte sp.		741	16			20	8	12	20	5	21	13	13	14	28	18	34	8	64	24
MOLL	MOBI	Cardiidae	Cardiidae indet.		48				8	1			4	3						10	4		
MOLL	MOBI	Cardiidae	Ciliatocardium ciliatum	1	25					3	2			1					1		1	3	5
MOLL	MOBI	Cardiidae	Serripes groenlandicus	1	108		1		8	11	1				1		4						1
MOLL	MOBI	Hiatellidae	Hiatella arctica	1	786	72	46	52	11	15	5	12	1	4	9	49	66	35	20	31	1	14	5
MOLL	MOBI	Lyonsiidae	Lyonsia arenosa	1	2					2													
MOLL	MOBI	Myidae	Mya sp.		214	24					5					1					13		32
MOLL	MOBI	Myidae	Mya truncata	1	316	3	15	5	11	3	2	4	4	4	12	20	15	29	23	30		2	1
MOLL	MOBI	Mytilidae	Crenella faba	1	38	24		4								4				3			
MOLL	MOBI	Mytilidae	Musculus discors	1	154	7	9	48							1	23	34						
MOLL	MOBI	Mytilidae	Musculus niger	1	3																		
MOLL	MOBI	Mytilidae	Musculus sp.		85		4	39															
MOLL	MOBI	Mytilidae	Mytilidae indet.		143	40		26								17	7						
MOLL	MOBI	Mytilidae	Mytilus sp.	1	7			4															
MOLL	MOBI	Nuculanidae	Nuculana minuta	1	157				8	3	5	4	3		4	1	3	8		21			4
MOLL	MOBI	Nuculanidae	Nuculana pernula	1	45					5	1	2	2	1									4
MOLL	MOBI	Nuculanidae	Nuculana sp.		277									3							4	24	13
MOLL	MOBI	Nuculidae	Ennucula tenuis	1	646				28	17	15	19	16	22				16	18	17	16	121	25
MOLL	MOBI	Pectinidae	Chlamys islandica	1	3														1				
MOLL	MOBI	Pectinidae	Pectinidae indet.		21																	9	
MOLL	MOBI	Periplomatidae	Periploma aleuticum	1	10														1	1		2	1
MOLL	MOBI	Propeamussiidae	Propeamussiidae indet.		5					1													
MOLL	MOBI	Propeamussiidae	Similipecten greenlandicus	1	202				1		9	24	10	2				1	1		25	41	20
MOLL	MOBI	Tellinidae	Macoma balthica	1	24																		
MOLL	MOBI	Tellinidae	Macoma calcarea	1	324				12	13	5	10	12	4	4			12	16	5	10	36	26
MOLL	MOBI	Tellinidae	Macoma moesta	1	10																		
MOLL	MOBI	Tellinidae	Macoma sp.		399				26	14	28	11	12	12	5	9		21	21	24	4	8	4
MOLL	MOBI	Thraciidae	Thracia myopsis	1	6																		
MOLL	MOBI	Thraciidae	Thracia sp.		110																44	56	
MOLL	MOBI	Thyasiridae	Axinopsida serricata	1	43					6													
MOLL	MOBI	Thyasiridae	Thyasira sp.	1	460				20	7	28	4	9	22	4	9	14	16	18	27			24
MOLL	MOBI	Thyasiridae	Thyasiridae indet.		324			9	20	1		12	13	19			3	36	18	7			24
MOLL	MOBI	Yoldiidae	Portlandia arctica	1	28				8		8		1				3	4		3			
MOLL	MOBI	Yoldiidae	Yoldiidae indet.		24																4		4
MOLL	MOBI		Bivalvia indet.		416	40		9	20	1	8	12	4	3		17		20		10	12	64	36
MOLL	MOBI		Nuculanoidea indet.		77								7		4				12	10			
MOLL	MOBI		Pectinoidea indet.		4																		
MOLL	MOGA	Buccinidae	Buccinidae indet.		30																	8	
MOLL	MOGA	Buccinidae	Colus sp.	1	12						1												
MOLL	MOGA	Buccinidae	Volutopsius norwegicus	1	1																		
MOLL	MOGA	Capulidae	Ariadnaria borealis	1	8																		
MOLL	MOGA	Colloniidae	Moelleria costulata	1	12																		
MOLL	MOGA	Cylichnidae	Acteocina sp.	1	117				12	1	4		4	8	12	9	7	12	18	10			
MOLL	MOGA	Cylichnidae	Cylichna sp.		44				4	2				3				4	6		4		
MOLL	MOGA	Cylichnidae	Cylichnidae indet.		21						4			3			3						
MOLL	MOGA	Cylichnidae	Cylichnoides occultus	1	16	8						4	4										
MOLL	MOGA	Lepetidae	Lepeta caeca	1	48													4	6			1	4
MOLL	MOGA	Lottiidae	Lottiidae indet.	1	10																		
MOLL	MOGA	Mangeliidae	Propebela sp.	1	6																		
MOLL	MOGA	Margaritidae	Margarites groenlandicus	1	6																		
MOLL	MOGA	Margaritidae	Margarites helicinus	1	74		8	22											6				
MOLL	MOGA	Margaritidae	Margarites sp.		8																		
MOLL	MOGA	Naticidae	Cryptonatica affinis	1	1																		
MOLL	MOGA	Naticidae	Euspira pallida	1	21				1	1			2					4		1		2	
MOLL	MOGA	Rissoidae	Rissoidae indet.	1	110				8	1	4		2				10			3			8
MOLL	MOGA	Trochidae	Trochidae indet.	1	8	8																	
MOLL	MOGA	Turridae	Turridae indet.	1	3												3						
MOLL	MOGA	Velutinidae	Velutinidae indet.	1	1																		
MOLL	MOGA		Cephalaspidea indet.		20						4						4						
MOLL	MOGA		Gastropoda indet.		159	8		9	8	1	4			5		9	14		12	3		16	4
MOLL	MOGA		Patellogastropoda indet.		2																		
MOLL	[illegible]	Tonicellidae	Tonicella marmorea	1	6																		

taxcode	grpcode	Family	TaxonName	Sample Name / Replicate / Date Sampled / Unique Taxa		BM-1 1 8/18/2017	BM-1 2 8/18/2017	BM-1 3 8/18/2017	BM-2 1 8/18/2017	BM-2 2 8/18/2017	BM-2 3 8/18/2017	BM-3 1 8/19/2017	BM-3 2 8/19/2017	BM-3 3 8/19/2017	BM-4 1 8/19/2017	BM-4 2 8/21/2017	BM-4 3 8/21/2017	BM-5 1 8/21/2017	BM-5 2 8/21/2017	BM-5 3 8/21/2017	BM-6 1 8/21/2017	BM-6 2 8/21/2017	BM-6 3 8/21/2017
					# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
MOLL	MOPO		Polyplacophora indet.		11																		
			Total Abundance		**68,622**	**3,625**	**1,669**	**1,852**	**1,507**	**638**	**858**	**1,162**	**1,015**	**1,117**	**800**	**1,881**	**1,550**	**2,020**	**2,253**	**1,727**	**2,270**	**2,460**	**2,533**
			Total Unique Taxa (Species Richness)		**235**	**28**	**33**	**29**	**64**	**70**	**51**	**60**	**64**	**59**	**45**	**37**	**42**	**68**	**62**	**69**	**68**	**63**	**72**
			No. composite grabs			**4**	**4**	**5**	**4**	**3**	**4**	**4**	**6**	**6**	**3**	**3**	**4**	**6**	**6**	**4**	**5**	**6**	**6**
			Total Density (Organisms/m^2)			**40278**	**18544**	**16458**	**16744**	**9452**	**9533**	**12911**	**7522**	**8274**	**11852**	**27872**	**17219**	**14963**	**16689**	**19190**	**20178**	**18222**	**18763**
			Incidental Organisms:																				
MEMO	MEMO		Balanomorpha indet. (planktonic)		137									28									
MEMO	MEMO		Calanoida indet. (planktonic)		14																		
MEMO	MEMO		Calanus sp. (planktonic)		121	8	8					12	4									8	4
MEMO	MEMO		Chaetognatha indet. (planktonic)		2																		
MEMO	MEMO		Copepoda indet. (parasitic)		14																8		
MEMO	MEMO		Egg/egg mass		9								2	3									
MEMO	MEMO		Ephemeroptera indet. (freshwater)		0																		
MEMO	MEMO		Hyperiidae indet. (planktonic)		2																		
MEMO	MEMO		Insecta indet. (terrestrial)		4																		
MEMO	MEMO		Nematoda indet.		182				9		4	19			8				9		24	10	12
MEMO	MEMO		Sabinea septemcarinata (planktonic)		4																4		
MEMO	MEMO		Themisto sp. (planktonic)		14							4											

Abundance data continued

				Sample Name	BM-7	BM-7	BM-7	BM-8	BM-8	BM-8	BM-9	BM-9	BM-9	BM-10	BM-10	BM-10	BM-11	BM-11	BM-11	BM-12	BM-12	BM-12	BM-13
				Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
				Date Sampled	8/21/2017	8/21/2017	8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/16/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ANNE	ANHI	Piscicolidae	Mysidobdella sp.	1		4																	
ANNE	ANOL	Enchytraeidae	Enchytraeidae indet.	1											6		4	4					
ANNE	POER	Dorvilleidae	Parougia caeca	1																			
ANNE	POER	Glyceridae	Glycera capitata	1																			
ANNE	POER	Glyceridae	Glycera sp.																2				
ANNE	POER	Hesionidae	Hesionidae indet.				6																
ANNE	POER	Hesionidae	Nereimyra punctata	1	12	105	91	20	32	27	12	24	5			4	44	52	56	22	42	4	64
ANNE	POER	Lumbrineridae	Scoletoma fragilis	1				9		1	20	16	14					8	4	20	11	9	
ANNE	POER	Lumbrineridae	Scoletoma impatiens	1				24	20	24	16	56					4	8	6				12
ANNE	POER	Nephtyidae	Bipalponephtys cornuta	1				60	52	58	85	68	26	4			16	4	12	14	7	12	4
ANNE	POER	Nephtyidae	Nephtys ciliata	1							1		1										
ANNE	POER	Nereididae	Nereididae indet.									4							2				
ANNE	POER	Nereididae	Nereis sp.																2				
ANNE	POER	Nereididae	Nereis zonata	1				10	1	1					1		2	1		5	3		4
ANNE	POER	Pholoidae	Pholoe minuta	1	20	179	145	37	25	48	4	4	14	233	30	36	12	5	28	2			192
ANNE	POER	Pholoidae	Pholoe sp.			36	42	208	116	171	93	117	31	16	288	68	260	108	66	48	65	8	261
ANNE	POER	Pholoidae	Pholoe tecta	1	24	699	581	53	86	151	61	52	77	560	168	68	52		110	75	55	68	479
ANNE	POER	Phyllodocidae	Eteone barbata	1				4	4											2			
ANNE	POER	Phyllodocidae	Eteone flava	1																			
ANNE	POER	Phyllodocidae	Eteone longa complex	1		4			8	3	5	4					4						
ANNE	POER	Phyllodocidae	Eteone sp.			4		8	4				2					4			2	8	
ANNE	POER	Phyllodocidae	Hypereteone sp.	1		4	54						2						2				
ANNE	POER	Phyllodocidae	Phyllodoce groenlandica	1																			
ANNE	POER	Phyllodocidae	Phyllodoce mucosa	1																			
ANNE	POER	Phyllodocidae	Phyllodoce sp.			8	1								6								
ANNE	POER	Polynoidae	Bylgides sarsi	1																			
ANNE	POER	Polynoidae	Gattyana cirrhosa	1					4	5		13	1	5			4		4				5
ANNE	POER	Polynoidae	Harmothoe extenuata	1																			8
ANNE	POER	Polynoidae	Harmothoe imbricata	1						3		1		5									5
ANNE	POER	Polynoidae	Harmothoe sp.							7													4
ANNE	POER	Polynoidae	Hartmania moorei	1						3	4		2										
ANNE	POER	Polynoidae	Polynoidae indet.																				
ANNE	POER	Polynoidae	Polynoinae indet.				12									16	4		4			4	
ANNE	POER	Sphaerodoridae	Sphaerodoropsis minuta	1								4											
ANNE	POER	Syllidae	Exogone hebes	1										4						2			
ANNE	POER	Syllidae	Syllidae indet.																		2		
ANNE	POER	Syllidae	Syllides sp.	1															2				
ANNE	POER		Errantia indet.																				
ANNE	PORI		Calcarea indet.	1																			
ANNE	POSE	Ampharetidae	Ampharete sp.							1	5	4	2	8			4		2				9
ANNE	POSE	Ampharetidae	Ampharete vega	1		4	14																
ANNE	POSE	Ampharetidae	Ampharetidae indet.						8	3	8		5					4					12
ANNE	POSE	Ampharetidae	Amphicteis sundevalli	1																			
ANNE	POSE	Ampharetidae	Lysippe labiata	1						3			2										
ANNE	POSE	Ampharetidae	Melinna elisabethae	1							8	1	2				4			4		1	
ANNE	POSE	Apistobranchidae	Apistobranchus sp.	1																			
ANNE	POSE	Capitellidae	Capitella capitata complex	1			1			1					6								
ANNE	POSE	Capitellidae	Capitellidae indet.													4						4	
ANNE	POSE	Capitellidae	Mediomastus ambiseta	1		5																	
ANNE	POSE	Capitellidae	Mediomastus sp.			116	44		4				2	40	6	36		4	8		4		8
ANNE	POSE	Capitellidae	Notomastus latericeus	1								1											
ANNE	POSE	Cirratulidae	Aphelochaeta sp.	1										4									
ANNE	POSE	Cirratulidae	Chaetozone bathyala	1				133	132	130	253	120	132	4			32	52	66	106	57	68	36
ANNE	POSE	Cirratulidae	Chaetozone careyi	1	40	317	884							8									
ANNE	POSE	Cirratulidae	Chaetozone pigmentata	1				16	12	39							4		6	18	4		4
ANNE	POSE	Cirratulidae	Chaetozone setosa complex	1																			
ANNE	POSE	Cirratulidae	Chaetozone sp.		20	167	123	24		10	20	37	22	8		4			4			28	
ANNE	POSE	Cirratulidae	Cirratulidae indet.				66	28	20	3			2				4	12	26	8	22	4	40
ANNE	POSE	Cirratulidae	Tharyx sp.	1					12														
ANNE	POSE	Cossuridae	Cossura sp.	1				12	16	7	16	16	17						10	2		16	4
ANNE	POSE	Fabriciidae	Fabriciidae indet.	1																			
ANNE	POSE	Maldanidae	Clymenura sp.	1							4		2							2			
ANNE	POSE	Maldanidae	Euclymene sp.	1						3			1										
ANNE	POSE	Maldanidae	Euclymeninae indet.																			4	
ANNE	POSE	Maldanidae	Maldane sarsi	1				41	37	74	16	30	26							2			
ANNE	POSE	Maldanidae	Maldanidae indet.																				
ANNE	POSE	Maldanidae	Microclymene sp.	1															2				
ANNE	POSE	Maldanidae	Nicomache lumbricalis	1						7													
ANNE	POSE	Maldanidae	Praxillella praetermissa	1							12												
ANNE	POSE	Maldanidae	Rhodine loveni	1																			
ANNE	POSE	Opheliidae	Ophelia limacina	1														4					
ANNE	POSE	Opheliidae	Ophelina acuminata	1														1	2				
ANNE	POSE	Opheliidae	Ophelina sp.																				
ANNE	POSE	Orbiniidae	Leitoscoloplos sp.	1																			
ANNE	POSE	Orbiniidae	Orbiniidae indet.																				
ANNE	POSE	Orbiniidae	Scoloplos acutus	1				16	24	3	20	16							2	10	4		
ANNE	POSE	Orbiniidae	Scoloplos armiger	1		1				1	1		5										
ANNE	POSE	Orbiniidae	Scoloplos sp.										17										
ANNE	POSE	Oweniidae	Galathowenia oculata	1				4	4	3	29		26										
ANNE	POSE	Oweniidae	Myriochele danielsseni	1																			
ANNE	POSE	Oweniidae	Myriochele heeri	1																			

				Sample name	BM-7	BM-7	BM-7	BM-8	BM-8	BM-8	BM-9	BM-9	BM-9	BM-10	BM-10	BM-10	BM-11	BM-11	BM-11	BM-12	BM-12	BM-12	BM-13
				Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
				Date Sampled	8/21/2017	8/21/2017	8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/16/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ANNE	POSE	Oweniidae	Myriochele sp.																				
ANNE	POSE	Oweniidae	Owenia fusiformis	1					5		143	30	43						2			23	
ANNE	POSE	Paraonidae	Aricidea catherinae	1				4	8		4												
ANNE	POSE	Paraonidae	Aricidea hartmanae	1				4		17		8	2					8	2	14	4	16	
ANNE	POSE	Paraonidae	Aricidea minuta	1						3									4				
ANNE	POSE	Paraonidae	Aricidea nolani	1						3	1								2				
ANNE	POSE	Paraonidae	Aricidea sp.					4				4											
ANNE	POSE	Paraonidae	Paraonidae indet.																		2		
ANNE	POSE	Pectinariidae	Cistenides granulata	1	16	136	105	10	9	19		1	2	126	29	20	34	6	14		3		56
ANNE	POSE	Sabellidae	Branchiomma sp.	1																			
ANNE	POSE	Sabellidae	Chone duneri	1																			
ANNE	POSE	Sabellidae	Dialychone sp.									4							4				
ANNE	POSE	Sabellidae	Dialychone sp. 1	1				16		7	20		2										
ANNE	POSE	Sabellidae	Dialychone sp. 2	1	25												4						
ANNE	POSE	Sabellidae	Euchone incolor	1				100	29	10	40	8	68						6	8		8	
ANNE	POSE	Sabellidae	Euchone rubrocincta	1																	1		
ANNE	POSE	Sabellidae	Hypsicomus sp.	1																2			
ANNE	POSE	Sabellidae	Sabellidae indet.					8		1			2						4	4			
ANNE	POSE	Sabellidae	Sabellidae sp. 2	1																			
ANNE	POSE	Sabellidae	Sabellidae sp. 3	1																			
ANNE	POSE	Sabellidae	Sabellidae sp. 4	1																			
ANNE	POSE	Scalibregmatidae	Polyphysia crassa	1							1												
ANNE	POSE	Scalibregmatidae	Scalibregma inflatum	1					32	3	21	8	5	4			24	16	5	6	7	2	12
ANNE	POSE	Scalibregmatidae	Scalibregmatidae indet.																				
ANNE	POSE	Serpulidae	Bushiella (Jugaria) quadrangularis	1																			
ANNE	POSE	Serpulidae	Pileolaria sp.	1									2							2			
ANNE	POSE	Serpulidae	Spirorbinae indet.																				
ANNE	POSE	Spionidae	Dipolydora caulleryi	1																			
ANNE	POSE	Spionidae	Dipolydora quadrilobata	1																			
ANNE	POSE	Spionidae	Dipolydora sp.										2										
ANNE	POSE	Spionidae	Marenzelleria sp.	1	1		1																
ANNE	POSE	Spionidae	Polydora sp. complex	1																			
ANNE	POSE	Spionidae	Prionospio cirrifera	1																	2		
ANNE	POSE	Spionidae	Prionospio sp.					4			4	24									2	4	
ANNE	POSE	Spionidae	Prionospio steenstrupi	1					1	3	149	23	113						6	24	4	36	
ANNE	POSE	Spionidae	Pygospio sp.	1		8		8	4							8						4	
ANNE	POSE	Spionidae	Spio filicornis	1		13	6							8					2				4
ANNE	POSE	Spionidae	Spionidae indet.		4	8	24		4														
ANNE	POSE	Terebellidae	Lanassa venusta venusta	1																			
ANNE	POSE	Terebellidae	Laphania boecki	1				4		3					1								8
ANNE	POSE	Terebellidae	Leaena abranchiata	1																			
ANNE	POSE	Terebellidae	Neoamphitrite affinis	1														1		1			4
ANNE	POSE	Terebellidae	Pista maculata	1		2		16	2	9		5	1	1	1	1	7	3	6	4	5		4
ANNE	POSE	Terebellidae	Polycirrus sp. complex	1													4						
ANNE	POSE	Terebellidae	Terebellidae indet.							1	4									4			
ANNE	POSE	Trichobranchidae	Terebellides reishi	1																			
ANNE	POSE	Trichobranchidae	Terebellides sp.					4			6	9	5	4						6		1	8
ANNE	POSE	Trichobranchidae	Terebellides stroemi	1														1				1	
ANNE	POSE	Trichobranchidae	Trichobranchus glacialis	1						3													
ANNE	POSE	Trochochaetidae	Trochochaeta watsoni	1																			
ARTH	CHAR	Halacaridae	Halacaridae indet.	1												16							8
ARTH	CHPY	Ammotheidae	Achelia sp.	1																			
ARTH	CHPY	Nymphonidae	Nymphon sp.	1															1				
ARTH	CHPY		Pycnogonida indet.	1								4											
ARTH	CRAM	Ampeliscidae	Ampelisca eschrichtii	1													1		3	2			
ARTH	CRAM	Ampeliscidae	Byblis sp.	1							4									2	2		
ARTH	CRAM	Ampeliscidae	Haploops tubicola	1														4					
ARTH	CRAM	Amphilochidae	Amphilochidae indet.						4														
ARTH	CRAM	Amphilochidae	Amphilochopsis hamatus	1																			
ARTH	CRAM	Atylidae	Atylus carinatus	1			1																
ARTH	CRAM	Calliopiidae	Calliopiidae indet.	1																			
ARTH	CRAM	Corophiidae	Crassicorophium bonellii	1																			
ARTH	CRAM	Corophiidae	Monocorophium insidiosum	1			60																
ARTH	CRAM	Corophiidae	Monocorophium sp.		4																		
ARTH	CRAM	Dexaminidae	Dexamine sp.	1																			
ARTH	CRAM	Dexaminidae	Guernea nordenskioldi	1				48	92	41	8	12	12	36			48	16	48	24	20	28	28
ARTH	CRAM	Eusiridae	Rhachotropis helleri	1																			
ARTH	CRAM	Eusiridae	Rhachotropis sp.																				
ARTH	CRAM	Gammaridae	Gammarus oceanicus	1			3								7	2	4						
ARTH	CRAM	Isaeidae	Protomedeia sp.	1																2			
ARTH	CRAM	Lysianassidae	Gronella groenlandica	1			24																
ARTH	CRAM	Lysianassidae	Lysianassidae indet.														4						
ARTH	CRAM	Lysianassidae	Orchomene sp.	1										8									
ARTH	CRAM	Lysianassidae	Orchomenella pinguis	1												4							
ARTH	CRAM	Oedicerotidae	Bathymedon obtusifrons	1																			
ARTH	CRAM	Oedicerotidae	Monoculodes latimanus	1						3													
ARTH	CRAM	Oedicerotidae	Monoculodes sp.		8			4					5						2				
ARTH	CRAM	Oedicerotidae	Monoculopsis longicornis	1			12	4								4							
ARTH	CRAM	Oedicerotidae	Oedicerotidae indet.		4		18		12		4						4					4	4
ARTH	CRAM	Oedicerotidae	Paroediceros lynceus	1	4	44	67		9			4		4	19	18	8			2			
ARTH	CRAM	Oedicerotidae	Rostroculodes borealis	1									7				8						
ARTH	CRAM	Oedicerotidae	Rostroculodes longirostris	1																			
ARTH	CRAM	Oedicerotidae	Rostroculodes sp.							10													
ARTH	CRAM	Oedicerotidae	Westwoodilla sp.	1					4	7	4								2	8		4	

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				Sample name	BM-7	BM-7	BM-7	BM-8	BM-8	BM-8	BM-9	BM-9	BM-9	BM-10	BM-10	BM-10	BM-11	BM-11	BM-11	BM-12	BM-12	BM-12	BM-13
				Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
				Date Sampled	8/21/2017	8/21/2017	8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/16/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ARTH	CRAM	Phoxocephalidae	Harpinia serrata	1														4					
ARTH	CRAM	Phoxocephalidae	Harpinia sp.																				
ARTH	CRAM	Podoceridae	Dyopedos sp.	1																			
ARTH	CRAM	Pontoporeiidae	Monoporeia affinis	1	824		7							16	24	8							
ARTH	CRAM	Pontoporeiidae	Pontoporeia femorata	1														4		2			
ARTH	CRAM	Pontoporeiidae	Pontoporeiidae indet.																				
ARTH	CRAM	Stenothoidae	Hardametopa nasuta	1																			
ARTH	CRAM	Stenothoidae	Stenothoidae indet.																				
ARTH	CRAM	Uristidae	Anonyx nugax	1						1	4			1				1	1		1		
ARTH	CRAM	Uristidae	Anonyx ochoticus	1																			
ARTH	CRAM	Uristidae	Anonyx sarsi	1										2									
ARTH	CRAM	Uristidae	Anonyx sp.														1						
ARTH	CRAM	Uristidae	Menigrates obtusifrons	1										4									
ARTH	CRAM	Uristidae	Onisimus barentsi Group	1		12																	
ARTH	CRAM	Uristidae	Onisimus sp.				1	4															
ARTH	CRAM	Uristidae	Uristidae indet.																				
ARTH	CRAM		Amphipoda indet.																				
ARTH	CRAM		Lysianassoidea indet.					4	4		4								2				12
ARTH	CRCI		Balanomorpha indet.	1		212	528	4	12		12	431	12		6	44	8	4		2	2		4
ARTH	CRCO		Cyclopoida indet.	1																			
ARTH	CRCO		Harpacticoida indet.	1								16			6	12						4	
ARTH	CRCU	Diastylidae	Brachydiastylis resima	1															2				
ARTH	CRCU	Diastylidae	Diastylidae indet.																				
ARTH	CRCU	Diastylidae	Diastylis alaskensis	1																			
ARTH	CRCU	Diastylidae	Diastylis bradyi	1					4		12								2				
ARTH	CRCU	Diastylidae	Diastylis goodsiri	1							4												
ARTH	CRCU	Diastylidae	Diastylis lucifera	1																			
ARTH	CRCU	Diastylidae	Diastylis rathkei	1					4			8	10							2		9	
ARTH	CRCU	Diastylidae	Diastylis scorpioides	1				4	28	7	40	4	21					10	4	30	22	5	4
ARTH	CRCU	Diastylidae	Diastylis sp.														4		2				
ARTH	CRCU	Diastylidae	Diastylis spinulosa	1									2										
ARTH	CRCU	Diastylidae	Diastyloides biplicatus	1																			
ARTH	CRCU	Lampropidae	Hemilamprops cristatus	1					16														
ARTH	CRCU	Lampropidae	Lampropidae indet.															4				4	
ARTH	CRCU	Lampropidae	Lamprops fuscatus	1				36	68	10	12	4	12	24			8	8	18	18			8
ARTH	CRCU	Leuconidae	Eudorella sp.																				
ARTH	CRCU	Leuconidae	Eudorella truncatula	1				8	4		20	16	17							6	2		
ARTH	CRCU	Leuconidae	Leucon nasicoides	1				12	44	17		8	12					4	14	18	7		
ARTH	CRCU	Leuconidae	Leucon sp.					8				4					4					4	
ARTH	CRCU	Leuconidae	Leuconidae indet.																				
ARTH	CRCU	Nannastacidae	Campylaspis rubicunda	1																			
ARTH	CRCU	Nannastacidae	Campylaspis sp.																				
ARTH	CRCU		Cumacea indet.																		2		
ARTH	CRDE	Crangonidae	Sabinea septemcarinata	1									1										
ARTH	CRDE	Crangonidae	Sclerocrangon boreas	1																			
ARTH	CRIS	Desmosomatidae	Desmosomatidae indet.	1																		8	
ARTH	CRIS	Gnathiidae	Gnathia sp.	1				4															
ARTH	CRIS	Gnathiidae	Gnathiidae indet.								4					4			2				
ARTH	CRIS	Paramunnidae	Pleurogonium rubicundum	1								4											
ARTH	CRIS	Paramunnidae	Pleurogonium sp.																				
ARTH	CRIS	Paramunnidae	Pleurogonium spinosissimum	1									2										
ARTH	CRIS		Asellota indet.																2				
ARTH	CRMY	Mysidae	Mysis mixta	1																			
ARTH	CRMY		Mysidacea indet.								4								4	20	4		8
ARTH	CROS	Philomedidae	Philomedes sp.	1				340	216	264	504		190				44	32	40	44	26	40	20
ARTH	CROS		Ostracoda indet.				6				8						20	4					
ARTH	CROS		Robertsonites tuberculatus	1										204			92	4					8
ARTH	CRTA	Akanthophoreidae	Akanthophoreus gracilis	1													8						
ARTH	CRTA	Akanthophoreidae	Akanthophoreus sp.																				
ARTH	CRTA	Pseudotanaidae	Pseudotanais sp.	1																			
ARTH	CRTA	Sphyrapodidae	Pseudosphyrapus anomalus	1							100	20	31							34	20	16	
ARTH	CRTA	Typhlotanaidae	Typhlotanais sp.	1					4		4	4	7										4
ARTH	CRTA		Tanaidacea indet.																				
ARTH	INDI	Chironomidae	Chironomidae indet.																2				
ARTH	INDI	Chironomidae	Orthocladiinae indet.	1															6				
ARTH	INDI		Diptera indet.																	2			
ECHI	ECEC	Strongylocentrotidae	Strongylocentrotus droebachiensis	1														8					
ECHI	ECEC	Strongylocentrotidae	Strongylocentrotus sp.														6		4	3	2		
ECHI	ECHO	Myriotrochidae	Myriotrochus rinkii	1																			
ECHI	ECHO	Psolidae	Psolus phantapus	1																			
ECHI	ECHO		Molpadida indet.	1							4	12											
ECHI	ECOP	Ophiuridae	Ophiura robusta	1						1		1											4
ECHI	ECOP	Ophiuridae	Ophiura sarsii	1																			
ECHI	ECOP	Ophiuridae	Ophiura sp.							3				4			8				2	12	4
MISC	BRYO	Crisiidae	Crisia sp.	1																			
MISC	BRYO	Epistomiidae	Synnotum sp.	1			6								6								
MISC	BRYO	Hippothoidae	Celleporella hyalina	1																			
MISC	BRYO	Vesiculariidae	Bowerbankia sp.	1					4														
MISC	BRYO		Bryozoa indet.																2				
MISC	BRYO		Ctenostomata indet.	1								2							1			1	
MISC	CNAN	Actiniidae	Urticina sp.	1																			
MISC	CNAN	Hormathiidae	Hormathia digitata	1																			
MISC	CNAN	Parazoanthidae	Parazoanthus sp.	1																			
MISC	CNHY	Bougainvilliidae	Bougainvilliidae indet.	1		1								1								1	
MISC	CNHY	Olindiidae	Monobrachium parasitum	1				1	2													3	

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				Sample name	BM-7	BM-7	BM-7	BM-8	BM-8	BM-8	BM-9	BM-9	BM-9	BM-10	BM-10	BM-10	BM-11	BM-11	BM-11	BM-12	BM-12	BM-12	BM-13
				Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
				Date Sampled	8/21/2017	8/21/2017	8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/16/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
MISC	CNHY		Hydrozoa indet.																				
MISC	NTEA	Cephalothricidae	Cephalothrix sp.	1															2	2			
MISC	NTEA	Lineidae	Cerebratulus sp.	1				12	4	5	4	6							2	4		8	4
MISC	NTEA	Tetrastemmatidae	Tetrastemma sp.	1																			
MISC	NTEA		Anopla indet.																	2			
MISC	NTEA		Enopla indet.									4								2			
MISC	NTEA		Nemertea indet.					4	4					4						2	2		4
MISC	PIXX	Ammodytidae	Ammodytes hexapterus	1																			
MISC	PIXX		Pisces indet.															1					
MISC	PLTY		Platyhelminthes indet.	1					4														
MISC	PRIA	Priapulidae	Priapulus caudatus	1						3							5		2				
MISC	PRIA	Priapulidae	Priapulus sp.															4					
MISC	SIPN	Golfingiidae	Golfingia sp.	1																			
MISC	SIPN	Golfingiidae	Nephasoma sp.	1																			
MISC	URAS	Ascidiidae	Ascidia sp.	1																			
MISC	URAS	Pyuridae	Boltenia echinata	1																			
MISC	URAS	Styelidae	Polycarpa fibrosa	1																			
MISC	URAS	Styelidae	Polycarpa pomaria	1																			
MISC	URAS		Ascidiacea indet.																				1
MOLL	MOAP	Chaetodermatidae	Chaetoderma sp.	1					1		4												
MOLL	MOAP		Aplacophora indet.																				
MOLL	MOBI	Astartidae	Astarte borealis	1		5	3	7	2	11	3	5	6	31	8	1	31	33	58	3	2	2	19
MOLL	MOBI	Astartidae	Astarte montagui	1		3		9	42	53	52	57	27	78	3	2	88	51	33	28	11	24	30
MOLL	MOBI	Astartidae	Astarte sp.					8	24	24	8	36	24	44	36	4	12	9	14			4	20
MOLL	MOBI	Cardiidae	Cardiidae indet.						4		4		10										
MOLL	MOBI	Cardiidae	Ciliatocardium ciliatum	1						1		4										2	
MOLL	MOBI	Cardiidae	Serripes groenlandicus	1				1	24	3	8		5	8	6		5	1		2		4	1
MOLL	MOBI	Hiatellidae	Hiatella arctica	1		13	15	10	7	22	11	24	4	32	33	24	6	6	5	6	6	5	41
MOLL	MOBI	Lyonsiidae	Lyonsia arenosa	1																			
MOLL	MOBI	Myidae	Mya sp.			8	13	12	12			12	10		2			8		1			8
MOLL	MOBI	Myidae	Mya truncata	1		8	2	1	5	10	6	1	1	16		1	17	3	5	10	1	1	9
MOLL	MOBI	Mytilidae	Crenella faba	1												1							1
MOLL	MOBI	Mytilidae	Musculus discors	1		3	2			1				1	15	4							2
MOLL	MOBI	Mytilidae	Musculus niger	1																			
MOLL	MOBI	Mytilidae	Musculus sp.			4									6	4							
MOLL	MOBI	Mytilidae	Mytilidae indet.				12			3				4									
MOLL	MOBI	Mytilidae	Mytilus sp.	1											2								1
MOLL	MOBI	Nuculanidae	Nuculana minuta	1					1	10		2		3			2	13	3	12		1	
MOLL	MOBI	Nuculanidae	Nuculana pernula	1				5		3	2			1			2	3	1	1	1	3	2
MOLL	MOBI	Nuculanidae	Nuculana sp.					16	80	14	16	24	10	8			4	8	4	4			4
MOLL	MOBI	Nuculidae	Ennucula tenuis	1				4	28	3	68	68	10				17	5	3	16	4	16	
MOLL	MOBI	Pectinidae	Chlamys islandica	1																			
MOLL	MOBI	Pectinidae	Pectinidae indet.										12										
MOLL	MOBI	Periplomatidae	Periploma aleuticum	1					1	2	2												
MOLL	MOBI	Propeamussiidae	Propeamussiidae indet.																				
MOLL	MOBI	Propeamussiidae	Similipecten greenlandicus	1				1	4		31	1	7							8		5	
MOLL	MOBI	Tellinidae	Macoma balthica	1	19											5							
MOLL	MOBI	Tellinidae	Macoma calcarea	1			1	5	53	17	19	11	11				1	2					
MOLL	MOBI	Tellinidae	Macoma moesta	1	1						1	2								1		3	
MOLL	MOBI	Tellinidae	Macoma sp.		10	1		16	16		9	4		12						10	7	8	
MOLL	MOBI	Thraciidae	Thracia myopsis	1								6											
MOLL	MOBI	Thraciidae	Thracia sp.					4										4		2			
MOLL	MOBI	Thyasiridae	Axinopsida serricata	1																6		8	
MOLL	MOBI	Thyasiridae	Thyasira sp.	1				24	20	14	16	32	5				20		10	14		8	10
MOLL	MOBI	Thyasiridae	Thyasiridae indet.					16	28	10	16	28	10					4	6	6		8	4
MOLL	MOBI	Yoldiidae	Portlandia arctica	1																			
MOLL	MOBI	Yoldiidae	Yoldiidae indet.								4		2										
MOLL	MOBI		Bivalvia indet.			4	6				16	8	7	4	6		8				2	12	
MOLL	MOBI		Nuculanoidea indet.										1						2	10		12	
MOLL	MOBI		Pectinoidea indet.																				
MOLL	MOGA	Buccinidae	Buccinidae indet.						4	3									2				
MOLL	MOGA	Buccinidae	Colus sp.	1													4	1					
MOLL	MOGA	Buccinidae	Volutopsius norwegicus	1							1												
MOLL	MOGA	Capulidae	Ariadnaria borealis	1																			
MOLL	MOGA	Colloniidae	Moelleria costulata	1																			
MOLL	MOGA	Cylichnidae	Acteocina sp.	1				8	4	3				4									
MOLL	MOGA	Cylichnidae	Cylichna sp.						4		4	8	2										
MOLL	MOGA	Cylichnidae	Cylichnidae indet.								4												4
MOLL	MOGA	Cylichnidae	Cylichnoides occultus	1																			
MOLL	MOGA	Lepetidae	Lepeta caeca	1								7	2							2	4	3	
MOLL	MOGA	Lottiidae	Lottiidae indet.	1																			
MOLL	MOGA	Mangeliidae	Propebela sp.	1								4								2			
MOLL	MOGA	Margaritidae	Margarites groenlandicus	1											1		1		2	2			
MOLL	MOGA	Margaritidae	Margarites helicinus	1																			8
MOLL	MOGA	Margaritidae	Margarites sp.						4					4									
MOLL	MOGA	Naticidae	Cryptonatica affinis	1																			
MOLL	MOGA	Naticidae	Euspira pallida	1								4										1	5
MOLL	MOGA	Rissoidae	Rissoidae indet.	1			6	8	12			4					4			4			4
MOLL	MOGA	Trochidae	Trochidae indet.	1																			
MOLL	MOGA	Turridae	Turridae indet.	1																			
MOLL	MOGA	Velutinidae	Velutinidae indet.	1																			
MOLL	MOGA		Cephalaspidea indet.									4											
MOLL	MOGA		Gastropoda indet.			4			4		4								2		2		
MOLL	MOGA		Patellogastropoda indet.																				
MOLL	[illegible]	Tonicellidae	Tonicella marmorea	1															2		3		

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				Sample name	BM-7	BM-7	BM-7	BM-8	BM-8	BM-8	BM-9	BM-9	BM-9	BM-10	BM-10	BM-10	BM-11	BM-11	BM-11	BM-12	BM-12	BM-12	BM-13
				Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
				Date Sampled	8/21/2017	8/21/2017	8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/18/2017	8/18/2017	8/18/2017	8/18/2017	8/16/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
MOLL	MOPO		Polyplacophora indet.														4						
			Total Abundance		**1,036**	**2,142**	**2,993**	**1,541**	**1,642**	**1,464**	**2,155**	**1,632**	**1,197**	**1,600**	**728**	**423**	**1,038**	**569**	**807**	**800**	**469**	**614**	**1,545**
			Total Unique Taxa (Species Richness)		**13**	**24**	**31**	**49**	**63**	**61**	**61**	**62**	**61**	**39**	**24**	**26**	**49**	**45**	**62**	**62**	**39**	**48**	**49**
			No. composite grabs		**5**	**6**	**6**	**6**	**6**	**5**	**6**	**5**	**4**	**6**	**4**	**4**	**5**	**6**	**4**	**3**	**4**	**3**	**3**
			Total Density (Organisms/m^2)		**9209**	**15867**	**22170**	**11415**	**12163**	**13013**	**15963**	**14507**	**13300**	**11852**	**8089**	**4700**	**9227**	**4215**	**8967**	**11852**	**5208**	**9096**	**22889**
			Incidental Organisms:																				
MEMO	MEMO		Balanomorpha indet. (planktonic)																			4	
MEMO	MEMO		Calanoida indet. (planktonic)															12		2			
MEMO	MEMO		Calanus sp. (planktonic)						4	14	16	8	10									12	
MEMO	MEMO		Chaetognatha indet. (planktonic)																				
MEMO	MEMO		Copepoda indet. (parasitic)																				
MEMO	MEMO		Egg/egg mass															4					
MEMO	MEMO		Ephemeroptera indet. (freshwater)																				
MEMO	MEMO		Hyperiidae indet. (planktonic)																	2			
MEMO	MEMO		Insecta indet. (terrestrial)													4							
MEMO	MEMO		Nematoda indet.					13	4	1	8	4		12			32		2				
MEMO	MEMO		Sabinea septemcarinata (planktonic)																				
MEMO	MEMO		Themisto sp. (planktonic)							3		5										1	

Abundance data continued

taxcode	grpcode	Family	TaxonName	Unique Taxa	BM-13	BM-13	BM-14	BM-14	BM-14	BM-15	BM-15	BM-15	BR-1	BR-2	BR-3	BR-4	AN-05	FT-16
			Replicate		2	3	1	2	3	1	2	3	1	1	1	1		
			Date Sampled		8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	9/11/2017	9/11/2017	9/11/2017	9/11/2017		9/1/2017
					# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ANNE	ANHI	Piscicolidae	Mysidobdella sp.	1														
ANNE	ANOL	Enchytraeidae	Enchytraeidae indet.	1	3			2		2								
ANNE	POER	Dorvilleidae	Parougia caeca	1					3									
ANNE	POER	Glyceridae	Glycera capitata	1						1								
ANNE	POER	Glyceridae	Glycera sp.															
ANNE	POER	Hesionidae	Hesionidae indet.															
ANNE	POER	Hesionidae	Nereimyra punctata	1	21	84	52	59	22	6	12	29	52	24	9	12		
ANNE	POER	Lumbrineridae	Scoletoma fragilis	1	1		4	1	21	5	14	20						
ANNE	POER	Lumbrineridae	Scoletoma impatiens	1	12	36	16	26	21	32		4			3			
ANNE	POER	Nephtyidae	Bipalponephtys cornuta	1	15	24	8	22	51	40	10	17	20	8	3	4		
ANNE	POER	Nephtyidae	Nephtys ciliata	1														
ANNE	POER	Nereididae	Nereididae indet.															
ANNE	POER	Nereididae	Nereis sp.					2										
ANNE	POER	Nereididae	Nereis zonata	1	3	1	6	1										
ANNE	POER	Pholoidae	Pholoe minuta	1	78	240		19	8	1			4	68	20	12		
ANNE	POER	Pholoidae	Pholoe sp.		21	24	40	6	5	10			272	148	123	185		
ANNE	POER	Pholoidae	Pholoe tecta	1	409	1,410	52	17	101	104	98	69	156	608	60	44		
ANNE	POER	Phyllodocidae	Eteone barbata	1														
ANNE	POER	Phyllodocidae	Eteone flava	1				1										
ANNE	POER	Phyllodocidae	Eteone longa complex	1										4				
ANNE	POER	Phyllodocidae	Eteone sp.						3	1			4	4				
ANNE	POER	Phyllodocidae	Hypereteone sp.	1		6		2		2		2				4		
ANNE	POER	Phyllodocidae	Phyllodoce groenlandica	1														
ANNE	POER	Phyllodocidae	Phyllodoce mucosa	1														
ANNE	POER	Phyllodocidae	Phyllodoce sp.															
ANNE	POER	Polynoidae	Bylgides sarsi	1														
ANNE	POER	Polynoidae	Gattyana cirrhosa	1		6		2			3	3		1		2		
ANNE	POER	Polynoidae	Harmothoe extenuata	1			1											
ANNE	POER	Polynoidae	Harmothoe imbricata	1	3	25		2					4		1			
ANNE	POER	Polynoidae	Harmothoe sp.				4							4	9	9		
ANNE	POER	Polynoidae	Hartmania moorei	1						2								
ANNE	POER	Polynoidae	Polynoidae indet.					4										
ANNE	POER	Polynoidae	Polynoinae indet.								2	2	8					
ANNE	POER	Sphaerodoridae	Sphaerodoropsis minuta	1														
ANNE	POER	Syllidae	Exogone hebes	1		12	8	9	11	2		2						
ANNE	POER	Syllidae	Syllidae indet.									2						
ANNE	POER	Syllidae	Syllides sp.	1								2						
ANNE	POER		Errantia indet.															
ANNE	PORI		Calcarea indet.	1									6					
ANNE	POSE	Ampharetidae	Ampharete sp.		15	12		2	3	4	10	2			3	4		
ANNE	POSE	Ampharetidae	Ampharete vega	1														
ANNE	POSE	Ampharetidae	Ampharetidae indet.		3	6			3	2		4						
ANNE	POSE	Ampharetidae	Amphicteis sundevalli	1														
ANNE	POSE	Ampharetidae	Lysippe labiata	1														
ANNE	POSE	Ampharetidae	Melinna elisabethae	1					5	5	3	4						
ANNE	POSE	Apistobranchidae	Apistobranchus sp.	1								2						
ANNE	POSE	Capitellidae	Capitella capitata complex	1			4						92	440				
ANNE	POSE	Capitellidae	Capitellidae indet.															
ANNE	POSE	Capitellidae	Mediomastus ambiseta	1														
ANNE	POSE	Capitellidae	Mediomastus sp.		30	24	4	4	3	4	5			4		12		
ANNE	POSE	Capitellidae	Notomastus latericeus	1								1						
ANNE	POSE	Cirratulidae	Aphelochaeta sp.	1	6					4		2						
ANNE	POSE	Cirratulidae	Chaetozone bathyala	1	63	18	40	63	120	82	73	87						
ANNE	POSE	Cirratulidae	Chaetozone careyi	1														
ANNE	POSE	Cirratulidae	Chaetozone pigmentata	1		6	8	9	3	4	14	15						
ANNE	POSE	Cirratulidae	Chaetozone setosa complex	1					8	40	34	2						
ANNE	POSE	Cirratulidae	Chaetozone sp.		12	24	20	20	29	74	34	42		24		4		
ANNE	POSE	Cirratulidae	Cirratulidae indet.		15	18	32	9	11	22	36	15		4				
ANNE	POSE	Cirratulidae	Tharyx sp.	1														
ANNE	POSE	Cossuridae	Cossura sp.	1	3		4	2	19	8	17	12	4		6	4		
ANNE	POSE	Fabriciidae	Fabriciidae indet.	1														
ANNE	POSE	Maldanidae	Clymenura sp.	1			1											
ANNE	POSE	Maldanidae	Euclymene sp.	1														
ANNE	POSE	Maldanidae	Euclymeninae indet.		3						2		4					
ANNE	POSE	Maldanidae	Maldane sarsi	1	6	12	1	7	21				4		6	16		
ANNE	POSE	Maldanidae	Maldanidae indet.				4		3			2						
ANNE	POSE	Maldanidae	Microclymene sp.	1						8		4			3	4		
ANNE	POSE	Maldanidae	Nicomache lumbricalis	1														
ANNE	POSE	Maldanidae	Praxillella praetermissa	1						9		5						
ANNE	POSE	Maldanidae	Rhodine loveni	1				4										
ANNE	POSE	Opheliidae	Ophelia limacina	1														
ANNE	POSE	Opheliidae	Ophelina acuminata	1	1			2										
ANNE	POSE	Opheliidae	Ophelina sp.										8		6			
ANNE	POSE	Orbiniidae	Leitoscoloplos sp.	1														
ANNE	POSE	Orbiniidae	Orbiniidae indet.			6			3									
ANNE	POSE	Orbiniidae	Scoloplos acutus	1	6			2	5	16	14	8						
ANNE	POSE	Orbiniidae	Scoloplos armiger	1	6		6	3										
ANNE	POSE	Orbiniidae	Scoloplos sp.						3									
ANNE	POSE	Oweniidae	Galathowenia oculata	1			4		3	8	2	8				4		
ANNE	POSE	Oweniidae	Myriochele danielsseni	1														
ANNE	POSE	Oweniidae	Myriochele heeri	1														

				Sample Name	BM-13	BM-13	BM-14	BM-14	BM-14	BM-15	BM-15	BM-15	BR-1	BR-2	BR-3	BR-4	AN-05	FT-16
				Replicate	2	3	1	2	3	1	2	3	1	1	1	1		
				Date Sampled	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	9/11/2017	9/11/2017	9/11/2017	9/11/2017		9/1/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ANNE	POSE	Oweniidae	Myriochele sp.								2							
ANNE	POSE	Oweniidae	Owenia fusiformis	1					5	3	4	1			27			
ANNE	POSE	Paraonidae	Aricidea catherinae	1		12				2	5			4				
ANNE	POSE	Paraonidae	Aricidea hartmanae	1						4	10	12						
ANNE	POSE	Paraonidae	Aricidea minuta	1				6		2								
ANNE	POSE	Paraonidae	Aricidea nolani	1	3	6		2	3	6	5	8	4		18			
ANNE	POSE	Paraonidae	Aricidea sp.						3	2	2							
ANNE	POSE	Paraonidae	Paraonidae indet.			6												
ANNE	POSE	Pectinariidae	Cistenides granulata	1	27	67	1		1				44	43	36	33		
ANNE	POSE	Sabellidae	Branchiomma sp.	1			1											
ANNE	POSE	Sabellidae	Chone duneri	1														
ANNE	POSE	Sabellidae	Dialychone sp.		3		8	2			2					8		
ANNE	POSE	Sabellidae	Dialychone sp. 1	1				9	32	4	7	12						
ANNE	POSE	Sabellidae	Dialychone sp. 2	1														
ANNE	POSE	Sabellidae	Euchone incolor	1	21	30	4	17	76	2	19	8		4				
ANNE	POSE	Sabellidae	Euchone rubrocincta	1					3	1								
ANNE	POSE	Sabellidae	Hypsicomus sp.	1														
ANNE	POSE	Sabellidae	Sabellidae indet.					2	5	2		7				4		
ANNE	POSE	Sabellidae	Sabellidae sp. 2	1														
ANNE	POSE	Sabellidae	Sabellidae sp. 3	1					5									
ANNE	POSE	Sabellidae	Sabellidae sp. 4	1														
ANNE	POSE	Scalibregmatidae	Polyphysia crassa	1														
ANNE	POSE	Scalibregmatidae	Scalibregma inflatum	1	24	6	16	15		11	2	4						
ANNE	POSE	Scalibregmatidae	Scalibregmatidae indet.															
ANNE	POSE	Serpulidae	Bushiella (Jugaria) quadrangularis	1														
ANNE	POSE	Serpulidae	Pileolaria sp.	1														
ANNE	POSE	Serpulidae	Spirorbinae indet.													8		
ANNE	POSE	Spionidae	Dipolydora caulleryi	1		6												
ANNE	POSE	Spionidae	Dipolydora quadrilobata	1														
ANNE	POSE	Spionidae	Dipolydora sp.		3			7								8		
ANNE	POSE	Spionidae	Marenzelleria sp.	1														
ANNE	POSE	Spionidae	Polydora sp. complex	1														
ANNE	POSE	Spionidae	Prionospio cirrifera	1														
ANNE	POSE	Spionidae	Prionospio sp.				4		3									
ANNE	POSE	Spionidae	Prionospio steenstrupi	1	3			4	35	50	89	46		4	9	4		
ANNE	POSE	Spionidae	Pygospio sp.	1	9	6		2	3		2							
ANNE	POSE	Spionidae	Spio filicornis	1	9	12								4				
ANNE	POSE	Spionidae	Spionidae indet.															
ANNE	POSE	Terebellidae	Lanassa venusta venusta	1					3									
ANNE	POSE	Terebellidae	Laphania boecki	1	3	18		2										
ANNE	POSE	Terebellidae	Leaena abranchiata	1														
ANNE	POSE	Terebellidae	Neoamphitrite affinis	1	1			1										
ANNE	POSE	Terebellidae	Pista maculata	1	5	8	6										1	
ANNE	POSE	Terebellidae	Polycirrus sp. complex	1	3				3									
ANNE	POSE	Terebellidae	Terebellidae indet.									2						
ANNE	POSE	Trichobranchidae	Terebellides reishi	1														
ANNE	POSE	Trichobranchidae	Terebellides sp.		6	12		4		2	2				9	8		
ANNE	POSE	Trichobranchidae	Terebellides stroemi	1	2	6			1						1			
ANNE	POSE	Trichobranchidae	Trichobranchus glacialis	1			4											
ANNE	POSE	Trochochaetidae	Trochochaeta watsoni	1														
ARTH	CHAR	Halacaridae	Halacaridae indet.	1									4	8	3			
ARTH	CHPY	Ammotheidae	Achelia sp.	1														
ARTH	CHPY	Nymphonidae	Nymphon sp.	1													3	
ARTH	CHPY		Pycnogonida indet.	1														
ARTH	CRAM	Ampeliscidae	Ampelisca eschrichtii	1		1		2	1			3						
ARTH	CRAM	Ampeliscidae	Byblis sp.	1							2	2						
ARTH	CRAM	Ampeliscidae	Haploops tubicola	1			1		1				4		3			
ARTH	CRAM	Amphilochidae	Amphilochidae indet.															
ARTH	CRAM	Amphilochidae	Amphilochopsis hamatus	1														
ARTH	CRAM	Atylidae	Atylus carinatus	1							1							
ARTH	CRAM	Calliopiidae	Calliopiidae indet.	1														
ARTH	CRAM	Corophiidae	Crassicorophium bonellii	1									4	8				
ARTH	CRAM	Corophiidae	Monocorophium insidiosum	1														
ARTH	CRAM	Corophiidae	Monocorophium sp.															
ARTH	CRAM	Dexaminidae	Dexamine sp.	1														
ARTH	CRAM	Dexaminidae	Guernea nordenskioldi	1	123	96	44	48	24		17	15	36	4	6	28		
ARTH	CRAM	Eusiridae	Rhachotropis helleri	1				2										
ARTH	CRAM	Eusiridae	Rhachotropis sp.												3			
ARTH	CRAM	Gammaridae	Gammarus oceanicus	1														
ARTH	CRAM	Isaeidae	Protomedeia sp.	1									4					
ARTH	CRAM	Lysianassidae	Gronella groenlandica	1														
ARTH	CRAM	Lysianassidae	Lysianassidae indet.															
ARTH	CRAM	Lysianassidae	Orchomene sp.	1														
ARTH	CRAM	Lysianassidae	Orchomenella pinguis	1														
ARTH	CRAM	Oedicerotidae	Bathymedon obtusifrons	1												4		
ARTH	CRAM	Oedicerotidae	Monoculodes latimanus	1														
ARTH	CRAM	Oedicerotidae	Monoculodes sp.										8		3			
ARTH	CRAM	Oedicerotidae	Monoculopsis longicornis	1					5	1	2		4					
ARTH	CRAM	Oedicerotidae	Oedicerotidae indet.					4			5	2	4		3			
ARTH	CRAM	Oedicerotidae	Paroediceros lynceus	1									8	1				
ARTH	CRAM	Oedicerotidae	Rostroculodes borealis	1														
ARTH	CRAM	Oedicerotidae	Rostroculodes longirostris	1	6			7										
ARTH	CRAM	Oedicerotidae	Rostroculodes sp.															
ARTH	CRAM	Oedicerotidae	Westwoodilla sp.	1					3	4	2							

APPENDIX G-3
BIOLOGICA DATA SET

taxcode	grpcode	Family	TaxonName	Sample Name / Replicate / Date Sampled / Unique Taxa	BM-13	BM-13	BM-14	BM-14	BM-14	BM-15	BM-15	BM-15	BR-1	BR-2	BR-3	BR-4	AN-05	FT-16
				Replicate	2	3	1	2	3	1	2	3	1	1	1	1		
				Date Sampled	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	9/11/2017	9/11/2017	9/11/2017	9/11/2017		9/1/2017
				Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
ARTH	CRAM	Phoxocephalidae	Harpinia serrata	1						6		2						
ARTH	CRAM	Phoxocephalidae	Harpinia sp.															
ARTH	CRAM	Podoceridae	Dyopedos sp.	1														
ARTH	CRAM	Pontoporeiidae	Monoporeia affinis	1														
ARTH	CRAM	Pontoporeiidae	Pontoporeia femorata	1	6			2			2		8			8		
ARTH	CRAM	Pontoporeiidae	Pontoporeiidae indet.															
ARTH	CRAM	Stenothoidae	Hardametopa nasuta	1														
ARTH	CRAM	Stenothoidae	Stenothoidae indet.															
ARTH	CRAM	Uristidae	Anonyx nugax	1	1													
ARTH	CRAM	Uristidae	Anonyx ochoticus	1													1	
ARTH	CRAM	Uristidae	Anonyx sarsi	1														
ARTH	CRAM	Uristidae	Anonyx sp.										4					
ARTH	CRAM	Uristidae	Menigrates obtusifrons	1	9						2							
ARTH	CRAM	Uristidae	Onisimus barentsi Group	1														
ARTH	CRAM	Uristidae	Onisimus sp.															
ARTH	CRAM	Uristidae	Uristidae indet.															
ARTH	CRAM		Amphipoda indet.							2			8					
ARTH	CRAM		Lysianassoidea indet.															
ARTH	CRCI		Balanomorpha indet.	1						2			5		3			
ARTH	CRCO		Cyclopoida indet.	1					3				4					
ARTH	CRCO		Harpacticoida indet.	1					3		5	2	16	8				
ARTH	CRCU	Diastylidae	Brachydiastylis resima	1					3	2	2		4		3	20		
ARTH	CRCU	Diastylidae	Diastylidae indet.															
ARTH	CRCU	Diastylidae	Diastylis alaskensis	1														
ARTH	CRCU	Diastylidae	Diastylis bradyi	1														
ARTH	CRCU	Diastylidae	Diastylis goodsiri	1					3	1	1							
ARTH	CRCU	Diastylidae	Diastylis lucifera	1														
ARTH	CRCU	Diastylidae	Diastylis rathkei	1		6	4				7	4						
ARTH	CRCU	Diastylidae	Diastylis scorpioides	1		18	1	11	29	16	17	6						
ARTH	CRCU	Diastylidae	Diastylis sp.			6			3	2								
ARTH	CRCU	Diastylidae	Diastylis spinulosa	1														
ARTH	CRCU	Diastylidae	Diastyloides biplicatus	1														
ARTH	CRCU	Lampropidae	Hemilamprops cristatus	1		6												
ARTH	CRCU	Lampropidae	Lampropidae indet.															
ARTH	CRCU	Lampropidae	Lamprops fuscatus	1	21	6		6	29	2			8	8				
ARTH	CRCU	Leuconidae	Eudorella sp.					2										
ARTH	CRCU	Leuconidae	Eudorella truncatula	1					8	3	2	12						
ARTH	CRCU	Leuconidae	Leucon nasicoides	1			12	7	8		7	2						
ARTH	CRCU	Leuconidae	Leucon sp.				8			8	2							
ARTH	CRCU	Leuconidae	Leuconidae indet.															
ARTH	CRCU	Nannastacidae	Campylaspis rubicunda	1														
ARTH	CRCU	Nannastacidae	Campylaspis sp.															
ARTH	CRCU		Cumacea indet.									2	4					
ARTH	CRDE	Crangonidae	Sabinea septemcarinata	1							1							
ARTH	CRDE	Crangonidae	Sclerocrangon boreas	1		1							1					
ARTH	CRIS	Desmosomatidae	Desmosomatidae indet.	1														
ARTH	CRIS	Gnathiidae	Gnathia sp.	1							7							
ARTH	CRIS	Gnathiidae	Gnathiidae indet.															
ARTH	CRIS	Paramunnidae	Pleurogonium rubicundum	1														
ARTH	CRIS	Paramunnidae	Pleurogonium sp.															
ARTH	CRIS	Paramunnidae	Pleurogonium spinosissimum	1														
ARTH	CRIS		Asellota indet.															
ARTH	CRMY	Mysidae	Mysis mixta	1														
ARTH	CRMY		Mysidacea indet.			6	9		19			2	4	8				
ARTH	CROS	Philomedidae	Philomedes sp.	1	15	42	8	41	51	188	118	58	140	100	144	220		
ARTH	CROS		Ostracoda indet.				24				17	12						
ARTH	CROS		Robertsonites tuberculatus	1			12			2	12	10				4		
ARTH	CRTA	Akanthophoreidae	Akanthophoreus gracilis	1					3									
ARTH	CRTA	Akanthophoreidae	Akanthophoreus sp.					4		2	2		28			8		
ARTH	CRTA	Pseudotanaidae	Pseudotanais sp.	1	3					2		2	4					
ARTH	CRTA	Sphyrapodidae	Pseudosphyrapus anomalus	1			4			52	74	25						
ARTH	CRTA	Typhlotanaidae	Typhlotanais sp.	1			8								3			
ARTH	CRTA		Tanaidacea indet.										4					
ARTH	INDI	Chironomidae	Chironomidae indet.															
ARTH	INDI	Chironomidae	Orthocladiinae indet.	1														
ARTH	INDI		Diptera indet.															
ECHI	ECEC	Strongylocentrotidae	Strongylocentrotus droebachiensis	1	3	1		1										
ECHI	ECEC	Strongylocentrotidae	Strongylocentrotus sp.			6	12			4		1		1				
ECHI	ECHO	Myriotrochidae	Myriotrochus rinkii	1														
ECHI	ECHO	Psolidae	Psolus phantapus	1						1								
ECHI	ECHO		Molpadida indet.	1														
ECHI	ECOP	Ophiuridae	Ophiura robusta	1														
ECHI	ECOP	Ophiuridae	Ophiura sarsii	1				1									2	
ECHI	ECOP	Ophiuridae	Ophiura sp.							2	2	2	4	4			3	
MISC	BRYO	Crisiidae	Crisia sp.	1														
MISC	BRYO	Epistomiidae	Synnotum sp.	1														
MISC	BRYO	Hippothoidae	Celleporella hyalina	1									1					
MISC	BRYO	Vesiculariidae	Bowerbankia sp.	1														
MISC	BRYO		Bryozoa indet.													4		
MISC	BRYO		Ctenostomata indet.	1						1	1	2						
MISC	CNAN	Actiniidae	Urticina sp.	1												1		
MISC	CNAN	Hormathiidae	Hormathia digitata	1											3			
MISC	CNAN	Parazoanthidae	Parazoanthus sp.	1														
MISC	CNHY	Bougainvilliidae	Bougainvilliidae indet.	1														
MISC	CNHY	Olindiidae	Monobrachium parasitum	1	1	1	1	1	2	2		1						

taxcode	grpcode	Family	TaxonName	Sample Name / Replicate / Date Sampled / Unique Taxa	BM-13 / 2 / 8/16/2017 / # of organisms	BM-13 / 3 / 8/16/2017 / # of organisms	BM-14 / 1 / 8/16/2017 / # of organisms	BM-14 / 2 / 8/16/2017 / # of organisms	BM-14 / 3 / 8/16/2017 / # of organisms	BM-15 / 1 / 8/16/2017 / # of organisms	BM-15 / 2 / 8/16/2017 / # of organisms	BM-15 / 3 / 8/16/2017 / # of organisms	BR-1 / 1 / 9/11/2017 / # of organisms	BR-2 / 1 / 9/11/2017 / # of organisms	BR-3 / 1 / 9/11/2017 / # of organisms	BR-4 / 1 / 9/11/2017 / # of organisms	AN-05 / # of organisms	FT-16 / 9/1/2017 / # of organisms
MISC	CNHY		Hydrozoa indet.															
MISC	NTEA	Cephalothricidae	Cephalothrix sp.	1					3	4								
MISC	NTEA	Lineidae	Cerebratulus sp.	1			1		12	7	5	7						
MISC	NTEA	Tetrastemmatidae	Tetrastemma sp.	1												4		
MISC	NTEA		Anopla indet.															
MISC	NTEA		Enopla indet.		3													
MISC	NTEA		Nemertea indet.				4			2	5							
MISC	PIXX	Ammodytidae	Ammodytes hexapterus	1														1
MISC	PIXX		Pisces indet.															
MISC	PLTY		Platyhelminthes indet.	1														
MISC	PRIA	Priapulidae	Priapulus caudatus	1					1		1	4						
MISC	PRIA	Priapulidae	Priapulus sp.								2							
MISC	SIPN	Golfingiidae	Golfingia sp.	1														
MISC	SIPN	Golfingiidae	Nephasoma sp.	1					3									
MISC	URAS	Ascidiidae	Ascidia sp.	1														
MISC	URAS	Pyuridae	Boltenia echinata	1		1												
MISC	URAS	Styelidae	Polycarpa fibrosa	1														
MISC	URAS	Styelidae	Polycarpa pomaria	1													1	
MISC	URAS		Ascidiacea indet.															
MOLL	MOAP	Chaetodermatidae	Chaetoderma sp.	1							2							
MOLL	MOAP		Aplacophora indet.															
MOLL	MOBI	Astartidae	Astarte borealis	1	41	19	12	18	4	17	2	4	20	20		4		
MOLL	MOBI	Astartidae	Astarte montagui	1	21	71	85	75	18	12	24	40	42	6	1	9		
MOLL	MOBI	Astartidae	Astarte sp.		3	42	16	17	8	12	10	16	10	12	6	4		
MOLL	MOBI	Cardiidae	Cardiidae indet.															
MOLL	MOBI	Cardiidae	Ciliatocardium ciliatum	1					1				1					
MOLL	MOBI	Cardiidae	Serripes groenlandicus	1	1	7			3				1		1			
MOLL	MOBI	Hiatellidae	Hiatella arctica	1	14	32	1	3	12	1	4						1	
MOLL	MOBI	Lyonsiidae	Lyonsia arenosa	1														
MOLL	MOBI	Myidae	Mya sp.		3	12	2		6		2	13	4	4	6			
MOLL	MOBI	Myidae	Mya truncata	1	10	1	2	2	6	1		3	1	1	5	3		
MOLL	MOBI	Mytilidae	Crenella faba	1														
MOLL	MOBI	Mytilidae	Musculus discors	1		2							1	1				
MOLL	MOBI	Mytilidae	Musculus niger	1									1	1		1		
MOLL	MOBI	Mytilidae	Musculus sp.			24	4											
MOLL	MOBI	Mytilidae	Mytilidae indet.			30									3			
MOLL	MOBI	Mytilidae	Mytilus sp.	1														
MOLL	MOBI	Nuculanidae	Nuculana minuta	1	2	18	6	4			2		4	5		4		
MOLL	MOBI	Nuculanidae	Nuculana pernula	1				1	1		2					1		
MOLL	MOBI	Nuculanidae	Nuculana sp.				8	2	11	2	7	10			3			
MOLL	MOBI	Nuculidae	Ennucula tenuis	1	1		1	2	5	12	18	35						
MOLL	MOBI	Pectinidae	Chlamys islandica	1													2	
MOLL	MOBI	Pectinidae	Pectinidae indet.															
MOLL	MOBI	Periplomatidae	Periploma aleuticum	1														
MOLL	MOBI	Propeamussiidae	Propeamussiidae indet.									4						
MOLL	MOBI	Propeamussiidae	Similipecten greenlandicus	1						4	7							
MOLL	MOBI	Tellinidae	Macoma balthica	1														
MOLL	MOBI	Tellinidae	Macoma calcarea	1	8		2	2	2	5	1	3	1	5	5	5		
MOLL	MOBI	Tellinidae	Macoma moesta	1		1				1								
MOLL	MOBI	Tellinidae	Macoma sp.		6	6		1	6	4	2	6	32	20	9	16		
MOLL	MOBI	Thraciidae	Thracia myopsis	1														
MOLL	MOBI	Thraciidae	Thracia sp.															
MOLL	MOBI	Thyasiridae	Axinopsida serricata	1						2	2	4		8	3	4		
MOLL	MOBI	Thyasiridae	Thyasira sp.	1	6	12	4	15	8	4	2	2	4	4	12	12		
MOLL	MOBI	Thyasiridae	Thyasiridae indet.		3			4	8		5			4	3			
MOLL	MOBI	Yoldiidae	Portlandia arctica	1														
MOLL	MOBI	Yoldiidae	Yoldiidae indet.							2	7							
MOLL	MOBI		Bivalvia indet.		3		4	2	13		5	2	20	24	9	4		
MOLL	MOBI		Nuculanoidea indet.					4	3	4		6			3			
MOLL	MOBI		Pectinoidea indet.							4								
MOLL	MOGA	Buccinidae	Buccinidae indet.											8		4	1	
MOLL	MOGA	Buccinidae	Colus sp.	1		6												
MOLL	MOGA	Buccinidae	Volutopsius norwegicus	1														
MOLL	MOGA	Capulidae	Ariadnaria borealis	1										4		4		
MOLL	MOGA	Colloniidae	Moelleria costulata	1												12		
MOLL	MOGA	Cylichnidae	Acteocina sp.	1														
MOLL	MOGA	Cylichnidae	Cylichna sp.						3									
MOLL	MOGA	Cylichnidae	Cylichnidae indet.						3									
MOLL	MOGA	Cylichnidae	Cylichnoides occultus	1														
MOLL	MOGA	Lepetidae	Lepeta caeca	1						3	2	9						
MOLL	MOGA	Lottiidae	Lottiidae indet.	1							2			4		4		
MOLL	MOGA	Mangeliidae	Propebela sp.	1														
MOLL	MOGA	Margaritidae	Margarites groenlandicus	1														
MOLL	MOGA	Margaritidae	Margarites helicinus	1		30												
MOLL	MOGA	Margaritidae	Margarites sp.															
MOLL	MOGA	Naticidae	Cryptonatica affinis	1						1								
MOLL	MOGA	Naticidae	Euspira pallida	1														
MOLL	MOGA	Rissoidae	Rissoidae indet.	1				9	5			6	4		3	4		
MOLL	MOGA	Trochidae	Trochidae indet.	1														
MOLL	MOGA	Turridae	Turridae indet.	1														
MOLL	MOGA	Velutinidae	Velutinidae indet.	1							1							
MOLL	MOGA		Cephalaspidea indet.											4		4		
MOLL	MOGA		Gastropoda indet.			12				2	2		4		9	20		
MOLL	MOGA		Patellogastropoda indet.							2								
MOLL	[illegible]	Tonicellidae	Tonicella marmorea	1			1											

APPENDIX G-3
BIOLOGICA DATA SET

				Sample Name	BM-13	BM-13	BM-14	BM-14	BM-14	BM-15	BM-15	BM-15	BR-1	BR-2	BR-3	BR-4	AN-05	FT-16
				Replicate	2	3	1	2	3	1	2	3	1	1	1	1		
				Date Sampled	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	9/11/2017	9/11/2017	9/11/2017	9/11/2017		9/1/2017
taxcode	grpcode	Family	TaxonName	Unique Taxa	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms	# of organisms
MOLL	MOPO		Polyplacophora indet.												3	4		
			Total Abundance		**1,170**	**2,711**	**664**	**670**	**1,005**	**1,002**	**978**	**801**	**1,159**	**1,685**	**613**	**817**	**15**	**1**
			Total Unique Taxa (Species Richness)		**53**	**50**	**48**	**58**	**65**	**73**	**67**	**63**	**46**	**38**	**36**	**47**	**9**	**1**
			No. composite grabs		**4**	**5**	**4**	**3**	**3**	**3**	**4**	**5**	**5**	**3**	**3**	**3**	**na**	**na**
			Total Density (Organisms/m^2)		**13000**	**24098**	**7378**	**9919**	**14884**	**14844**	**10864**	**7122**	**409**	**563**	**533**	**696**		
			Incidental Organisms:															
MEMO	MEMO		Balanomorpha indet. (planktonic)						3	2							100	
MEMO	MEMO		Calanoida indet. (planktonic)															
MEMO	MEMO		Calanus sp. (planktonic)					7		4		2						
MEMO	MEMO		Chaetognatha indet. (planktonic)							2								
MEMO	MEMO		Copepoda indet. (parasitic)								2					4		
MEMO	MEMO		Egg/egg mass															
MEMO	MEMO		Ephemeroptera indet. (freshwater)															
MEMO	MEMO		Hyperiidae indet. (planktonic)															
MEMO	MEMO		Insecta indet. (terrestrial)															
MEMO	MEMO		Nematoda indet.		3			5	1	2								
MEMO	MEMO		Sabinea septemcarinata (planktonic)															
MEMO	MEMO		Themisto sp. (planktonic)									1						

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For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
201 Columbia Avenue
Castlegar, British Columbia, V1N 1A8
Canada
T: +1 (250) 365 0344

Golder Associates