AECOM

PIN-D Ross Point Long-Term Monitoring Report

Year 10

Crown-Indigenous Relations and Northern Affairs Canada

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Executive Summary

The PIN-D Site is a former intermediate Distant Early Warning (DEW) Line site constructed by the Department of National Defence (DND) in 1959 and deactivated in 1963. In 1985, a program conducted by DND, Environment Canada (currently Environment and Climate Change Canada, ECCC), and Indian and Northern Affairs Canada (INAC; currently CIRNAC) cleaned up surface contaminants on site. Remediation of the site was conducted between 2011 and 2012, which involved the demolition and disposal of buildings, structures, and other debris, and the clean-up of hazardous materials and contaminated soil. A Non-Hazardous Waste Landfill (NHWL) was constructed during this time and completed in August 2012. Non-hazardous items from PIN-E Cape Peel were transported from PIN-E to PIN-D in August 2012 and disposed of in the PIN-D NHWL.

The field program was conducted on August 4, 2022, to complete Year 10 monitoring activities as described in the PIN-D Ross Point Long-Term Monitoring Plan (AANDC, 2013; LTMP), The program included visual monitoring of the NHWL, visual inspection of general site conditions, collection and analysis of groundwater samples, and surface water or soil samples, if identified. The visual and environmental monitoring inspection was documented via checklist along with a photographic record.

The Site was accessed via Twin Otter aircraft, with take off and landing on the northeast-southwest airstrip. Overall, the access roads and northeast-southwest airstrip were in good condition. Some sparce vegetation was noted around the airstrip, but the charter airline staff deemed the strip to be in good landing condition. The east-west airstrip was not inspected during the 2022 field activities due to limited time onsite. A fuel barrel was found at the intersection of the northeast-southwest airstrip and the access road. The access roads on Site, specifically between the northeast-southwest airstrip and the NHWL, were in good condition and easily traversed with a tundra wagon.

All four groundwater monitoring wells located around the NHWL were inspected and sampled as active layer groundwater was present. Groundwater samples collected from the landfill did exhibit ULA exceedances for several metal parameters, however they are not cause for concern at this time. The exceedances are not successive with previous years, are not within the contaminants of concern (COC) outlined in the Abandoned Military Sites Remediation Protocol (AMSRP), and therefore appear anomalous to historical data. The metals exceedances noted in the 2019 Year 7 report were not repeated in the results of the Year 10 monitoring, however continued observation is recommended to determine if any potential trends are established.

The overall performance condition of the NHWL is rated as acceptable in 2022 based on the severity ratings presented in AMSRP Volume II (INAC, 2009). Settlement features identified on Site do not appear to be notably changing or affecting the stability or performance of the landfill.

Based on the results of the 2022 Year 10 activities, the remediation strategy for PIN-D appears to be meeting the objectives expected for this phase of the LTMP. Geotechnical monitoring and visual inspection rate the NHWL as acceptable as per the AMSRP, consistent with the Year 7 results. The landfill condition combined with the analytical groundwater results and lack of cause for surface water or soil samples indicates little to no risk associated with contaminant migration from the landfill. Concentrations of polychlorinated biphenyls (PCBs) and petroleum hydrocarbons (PHCs) have not been detected in any of the long-term monitoring events, which began in 2013. It is recommended that sample collection and analyses for PCBs and PHCs could be discontinued and removed from the scope of future monitoring events on Site. The same recommendation was made in the Year 5 monitoring report by Arcadis.

Continuation of the monitoring schedule as written in the LTMP is recommended, with the next monitoring event being Year 15 in 2027.

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Acronyms and Abbreviations

ACM	Asbestos Containing Materials
AECOM	AECOM Canada Ltd.
ALS	ALS Environmental Laboratories
AMSRP	Abandoned Military Site Remediation Protocol
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
COC	Contaminant of Concern
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
DEW	Intermediate Distant Early Warning
DLCC	DEW Line Cleanup Criteria
DND	Department of National Defense
DO	Dissolved Oxygen
ECCC	Environment and Climate Change Canada
ESG	Environmental Sciences Group of the Royal Military College of Canada (RCM)
FIGQGs	Federal Interim Groundwater Quality Guidelines
GPS	Global Positioning System
HASP	Health and Safety Plan
INAC	Indigenous and Northern Affairs Canada (formerly AANDC)
LDPE	Low Density Polyethylene
LTM	Long-Term Monitoring
LTMP	Long-Term Monitoring Plan
NHWL	Non-Hazardous Waste Landfill
NU	Nunavut
ORP	Oxidative-Reduction Potential
PCBs	Polychlorinated Biphenyls
PHCs	Petroleum Hydrocarbons
POL	Petroleum, Oil, and Lubricants
QA	Quality Assurance
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
RDL	Reported Detection Limit
RPD	Relative Percent Difference
ULA	Upper Limit of Acceptability
UTM	Universal Transverse Mercator

1. Introduction

AECOM Canada Ltd. (AECOM) was retained by Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) to conduct the long-term monitoring (LTM) activities at former Distant Early Warning (DEW) Line site PIN-D Ross Point (herein referred to as "the Site"). PIN-D is located at 68º 35' 48.74" N, 111º 07' 3.47" W in the Kitikmeot Region of Nunavut (NU), approximately 250 kilometres (km) west of Cambridge Bay on Victoria Island, NU.

1.1 Objectives

The objective of the long-term monitoring event was to complete Year 10 monitoring activities as described in the *PIN-D Ross Point Long-Term Monitoring Plan* (INAC, 2013; LTMP). The program included visual monitoring of the Non-Hazardous Waste Landfill (NHWL), visual inspection of general site conditions and the natural environment, and collection and analysis of groundwater samples. Analysis of field data and visual observations were conducted to satisfy the requirements of the *Abandoned Military Site Remediation Protocol* (INAC, 2009; AMSRP).

1.2 Scope of Work

The scope of work for the 2022 long-term monitoring activities included the following:

- Prepare and submit a Logistics Plan detailing the work schedule.
- Prepare and submit a Work Plan detailing the work methodologies.
- Prepare and submit a detailed Health and Safety Plan (HASP).
- Mobilize to and from PIN-D Ross Point via chartered Twin Otter aircraft, with one field day on site.
- Provision of a wildlife monitor (with firearm).
- Monitoring of general site conditions (i.e., access roads and airstrip, etc.) and natural environment as outlined in Section 2.1 of the LTMP.
- Visual inspection of the NHWL in accordance with Appendix C of the LTMP. Observations will be documented via a photographic record, visual monitoring checklist, and a site map.
- Purge monitoring wells, collect in-situ field parameters, and collect groundwater samples from four (4) monitoring wells around the NHWL.
- Collect soil samples if seepage or staining is identified during visual inspection. Parameters to be analysed include: polychlorinated biphenyls (PCBs), petroleum hydrocarbons, and metals (As, Cd, Co, Cr, Pb, Ni, and Zn).
- Collect and analyse blind duplicates from at least 20% of samples.
- Submit water samples to a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for analysis of petroleum hydrocarbon (PHC) fractions (F1 and F2), total and dissolved metals, major ions, hardness, total dissolved solids, total suspended solids, pH, conductivity, and polychlorinated biphenyls (PCBs).
- Prepare a field report summarizing LTM activities within two weeks of fieldwork completion.
- Submit draft and final copies of the *PIN-D Ross Point Long Term Monitoring (Year 10) Report* to CIRNAC.

This report presents the results of the monitoring event completed in August 2022. Sections 2 and 3 provide background information on the Site and reference guideline information, respectively. Details regarding specific methodologies of each task are included in Section 4, while monitoring results are presented in Section 5. Recommendations and conclusions are available in Section 6.

2. Background Information

2.1 Site Description

PIN-D Ross Point is located approximately 250 (km) west of Cambridge Bay, NU, and 185 km east of Kugluktuk, NU, at 68º 35' 48.74" N, 111º 07' 3.47" W. Figure 1 in **Appendix A** shows the general site location. The PIN-D site was an intermediate DEW Line site constructed by the Department of National Defence (DND) in 1959 and deactivated in 1963.

The main site consisted of a module train, warehouse, garage, Inuit house, petroleum, oil and lubricant (POL) tanks, and a doppler antenna. A beach landing area was constructed with gravel roads connecting to the main site. Two airstrips were constructed: one closest to the beach, oriented east to west approximately 500 m long; and a second oriented northeast to southwest approximately 300 m long.

In 1985, a program conducted by DND, Environment Canada (currently Environment and Climate Change Canada, ECCC), and Indian and Northern Affairs Canada (INAC; currently CIRNAC) cleaned up surface contaminants on site. An investigation in 1994 observed the following:

- Damage from prolonged weathering at the module train and garage;
- Warehouse dismantled to the concrete foundation;
- Four POL tanks removed: two from the beach, and two from the main station;
- Station pumphouse remained intact with the pump removed;
- The pipeline connecting the beach and station tanks was mostly intact and marked with barrels; and
- The refueling pipeline at the beach was mostly removed with some pieces remaining.

Remediation of the site was conducted between 2011 and 2012, which involved the demolition and disposal of buildings, structures, and other debris, and the clean-up of hazardous materials and contaminated soil. A NHWL was constructed during this time and completed in August 2012 (Figure 2 in **Appendix A**). The NHWL consists of four perimeter berms constructed of granular material with 0.5 m lifts covered by 0.15 m of granular fill and a minimum 1.0 m cover of granular fill.

The NHWL contents contains the following:

- Tier I contaminated soil (i.e., soil with lead concentrations up to 500 parts per million (ppm) and PCB concentrations up to 5 ppm;
- Type A PHC contaminated soil;
- Non-hazardous site debris such as scrap metal and wood; and
- Asbestos containing materials (ACMs).

Items detailed above from PIN-E Cape Peel were transported from PIN-E to PIN-D in August 2012 and disposed of in the PIN-D NHWL.

2.2 Previous Reports and Monitoring Programs

AECOM reviewed the following reports prior to the field program:

- *PIN-D Ross Point Long Term Monitoring Event Kitikmeot Region, Nunavut* (SLR, 2020)
- *Long Term Monitoring, 2017 PIN-D, Ross Point, Nunavut* (Arcadis, 2017)
- *PIN-D Ross Point Long-Term Monitoring Plan* (AANDC, 2013)
- *Abandoned Military Site Remediation Protocol* (AMSRP) (INAC, 2009)

The requirements for long-term monitoring as laid out in the AMSRP include:

- **Phase I**: Years 1, 3, and 5
- **Phase II**: Years 7, 10, 15, and 25
- **Phase III**: Beyond Year 25, if required

The monitoring plan at PIN-D Ross Point began in 2013 and was scheduled every other year for the first seven years, decreasing frequency to Years 10, 15, 20 and 25. The program will be reviewed at the end of Year 25 to assess the need for continued monitoring.

3. Reference Guidelines

Review of the PIN-D LTMP and AMSRP identified the applicable guidelines for use in the LTM program. The following sections describe the reference guidelines selected for each type of sample collected at the Site.

3.1 Groundwater

Four monitoring wells, MW-1 – MW-4, were installed in 2012 at the Site surrounding the NHWL: one upgradient (MW-2), and three downgradient (MW-1, MW-3, MW-4). Due to the absence of Regulatory groundwater criteria, AECOM applied Upper Limits of Acceptability (ULAs), as per the AMSRP, instead of Canadian Council of Ministers of the Environment (CCME) Federal Interim Groundwater Quality Guidelines (FIGQGs) which have receptor and land use scenarios that do not apply to PIN-D. As such, the analytical data for groundwater were compared to available historical data from the Site. According to the AMSRP, if the analytical results are within the average +/- three (3) standard deviations, the landfill is deemed acceptable and performing as expected. If the analytical results do not meet these criteria, further measures are recommended ranging from increasing monitoring frequency to development of a new remedial plan. Further, due to the presence of permafrost, shallow groundwater depth, and a lack of nearby communities, it is assumed that groundwater will not be used as drinking water in this area.

As per the AMSRP, ULAs were calculated using the average + three (3) standard deviations of all available data from 2015 to 2019. ULAs were only calculated for a limited number of parameters since baseline data is sparse, and concentrations for many parameters are below detectable limits. Duplicates were omitted from the calculations as to not over-represent results from one well in the ULA calculation. Tables D-7 to D-10 in **Appendix D** summarize the available historical groundwater data and the calculated ULAs (where available). Due to the nature of the ULA calculation, inclusion of new historical data for each monitoring event results in increasing ULA values when previous exceedances are included in the data set. As a result, the elevated metals concentrations from Year 7 have influenced the ULA calculation and therefore raised the ULA values for Year 10 analyses.

For PIN-D, no groundwater data is available from the year of installation. Groundwater samples were collected from monitoring wells in 2013, 2015, 2017, and 2019, which represent Years 1, 3, 5, and 7 of the LTMP, however, limited data is available from previous monitoring events as wells were either frozen or dry within the active layer.

For the purposes of the 2017 Year 5 LTM Report, Arcadis considered baseline data to be 2013 and 2015 so that ULA criteria could be calculated for total and dissolved metals, and inorganic parameters. There is insufficient historical and baseline information to calculate ULAs for other parameters including PCBs and PHCs.

3.2 Surface Water

Due to the absence of appropriate surface water criteria, the analytical data for surface water was compared to available historical data from the Site. According to the AMSRP, if the analytical results are within +/- three (3) standard deviations, the landfill is deemed acceptable and performing as expected. If the analytical results do not meet criteria, further measures are recommended ranging from increasing monitoring frequency to development of a new remedial plan.

No baseline surface water samples exist for the Site. Given the absence of appropriate reference guidelines or baseline reference data, the CCME guidelines for Protection of Aquatic Life are used purely as a point of reference and are not meant to be interpreted as criteria. The CCME guidelines are a conservative reference as the closest permanent surface water body is approximately 840 m from the NHWL.

3.3 Soil

In 2009, Environmental Science Group (ESG) of the Royal Military College of Canada (RMC) conducted a background geochemical assessment at PIN-D Ross Point. This assessment established the natural levels of inorganic parameters in the surrounding environment. As a result of the analysis, it was recommended that the DEW Line Cleanup Criteria (DLCC) be used for lead, cadmium, arsenic, cobalt, chromium, nickel, and zinc. Background concentrations of copper were found to be elevated with outlier values of 254 ppm and 221 ppm in various geologic units.

Baseline soil samples were collected in 2011 by AECOM at the NHWL footprint prior to construction and tested for PHCs, PCBs, and metals; results of which showed no exceedance of the DLCC Tier I and II in soils (Tables E-1 to E-5 in **Appendix E**).

Soil samples have not been collected during the previous three monitoring events (including the 2022 LTM monitoring event) as no seepage or staining has been observed. Should samples be collected in future programs, analytical results will be compared to the background results collected by ESG and baseline collected by AECOM with calculated ULAs as the guideline per the AMSRP.

4. 2022 Monitoring Program Methodologies

The Site investigation for the 2022 PIN-D Long-Term Monitoring Program was completed on August 4, 2022, by AECOM personnel David Bugden and Alysha Selinger, accompanied by CIRNAC representative Melanie Netser, wildlife monitor Noah Alookie, and field technician Max Dubeau from Nunatta Environmental. The Site was accessed by Twin-Otter aircraft chartered by Kenn Borek Air Ltd. mobilizing from Kugluktuk, NU. Logistics for the Site visit were carried out as per the Logistics Plan provided under a separate cover. A summary of the activities, field notes, and analyses can be found in **Appendices C** through **E**.

4.1 Health and Safety Plan

In preparation for the field program, a site-specific HASP was produced and submitted to CIRNAC previously under a separate cover. The HASP identified risks and suspected hazards associated with work on the Site. It specifically addressed any known or suspected hazards and provided mitigative measures including protocols for COVID-19. Included in the HASP were emergency contacts and procedures for medical, mechanical, or weather emergencies. Prior to the start of work, a review of the HASP was completed with all personnel involved in the field program.

4.2 Geotechnical Monitoring and Visual Inspection

The physical integrity of the NHWL was inspected at the PIN-D site during the 2022 long-term monitoring event. The visual inspection looked for evidence of:

- Erosion, ponding, frost action, settlement, and lateral movement;
- Animal burrows, vegetation, vegetation stresses; and
- Staining or seepage.

These features were documented by use of the visual monitoring checklist and through site photographs. Site features documented in the previous monitoring event were specifically inspected for any observed changes, and new features observed during the 2022 visual monitoring were added to the figure markup.

4.3 Groundwater Sampling Methodology

The following outlines the methodology prepared for this program. Water level and depth to bottom were recorded, and an approximate well volume calculated. Samples were collected from all four groundwater wells using a peristaltic pump and dedicated disposable polyethylene tubing to purge and sample using low-flow methodology. The following recordings were taken prior to sampling; water level, total depth of water, height of well casing above surface (stick-up), presence of hydrocarbons, and hydrocarbon thickness (if applicable). Prior to the collection of representative groundwater samples, the monitoring wells were purged until water quality parameters stabilized, including dissolved oxygen (DO), oxidative-reduction potential (ORP), temperature, pH, conductivity, and turbidity. All field parameters were recorded prior to sampling. Parameter readings during the purging process were recorded every 3-5 minutes, aiming for three consecutive readings within 5% prior to sampling. If stabilization could not be achieved before depletion of the water column, purging would stop, and sample collection would begin. Laboratory supplied containers were filled, packed in coolers, and shipped with ice to CALA accredited ALS Environmental Laboratories (ALS) in Edmonton, AB, for analysis.

Samples were analyzed for:

- Total and dissolved metals;
- Major ions, hardness, total dissolved solids, total suspended solids; and
- pH, conductivity.

4.4 Surface Water Sampling Methodology

The following outlines the methodology prepared for this program in the event surface water was identified on site.

Following the collection of each water sample, temperature, pH, dissolved oxygen, and conductivity were recorded using a YSI 6920 V2 probe. Observations such as turbidity, evidence of groundwater indicators (surface sheen, vegetation), presence or evidence of aquatic life, and human and/or animal presence on site were also to be noted.

All collected surface water samples were placed in appropriate laboratory-supplied clean sample bottles, placed in insulated coolers (provided by ALS Laboratory) to be maintained between 0 and 10ºC, and shipped to the laboratory under a Chain of Custody. Global Positioning System (GPS) UTM coordinates were to be documented for surface water sampling locations.

Samples were to be analyzed by a CALA accredited laboratory for:

- PHC Fractions F1 and F2 (C6-C16);
- Total and dissolved metals;
- PCBs; and
- Total suspended solids, total dissolved solids, and routine parameters including major ions and hardness.

4.5 Soil Sampling Methodology

In the event visual inspection identified the need for soil samples collection, samples were to be collected with a small trowel decontaminated with a laboratory-grade biodegradable cleaner (Alconox®) and rinsed between sampling locations. Soil samples were to be collected to a maximum depth of 30 cm and packed into laboratory supplied jars with minimal to no headspace. Samples were to be kept cool and packed on ice for shipment to the receiving laboratory.

The following parameters were to be analysed:

- PHC Fractions F1-F4;
- PCBs; and
- Metals.

4.6 Quality Assurance and Quality Control

A Quality Assurance/Quality Control (QA/QC) program was followed during the monitoring event to verify sampling and analytical data collected are interpretable, defensible, and comparable. This involved following QA/QC measures in both the collection and analysis of environmental samples.

Quality Control (QC) measures used in the collection, preservation, shipment, and analysis of samples included the following:

- Sampling techniques were performed in accordance with standard written AECOM protocols;
- Thorough field notes taken during the site visit;
- All samples collected in laboratory provided sample containers, and kept cool prior to shipment;
- Samples assigned unique sample control numbers and transported under chain of custody procedures; and
- The analytical laboratory chosen had proficiency certification issued by CALA.

Quality Assurance (QA) measures established for the investigation included collection of field duplicate samples at a rate of at least 20%. A blind duplicate sample consists of a second aliquot of an individual sample submitted to the analytical laboratory under a separate label such that the analytical laboratory has no prior knowledge that it is a duplicate.

The relative percent difference (RPD) between duplicate results was used to assess overall sampling precision. The RPD is a measure of the variability between two duplicate analyses and is calculated by the following equation:

$$RPD = 100 \times ((2 \times (x_1 - x_2))/(x_1 + x_2))$$

Where x_1 is the primary results and x_2 is the blind duplicate result.

Acceptable RPD values vary on the analytical parameters, the sample matrix, and concentrations of analytes in the sample. For metals in soils acceptable RPD values are 35%, and 50% for organics in soils (PHCs and PCBs). Only when concentrations are at least 10 times the method detection limit are RPD calculations considered valid.

5. Results

This section presents a summary of the analytical results and observations collected during the 2022 Year 10 monitoring activities. Drawings, with inspection feature markups, are provided in **Appendix A**. Photographs of the Site taken during the Site monitoring program are presented in **Appendix B**. The Visual Inspection Checklist can be found in **Appendix C.**

5.1 Non-Hazardous Waste Landfill

5.1.1 Geotechnical Monitoring and Visual Inspection

During the ground inspection, the perimeter of the landfill was walked. Any defects found on the top cap, slopes, and extending area from the base of the landfill was recorded. The following subsections describe the results of the geotechnical monitoring visual inspection completed at the landfill and immediate surrounding area.

5.1.1.1 Frost and Settlement

Some small areas of settlement were noted on the northwest corner and the east side of the landfill cover (see Photographs 2, 9 and 10 in **Appendix B**). Additional settlement was noted on the toe of the south slope near a poorly graded area, as well as near the toe of the slope on the east side (see Photographs 4 and 8 in **Appendix B**). These areas of settlement were previously identified in the 2019 inspection report (SLR, 2020) and do not appear to have worsened.

5.1.1.2 Erosion

No signs of erosion were observed during the investigation. It was recorded that the north and south sides of the landfill were poorly graded near the toe with large marks left over by grading equipment from landfill construction (see Photographs 3 and 4 in **Appendix B**). This observation was also previously identified in the 2019 inspection (SLR, 2020) and the condition remains consistent.

5.1.1.3 Animal Presence

No evidence of wildlife activity was noted at the NHWL; no animals were sighted, nor burrows noted during the investigation.

5.1.1.4 Debris

No exposed debris was noted around the landfill cell; however, a few pieces of scattered wood and asphalt shingles were noted around site (see Photographs 25 through 27 in **Appendix B**). Scattered debris was noted in the previous 2017 and 2019 inspections.

5.1.1.5 Staining

During the inspection no observations of staining were observed.

5.1.1.6 Vegetation Stress

No significant vegetation was noted around the NHWL, some sparce vegetation was beginning to develop on the landfill slopes (see Photographs 12 and 13 in **Appendix B**).

5.1.1.7 Seepage and Ponding

During the inspection, no indication of seepage or active seepage points were observed.

5.1.1.8 Monitoring Instruments

All four (4) monitoring wells MW-1, MW-2, MW-3 and MW-4 installed around the perimeter of the NHWL, were found to be in good condition.

5.1.2 Groundwater Monitoring

During the inspection, all 4 groundwater monitoring wells located around the NHWL were inspected and sampled. At the time of assessment, the well locks were removed and replaced with Guard 111 keys. The well casings appeared in good condition. Active layer groundwater was present during the 2022 monitoring event and as a result, all monitoring wells were sampled during the inspection. During the inspection, a blind field duplicate was also collected from MW-1. A slow recharge at MW-4 resulted in eight recharges to fill all sample bottles. Well locations are provided in **Table 5-1** and shown in Figure 2 of **Appendix A**.

Table 5-1: PIN-D Ross Point Groundwater Well Locations

Well	UTM83-12 Northing	UTM83-12 Easting
MW-1	7609254.26	495370.94
MW-2	7609139.94	495415.21
MW-3	7609277.60	495409.70
MW-4	7609295.18	495443.20

The AMSRP suggests analytical results be compared to previous data, and if the groundwater concentrations are within range of the average +/- three standard deviations, the landfill is performing acceptably. The average + three standard deviations of all available historical data form the ULA, which was applied to the present data as reference criteria.

Field parameters for the groundwater monitoring wells are summarized in Table D-1 in **Appendix D**. Analytical results from the Year 10 monitoring event can be found in Tables D-2 to D-6 of **Appendix D**. Tabulation of all historical groundwater results collected since 2013 are presented in Tables D-7 to D-10 of **Appendix D** for trend evaluation.

Table 5-2 summarizes the exceedances of calculated ULAs for groundwater samples analyzed at the NHWL during the 2022 long-term monitoring event.

Table 5-2: Summary of ULA Exceedances in Groundwater at the NHWL

Parameter	Result	ULA
MW-1		
General Chemistry		
Nitrate	6.83 mg/L	2.45 mg/L
Metals		
Thallium, Dissolved	0.000067 mg/L	0.000055 mg/L
MW-1 – DUP		
General Chemistry		
Nitrate	6.56 mg/L	2.45 mg/L
Metals		
Thallium, Dissolved	0.000071 mg/L	0.000055 mg/L
MW-3		
General Chemistry		
Nitrate	4.53 mg/L	2.45 mg/L
Metals		
Thallium, Dissolved	0.000083 mg/L	0.000055 mg/L
MW-4		
Metals		
Silicon, Dissolved	2.64 mg/L	1.54 mg/L
Strontium, Dissolved	0.0866 mg/L	0.0823 mg/L

Several metal exceedances were identified in the Year 7 monitoring event, none of which were repeated in the Year 10 data. Dissolved Thallium exceeded the ULA at MW-1, MW-1-DUP, and MW-3 in 2022, however based on the historical data set, 2022 was the first monitoring event that Thallium exceeded the ULA. It should be noted the

laboratory reported detection limits (RDLs) for iron and vanadium were higher than the calculated ULA for these two parameters; therefore, it is unknown if the concentrations for these parameters exceeded the ULA. Overall, the Year 10 ULA exceedances in the analytical data were not observed in successive sampling events (2019 and 2022), therefore as defined by the LTMP, the exceedances reported in 2022 appear anomalous to historical data (see Table D-8 in **Appendix D** for historical data). Further discussion on the nitrate exceedances is provided in **Section 5.3.3** pertaining to analytical QA/QC.

All PCB and PHC concentrations were below laboratory detection limits, consistent with previous monitoring years.

5.1.3 Surface Water Monitoring

Surface water ponding or seepage was not observed; this is consistent with baseline and previous monitoring events. No samples were collected during the 2022 long-term monitoring event.

5.1.4 Soil Monitoring

No soil samples were collected at the time of the 2022 long-term monitoring event as there was no evidence of seepage or staining.

5.1.5 Landfill Performance

The overall performance condition of the NHWL is rated as acceptable in 2022 based on the severity ratings presented in AMSRP Volume II (INAC, 2009). This is consistent with the previous condition documented in Year 7 (SLR, 2020). Settlement features identified on Site do not appear to be notably changing or affecting the stability or performance of the landfill. The landfill condition combined with the analytical groundwater results and lack of cause for surface water or soil samples indicates little to no risk associated with contaminant migration from the landfill.

5.2 Site Condition

Overall, the access roads and northeast-southwest airstrip were in good condition. The east-west airstrip was not inspected during the 2022 field activities due to limited time onsite. A fuel barrel was found at the intersection of the northeast-southwest airstrip and the access road (see Figure 1 in **Appendix A** and Photograph 15 in **Appendix B**). Some sparce vegetation was noted around the airstrip, but the Kenn Borek staff deemed the strip to be in good landing condition (see Photographs 18 and 19 in **Appendix B**). The access roads on Site, specifically between the northeast-southwest airstrip and the NHWL, were in good condition and easily traversed with a tundra wagon (see Photographs 22-24 in **Appendix B**).

5.3 QA/QC Discussion

Field procedures were implemented to minimize the potential of cross contamination between sampling locations. Sample handling protocols were established to track and maintain the integrity of the samples. Field handling of samples was minimized by transferring samples directly into containers, when possible. Where handling is required, disposable nitrile gloves were used at all times and changed between samples. All monitoring equipment was decontaminated prior to initial use and between each sample location. During groundwater sampling, disposable low-density polyethylene (LDPE) and master flex tubing was dedicated to the individual wells and during all sampling activities, a new pair of disposable nitrile gloves was used between each sample. Photographs were taken of all areas of interest; location and directional viewpoint was recorded.

5.3.1 Duplicate Samples

A duplicate sample is a sequential sample taken immediately following the collection of a regular sample. The duplicate samples were collected for approximately 25 percent (%) of the samples collected as part of the QA/QC sampling program. This equates to one duplicate per four wells sampled. Duplicate samples provide a rough estimate of the overall variability of the field technique and laboratory analysis.

5.3.2 Relative Percent Difference

The relative percent difference (RPD) is the absolute difference between the duplicate analysis values divided by the mean and is used to evaluate the variability of sample results. Where the concentration of a parameter is less than five times the laboratory reportable detection limit (RDL), the results are less precise and the RPD is not calculated. The guidance manual for *Environmental Site Characterization in Support of Human Health Risk Assessment, Volume I* (CCME, 2016) acknowledges added variability introduced by matrix variability and sampling and handling procedures, therefore quantifying acceptable precision is a matter of judgement. Given the Site considerations and literature, a RPD of 50% for parameters of duplicate groundwater samples was selected for this assessment. The guide also recommends RPDs for laboratory duplicates not exceed 20%. Should either of these limits be exceeded, a potential problem may be indicated such as compromised sample collection, equipment malfunction, or handling errors.

5.3.3 Analytical QA/QC

Both samples were analyzed by ALS Environmental Laboratories which is accredited by CALA for the parameters proposed for analysis and uses recognized methods to conduct laboratory analyses. As conveyed by the laboratory, method blanks, certified reference materials, method spikes, duplicates, surrogates, and laboratory control samples are routinely analyzed as part of their QA/QC programs. Analytical QA/QC was completed by ALS by way of analytical method blanks, analytical control spikes and analytical duplicates.

Hold times for pH, nitrate, and nitrite were exceeded. The hold time exceedances were in part due to logistical constraints of shipment from the Site to ALS in Edmonton, AB, for analysis. As stated in ALS laboratories guidance document, “Hold Times: General Information of Exceedances (2017), hold times are established and intended as best-practice to protect the integrity of the test samples and minimize the potential for significant changes to samples prior to analysis” (ALS, 2017). If exceeded, it is common practice to apply professional judgement to assess whether the results may still be useable and fit-for-purpose. It was expected that the hold time for pH would exceed, and as a standard procedure, field measurements were collected to represent conditions at the time of sampling (see **Appendix D**). Based on recommendations from ALS, test results with hold time exceedances less than 50% of the recommended hold time may be considered valid and defensible, with the caveat that the measurement uncertainty associated with those tests may be higher than usual.

For significant hold time exceedances such as samples for nitrate and nitrite, the environmental stability characteristics for the specific sample should be considered prior to determining whether the test results are fit-for-purpose. ALS recommends that consistency with historical, expected, or available test results from related or similar samples be considered. Results for nitrite were below the detectable limit. Results for nitrate were significantly higher than previous years by approximately 116% - 140% and are not considered fit-for-purpose as defined by ALS.

Logistical challenges were expected working in remote locations, and some hold time exceedances were anticipated. For future monitoring programs, implementing methods to expedite sample delivery would help to reduce uncertainty related to the results.

The complete analytical quality control report can be found as part of the certificate of analyses in **Appendix F**.

6. Conclusion and Recommendations

Based on the results of the 2022 Year 10 activities, the remediation strategy for PIN-D appears to be meeting the objectives expected for this phase of the LTMP. Geotechnical monitoring and visual inspection rate the NHWL as acceptable per the severity ratings presented in AMSRP Volume II, consistent with the Year 7 results. Settlement features identified on Site do not appear to be notably changing or affecting the stability or performance of the landfill. The landfill condition combined with the analytical groundwater results and lack of cause for surface water or soil samples indicates little to no risk associated with contaminant migration from the landfill. It is recommended that monitoring continue for Year 15 as per the schedule in the LTMP.

Groundwater samples collected from the landfill did exhibit ULA exceedances for several metal parameters, however they are not cause for concern at this time. The exceedances are not successive with previous years, are not within the contaminants of concern (COC) outlined in the AMSRP, and therefore appear anomalous to historical data. The metals exceedances noted in the Year 7 report were not repeated in the results of the Year 10 monitoring, however continued observation is recommended to determine if any potential trends are established. Concentrations of PCBs and PHCs have not been detected in any of the long-term monitoring events, which began in 2013. It is recommended that sample collection and analyses for PCBs and PHCs could be discontinued and removed from the scope of future monitoring events on Site. The same recommendation was made in the Year 5 LTM report by Arcadis (Arcadis, 2018).

Groundwater wells were locked with Guard Key 111 and additional keys sets were left with a CIRNAC representative. It is recommended keys are provided for the next monitoring event to avoid cutting and replacement of locks on site. Further, it is recommended additional locks are brought to site during the future visits in the event locks are found missing or damaged.

The Site was accessed via Twin Otter aircraft, with take off and landing on the northeast-southwest airstrip, which was deemed to be in good condition by the charter airline staff. It is understood that a helicopter was used in the previous monitoring event, mobilizing from Cambridge Bay. Currently both methods of transport are acceptable for Site access.

7. References

Arcadis Canada Inc. (Arcadis). 2018. Long Term Monitoring, 2017 - PIN-D, Ross Point, Nunavut. Prepared for Indigenous and Northern Affairs Canada. January 18, 2018.

Canadian Council of Ministers of the Environment (CCME). 2016. Environmental Site Characterization in Support of Human Health Risk Assessment, Volume I.

Indigenous and Northern Affairs Canada (INAC). 2013. PIN-D Ross Point Long-Term Monitoring Plan. March 28, 2013.

INAC. 2009. Abandoned Military Site Remediation Protocol.

SLR Consulting Canada Ltd. (SLR). 2020. PIN-D Ross Point Long Term Monitoring Event - Kitikmeot Region, Nunavut. Prepared for Crown-Indigenous Relations and Northern Affairs Canada. January 8, 2020.

Appendix A

Drawings

LEGEND

- FUEL BARREL

0 250 500 m

1:10000

NOTES:
1. ALL COORDINATES ARE REFERENCED TO NAD83 UTM ZONE 12.
2. IMAGERY FROM ARCGIS DATAMAP.

Issue Status: FINAL

2022 Nunavut Sites Long-Term Monitoring
PIN-D Ross Point (Year 10)
Crown-Indigenous Relations and Northern Affairs Canada
Project No.: 60686962 Date: 2023-01-11

NON-HAZARDOUS WASTE LANDFILL
LOCATION PLAN

AECOM

Figure 1

SITE LOCATION PLAN
N.T.S.

LEGEND

- MW — MONITORING WELL
- SETTLEMENT
- FUEL BARREL

NOTES:
1. ALL COORDINATES ARE REFERENCED TO NAD83 UTM ZONE 12.
2. IMAGERY FROM ARCGIS DATAMAP.

0 25 50 m
1:1000

Issue Status: FINAL

2022 Nunavut Sites Long-Term Monitoring
PIN-D Ross Point (Year 10)
Crown-Indigenous Relations and Northern Affairs Canada
Project No.: 60686962 Date: 2023-01-11

NON-HAZARDOUS WASTE LANDFILL
VISUAL INSPECTION

AECOM

Figure 2

Appendix B

Photographic Record

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
1	8/4/2022

Direction Photo Taken

Northeast

Area

NHWL

Description

West slope of NHWL in good condition.

Photo No.	Date
2	8/4/2022

Direction Photo Taken

East/Southeast

Area

NHWL

Description

Northwest corner of NHWL. Settlement at corner toe (circled).

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
3	8/4/2022

Direction Photo Taken: East

Area: NHWL

Description: North slope of NHWL. Poor dozer grading on lower portion of slope (cricled).

Photo No.	Date
4	8/4/2022

Direction Photo Taken: South

Area: NHWL

Description: South Slope of NHWL. Poor dozer grading on west portion of slope (circled).

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
5	8/4/2022

Direction Photo Taken: Southwest

Area: NHWL

Description: Northeast corner of NHWL in good condition.

Photo No.	Date
6	8/4/2022

Direction Photo Taken: West

Area: NHWL

Description: East slope of NHWL in good condition.

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
7	8/4/2022

Direction Photo Taken: Northwest

Area: NHWL

Description: Southeast corner of NHWL. Area of settlement on south slope partially visible (circled).

Photo No.	Date
8	8/4/2022

Direction Photo Taken: Northeast

Area: NHWL

Description: South slope of NHWL. Area of settlement near base of slope (circled).

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
9	8/4/2022

Direction Photo Taken

Northeast

Area

NHWL

Description

NHWL cover in good condition overall. Area of minimal settlement along east side (circled).

Photo No.	Date
10	8/4/2022

Direction Photo Taken

North-Northeast

Area

NHWL

Description

NHWL cover in good condition. Area of settlement from Photograph 9 partially visible (circled).

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
11	8/4/2022

Direction Photo Taken: Northwest

Area: NHWL

Description: NHWL cover in good condition.

Photo No.	Date
12	8/4/2022

Direction Photo Taken: Northwest

Area: NHWL

Description: NHWL cover and northern portion of west slope. Sparse revegetation of slope.

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
13	8/4/2022

Direction Photo Taken

Northeast

Area

NHWL

Description

NHWL cover and eastern portion of north slope. Sparse revegetation of cover and lower slope.

Photo No.	Date
14	8/4/2022

Direction Photo Taken

West

Area

Site Condition

Description

Access road in good condition.

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
15	8/4/2022

Direction Photo Taken: Northeast

Area: Site Condition

Description:

Fuel drum located at intersection of airstrip and access road. Estimated to be approximately 2/3 full. Sealed, but bungs are rusted.

See Figure 1 in Appendix A.

Photo No.	Date
16	8/4/2022

Direction Photo Taken: South

Area: Site Condition

Description:

Access road to PIN-D main station from airstrips, NHWL in background (circled).

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
17	8/4/2022

Direction Photo Taken

North

Area

Site Condition

Description

Access road from NHWL back down towards the airstrips.

Photo No.	Date
18	8/4/2022

Direction Photo Taken

Northeast

Area

Site Condition

Description

Northeast-Southwest airstrip in good condition. Sparce vegetation on surface and slopes.

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
19	8/4/2022

Direction Photo Taken

Southwest

Area

Site Condition

Description

Northeast-Southwest airstrip in good condition. Sparce vegetation on surface and slopes.

Photo No.	Date
20	8/4/2022

Direction Photo Taken

North

Area

Site Condition

Description

Groundwater sampling at MW-4.

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
21	8/4/2022

Direction Photo Taken

N/A

Area

Site Condition

Description

MW-3 in good condition.

Photo No.	Date
22	8/4/2022

Direction Photo Taken

East

Area

Site Condition

Description

Access road in good condition.

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
23	8/4/2022

Direction Photo Taken

North

Area

Site Condition

Description

Access road in good condition.

Photo No.	Date
24	8/4/2022

Direction Photo Taken

North

Area

Site Condition

Description

Access road facing Airstrip in good condition.

AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
25	8/4/2022

Direction Photo Taken

N/A

Area

Site Condition

Description

Scattered debris across site.

Photo No.	Date
26	8/4/2022

Direction Photo Taken

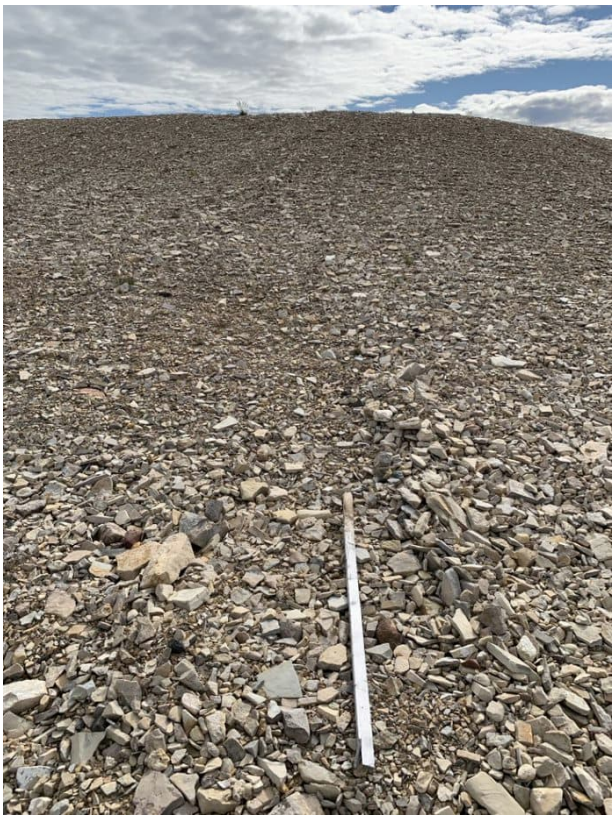
N/A

Area

Site Condition

Description

Scattered debris across site.



AECOM

PHOTOGRAPHIC LOG

Site Name:	Site Location	Project No.
PIN-D Long-Term Monitoring – Year 10	Ross Point, NU	60686962

Photo No.	Date
27	8/4/2022

Direction Photo Taken

N/A

Area

Site Condition

Description

Scattered debris across site.

Appendix C

Monitoring Checklist and Daily Field Report

VISUAL MONITORING CHECKLIST

ITEM	PRESENCE / ABSENCE	EXTENT	DESCRIPTION / PHOTOGRAPHIC REFERENCE
Settlement	Yes	Small areas on northwest corner and east side of landfill cover, also on south slope and near toe on east side	Areas were previously identified in 2019 inspection [Photographs 2, 4, 8, 9, 10 in Appendix B]
Erosion	No	-	-
Frost Action	No	-	-
Animal Burrows	No	-	-
Vegetation	Yes	Some sparse clumps of vegetation	Vegetation beginning to develop on landfill cover and slopes [Photographs 12, 13, 18, 19 in Appendix B]
Staining	No	-	-
Vegetation Stress	No	-	-
Seepage Points	No	-	-
Exposed Debris	Yes	No exposed debris from landfill cell. Couple of pieces of scattered wood and shingles	Very little debris [Photographs 25, 26, 27 in Appendix B]
Condition of Monitoring Instruments	N/A	All groundwater wells	Good condition
Other Features of Note	N/A	-	-

NATURAL ENVIRONMENT CHECKLIST

ITEM	PRESENCE / ABSENCE	EXTENT	DESCRIPTION / PHOTOGRAPHIC REFERENCE
Wildlife Sightings	No	-	-
Evidence of Wildlife	No	-	-
Wildlife Activity	No	-	-
Relative Number	N/A	-	-
Evidence of Revegetation	Yes	Sparse	Some vegetation on northeast-southwest airstrip [Photograph 18 in Appendix B]

Groundwater Sampling
Field Data

PIN-D
Year 10 2022

AECOM

Aquatics Monitoring								
Time	**Temperature (°C)**	**Conductivity (µS/cm)**	**pH**	**ORP (mV)**	**NTU**	**ODO (mg/L)**	**Water Level (mTOC)**	**Note(s)**
MW-1								
11:50	4.11	620	6.42	194.0	6.2	9.41	-	
11:52	3.01	588	7.02	172.0	5.4	9.55	-	
11:55	3.40	501	7.13	164.2	4.9	9.34	-	
11:58	3.53	497	7.21	159.0	6.1	9.63	-	Duplicate
12:01	3.61	499	7.26	157.2	8.6	9.67	-	
12:03	3.30	506	7.27	155.3	7.7	9.80	-	No odour and clear
12:06	3.14	504	7.30	154.1	7.3	9.81	-	
12:09	3.14	501	7.31	153.1	7.5	9.82	2.910	
12:12	2.98	501	7.33	152.0	7.8	9.81	2.910	
12:15	2.96	497	7.34	151.3	7.4	9.82	-	
MW-2								
2:57	8.81	356	8.05	107.2	25.2	10.86	2.780	
3:00	4.72	314	8.23	105.1	10.7	11.46	2.720	
3:03	4.07	303	8.22	106.3	6.1	11.65	2.780	
3:06	3.80	297	8.20	108.5	4.2	11.44	2.780	No odour and clear
3:09	3.50	356	8.19	110.2	7.3	11.70	2.780	
3:12	3.35	293	8.20	111.1	8.6	11.63	2.780	
3:15	3.50	292	8.19	111.6	5.9	11.54	2.780	
3:18	3.50	293	8.20	113.0	1.5	11.54	2.780	
MW-3								
12:45	3.17	444	7.54	141.7	6.2	8.64	2.075	
12:48	2.88	432	7.57	139.6	2.8	8.50	2.075	
12:51	2.97	425	7.56	139.7	3.3	8.65	2.075	
12:54	2.92	423	7.55	139.6	2.4	8.70	2.073	No odour and clear
12:57	2.95	422	7.58	139.4	1.8	8.67	-	
1:00	3.03	421	7.58	139.3	1.7	8.62	2.077	
1:03	3.00	420	7.58	139.5	1.6	8.60	2.082	
MW-4								
1:20	5.39	453	7.83	141.0	48.8	9.02	-	Well pumped dry. Turned off to recharge after initial 4 min pump. After 28 min water level was 1.875 then pumped dry in 3 minutes. Recharged 8 times to fill all sample bottles.
1:48	8.77	467	8.77	139.7	42.3	9.10	1.875	

Notes:
ORP - Oxidative-Reduction Potential
NTU - Nephelometric Turbidity Units
ODO - Optical Dissolved Oxygen
mTOC - Distance (metres) from top of casing (TOC) down into well

Depth to Water (mTOC)	Depth to Bottom (mTOC)	Stick Up (mTOC)
MW-1		
2.881	2.957	0.62
MW-2		
2.764	2.805	0.60
MW-3		
2.048	2.278	0.53
MW-4		
1.825	1.977	0.37

Notes:
mTOC - Distance (metres) from top of casing (TOC) down into well
Depth to Water - Depth from top of casing to top of water surface
Depth to Bottom - Depth from top of casing to bottom of well
Stick Up - Height of well casing from ground surface to top of casing

AECOM

Project Daily Report			
Client:	CIRNAC	**Date:**	4-Aug-22
Project:	Nunavut Sites LTM	**Weather:**	9°C light rain at takeoff
Project No.:	60686962		
Location:	Kugluktuk / PIN-D	**Number of Personnel On-Site :**	7
Departure Time:	9:30 AM MST	**Return Time:**	6:45 PM MST

Company			Total # Workers
AECOM	David Bugden	Alysha Selinger	2
CIRNAC	Melanie Netser		1
Nunatta	Max Dubeau	Noah Alookie	2
Kenn Borek	Brian Good	Travis Fawcett	2
Total			**7**

Health and Safety

Observations/Near Misses/Incidents/H&S Issues

Observation: David confirmed no members of the field team had peanut allergies prior to opening his trail mix. This then sparked a discussion as to whether any team members had allergies the group should be aware of (no one declared any).

Technical Scope

Geotechnical Inspection

Visual inspection of the landfill, air strip, and overall site. The site was in very good condition, no signs of erosion or seepage, minor settlement features (observed in previous monitoring event). Pilots were impressed with the air stip conditions. Area showed signs of revegetation and naturalization.

Aquatic Monitoring

Low-flow sampled all four (4) wells on site. MW-4 had a very slow recharge and required eight recharge periods (10-40 min each) to fill the sample bottles. Well casings were in good condition. Locks had to be cut and replaced - now keyed with Guard 111 keys.

Temperature Monitoring

N/A

Communications or Deviation from Work Plan

Departure from Kugluktuk was delayed approx. 30 min due to refuelling delays. Field team was able to land and perform required activities at PIN-D as planned.

Other:

A single fuel drum was found on site near the air strip. No signs of leakage. Estimaed to be approx. two thirds full. Bung was rusted shut. Labels indicate ownership is Department of Environment - Polar Bear Division circa 2015.

Project Daily Photo Record

Photograph 1: Low-Flow Sampling at MW-3

Photograph 2: Fuel Drum found at Air Strip

S. Sather, Department of Environment, Gov't of Nunavut
Box 91, Cambridge Bay NU X0B 0C0, 867-983-4167
PO # 154045
Gross Weight 781 KG, Width 1.21M, Length 1.21M, Height 1.21M

Photograph 3: Fuel Drum Details

Appendix D

Groundwater Tables

TABLE D-1

PIN-D
Year 10 2022

In-situ Field Parameters of Groundwater Monitoring Wells

Parameter	Units	MW-1	MW-2	MW-3	MW-4
		4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022
Field Parameters		Year 10	Year 10	Year 10	Year 10
Depth to Water	mTOC	2.881	2.764	2.048	1.825
Depth to Bottom	mTOC	2.957	2.805	2.278	1.977
Stick Up	mTOC	0.62	0.6	0.53	0.37
Temperature *	ºC	2.96	3.5	3	8.77
Conductivity *	µS/cm	497	293	420	467
pH *	-	7.34	8.2	7.58	8.77
ORP *	mV	151.3	113	139.5	139.7
NTU *	NTU	7.4	1.5	1.6	42.3
Dissolved Oxygen *	mg/L	9.82	11.54	8.6	9.1
Water Level **	mTOC	2.91	2.78	2.082	1.875

Notes:

MW-4 continuously went dry during sampling; sampled with 8 recharges.

mTOC - Distance (metres) from top of casing (TOC) down into well

Depth to Water - Depth from top of casing to top of water surface

Depth to Bottom - Depth from top of casing to bottom of well

Stick Up - Height of well casing from ground surface to top of casing

* - Last recorded YSI probe flow-though cell parameters prior to sampling

** - Water level recorded in conjunction with YSI probe parameters, measured as per Depth to Water

TABLE D-2

General Chemistry of Groundwater Monitoring Wells

PIN-D
Year 10 2022

Parameter	Units	RDL	Reference Criteria (ULA)	MW-1	MW-1 - DUP	MW-2	MW-3	MW-4
				4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022
General Chemistry				Year 10	Year 10	Year 10	Year 10	Year 10
Physical Tests								
Conductivity	µS/cm	2	924	479	476	281	408	544
Hardness (as CaCO3), dissolved	mg/L	0.5	491	264	262	151	212	277
pH	pH units	0.1	9.07	7.85	7.95	8.13	7.96	8.02
Total Suspended Solids (TSS)	mg/L	3	504	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids (TDS)	mg/L	10	709	296	300	154	226	362
Total Dissolved Solids (TDS), calculated	mg/L	1	-	285	282	157	241	328
Anions and Nutrients								
Chloride	mg/L	0.5	28.78	8.45	7.99	6.09	6.4	8.71
Fluoride	mg/L	0.02	0.071	<0.020	<0.020	<0.020	<0.020	0.067
Nitrate (as N)	mg/L	0.02	2.45	6.83	6.56	0.442	4.53	2.43
Nitrate + Nitrite (as N)	mg/L	0.05	-	6.83	6.56	0.442	4.53	2.43
Nitrite (as N)	mg/L	0.01	3.047	<0.010	<0.010	<0.010	<0.010	<0.010
Sulfate (as SO4)	mg/L	0.3	285.2	28.7	27.7	20.2	48	96.9
Alkalinity								
Bicarbonate (as HCO3)	mg/L	1	-	256	254	161	188	222
Carbonate (as CO3)	mg/L	1	-	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide (as OH)	mg/L	1	-	<1.0	<1.0	<1.0	<1.0	<1.0
Total (as CaCO3)	mg/L	2	-	210	209	132	154	182
Ion Balance								
Anion Sum	meq/L	0.1	-	5.52	5.45	3.26	4.58	6.08
Cation Sum	meq/L	0.1	-	5.47	5.44	3.18	4.43	5.78
Ion Balance (APHA)	%	0.01	-	0.455	0.092	1.24	1.66	2.53
Ion Balance (cations/anions)	%	0.01	-	99.10	99.80	97.50	96.70	95.10

Notes:

Reference Criteria - Site-specific Upper Limit of Acceptability (ULA)

ULA - Upper Limit of Acceptability; calculated using the average + three times (x3) standard deviations of all available data. Only calculated for parameters with three or more data points of detectable concentrations.

RDL - Reported Detection Limit, which may vary between sample locations and events

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

TABLE D-3

Total and Dissolved Metals of Groundwater Wells

PIN-D
Year 10 2022

AECOM

Parameter	Units	RDL	Reference Criteria (ULA)	MW-1	MW-1 - DUP	MW-2	MW-3	MW-4
				4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022
Metals				Year 10	Year 10	Year 10	Year 10	Year 10
Total Metals								
Aluminum, Total	mg/L	0.003	5.245	0.01	0.0119	0.0217	0.0124	0.0312
Antimony, Total	mg/L	0.0001	0.0013	0.00026	0.00026	<0.00010	0.00023	0.00051
Arsenic, Total	mg/L	0.0001	0.0043	0.00021	0.00022	0.00034	0.00016	0.00023
Barium, Total	mg/L	0.0001	0.0894	0.0208	0.0209	0.00882	0.0166	0.0378
Beryllium, Total	mg/L	0.00002	0.00054	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth, Total	mg/L	0.00005	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron, Total	mg/L	0.01	-	0.014	0.015	0.01	0.033	0.042
Cadmium, Total	mg/L	0.000005	0.000116	<0.0000050	0.0000099	0.0000138	0.0000188	0.000017
Calcium, Total	mg/L	0.05	87.9	55.1	53	20.2	41.9	55
Cesium, Total	mg/L	0.00001	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium, Total	mg/L	0.0005	0.0158	<0.00050	<0.00050	<0.00050	<0.00050	0.00174
Cobalt, Total	mg/L	0.0001	0.0041	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper, Total	mg/L	0.0005	0.0365	0.00081	0.00095	0.0009	0.00131	0.00283
Iron, Total	mg/L	0.01	9.71	0.025	0.039	0.022	0.034	0.035
Lead, Total	mg/L	0.00005	0.01306	0.000147	0.000195	0.000112	0.000176	0.000056
Lithium, Total	mg/L	0.001	0.007	<0.0010	<0.0010	<0.0010	<0.0010	0.0039
Magnesium, Total	mg/L	0.005	62.9	35.5	35.4	27.8	30.5	35.2
Manganese, Total	mg/L	0.0001	0.2081	0.00074	0.00095	0.00255	0.00088	0.0106
Molybdenum, Total	mg/L	0.00005	0.00442	0.000632	0.000652	0.00125	0.000849	0.00199
Nickel, Total	mg/L	0.0005	0.0127	0.00065	0.00065	0.00065	0.00085	0.00233
Phosphorus, Total	mg/L	0.05	-	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium, Total	mg/L	0.05	4.341	0.777	0.781	0.528	0.963	1.67
Rubidium, Total	mg/L	0.0002	-	<0.00020	<0.00020	<0.00020	<0.00020	0.00108
Selenium, Total	mg/L	0.00005	0.00061	0.000147	0.000145	0.000109	0.000117	0.000241
Silicon, Total	mg/L	0.1	16.6	1.04	1.05	0.7	0.93	3.04
Silver, Total	mg/L	0.00001	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium, Total	mg/L	0.05	36.38	4.27	4.39	3.58	3.91	5.09
Strontium, Total	mg/L	0.0002	0.0852	0.0292	0.0296	0.0174	0.0311	0.0849
Sulfur, Total	mg/L	0.5	115	10.3	10.6	7.36	18	30.5
Tellurium, Total	mg/L	0.0002	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium, Total	mg/L	0.00001	0.00034	0.000084	0.000079	0.00004	0.000097	0.000023
Thorium, Total	mg/L	0.0001	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin, Total	mg/L	0.0001	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium, Total	mg/L	0.0003	0.1501	<0.00030	<0.00030	<0.00030	<0.00030	0.00069
Tungsten, Total	mg/L	0.0001	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00011
Uranium, Total	mg/L	0.00001	0.00901	0.00221	0.00218	0.00173	0.00222	0.00538
Vanadium, Total	mg/L	0.0005	0.0162	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc, Total	mg/L	0.003	0.139	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium, Total	mg/L	0.0002	0.0051	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020

TABLE D-3

Total and Dissolved Metals of Groundwater Wells

PIN-D
Year 10 2022

AECOM

Parameter	Units	RDL	Reference Criteria (ULA)	MW-1	MW-1 - DUP	MW-2	MW-3	MW-4
				4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022
Metals				Year 10	Year 10	Year 10	Year 10	Year 10
Dissolved Metals								
Aluminum, Dissolved	mg/L	0.001	0.034	0.0022	0.0019	0.0044	0.0019	0.0022
Antimony, Dissolved	mg/L	0.0001	0.0008	0.00025	0.00026	<0.00010	0.00022	0.0004
Arsenic, Dissolved	mg/L	0.0001	0.0004	0.00016	0.00016	0.00024	0.00011	0.00018
Barium, Dissolved	mg/L	0.0001	0.0514	0.0218	0.0216	0.00895	0.014	0.0423
Beryllium, Dissolved	mg/L	0.00002	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth, Dissolved	mg/L	0.00005	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron, Dissolved	mg/L	0.01	-	0.014	0.014	<0.010	0.031	0.04
Cadmium, Dissolved	mg/L	0.000005	0.000014	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000056
Calcium, Dissolved	mg/L	0.05	90.1	51.5	52.2	19.4	39.8	54.9
Cesium, Dissolved	mg/L	0.00001	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium, Dissolved	mg/L	0.0005	0.0017	<0.00050	<0.00050	<0.00050	<0.00050	0.0008
Cobalt, Dissolved	mg/L	0.0001	0.0005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper, Dissolved	mg/L	0.0002	0.0070	0.00081	0.00079	0.00077	0.00118	0.00178
Iron, Dissolved	mg/L	0.03	0.02	<0.030	<0.030	<0.030	<0.030	<0.030
Lead, Dissolved	mg/L	0.00005	0.00056	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium, Dissolved	mg/L	0.001	0.005	<0.0010	<0.0010	<0.0010	<0.0010	0.0038
Magnesium, Dissolved	mg/L	0.005	67.9	32.8	32.1	24.9	27.4	33.9
Manganese, Dissolved	mg/L	0.005	0.075	<0.00500	<0.00500	<0.00500	<0.00500	0.0108
Molybdenum, Dissolved	mg/L	0.00005	0.00391	0.00062	0.000573	0.00116	0.000796	0.0017
Nickel, Dissolved	mg/L	0.0005	0.0054	0.00066	0.00074	0.00055	0.00066	0.0018
Phosphorus, Dissolved	mg/L	0.05	-	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium, Dissolved	mg/L	0.05	3.31	0.77	0.781	0.523	0.997	1.79
Rubidium, Dissolved	mg/L	0.0002	-	<0.00020	<0.00020	<0.00020	0.00021	0.00104
Selenium, Dissolved	mg/L	0.00005	0.00057	0.000143	0.000126	0.000118	0.000108	0.000238
Silicon, Dissolved	mg/L	0.05	1.54	0.968	0.962	0.642	0.875	2.64
Silver, Dissolved	mg/L	0.00001	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium, Dissolved	mg/L	0.05	24.5	4.18	4.13	3.42	3.81	4.82
Strontium, Dissolved	mg/L	0.0002	0.0823	0.028	0.0274	0.0164	0.0284	0.0866
Sulfur, Dissolved	mg/L	0.5	114.5	10.2	9.96	7	17	32.2
Tellurium, Dissolved	mg/L	0.0002	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium, Dissolved	mg/L	0.00001	0.000055	0.000067	0.000071	0.000022	0.000083	0.000021
Thorium, Dissolved	mg/L	0.0001	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin, Dissolved	mg/L	0.0001	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium, Dissolved	mg/L	0.0003	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten, Dissolved	mg/L	0.0001	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium, Dissolved	mg/L	0.00001	0.00965	0.0019	0.00192	0.00147	0.00202	0.00537
Vanadium, Dissolved	mg/L	0.0005	0.0003	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc, Dissolved	mg/L	0.001	0.078	0.0012	0.0011	<0.0010	0.0011	0.0017
Zirconium, Dissolved	mg/L	0.0002	0.0003	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020

Notes:

Reference Criteria: Site-specific Upper Limit of Acceptability (ULA)

ULA - Upper Limit of Acceptability; calculated using the average + three times (x3) standard deviations of all available data. Only calculated for parameters with three or more data points of detectable concentrations.

RDL - Reported detection limit

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

TABLE D-4

PIN-D

Year 10 2022

Petroleum Hydrocarbons of Groundwater Wells

Parameter	Units	RDL	Reference Criteria (ULA)	MW-1	MW-1 - DUP	MW-2	MW-3	MW-4
				4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022
Petroleum Hydrocarbons (PHCs) and Volatiles				Year 10	Year 10	Year 10	Year 10	Year 10
Volatile Organic Compounds (VOCs) - BTEX								
Benzene	µg/L	0.50	NC	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	µg/L	0.50	NC	<0.50	<0.50	<0.50	<0.50	<0.50
Toluene	µg/L	0.50	NC	<0.50	<0.50	<0.50	<0.50	<0.50
Xylene, m+p-	µg/L	0.50	NC	<0.50	<0.50	<0.50	<0.50	<0.50
Xylene, o-	µg/L	0.50	NC	<0.50	<0.50	<0.50	<0.50	<0.50
Xylenes, total	µg/L	0.75	NC	<0.75	<0.75	<0.75	<0.75	<0.75
BTEX, total	µg/L	1.20	NC	<1.2	<1.2	<1.2	<1.2	<1.2
Hydrocarbons								
F1 (C6-C10)	µg/L	100	NC	<100	<100	<100	<100	<100
F1-BTEX	µg/L	100	NC	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	100	NC	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L	250	NC	<250	<250	<250	<250	<250
F4 (C34-C50)	µg/L	250	NC	<250	<250	<250	<250	<250
Hydrocarbons, total (C6-C50)	µg/L	400	NC	<400	<400	<400	<400	<400

Notes:

Reference Criteria: Site-specific Upper Limit of Acceptability (ULA)

RDL - Reported detection limit

NC - Not calculated

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

TABLE D-5

PIN-D

Year 10 2022

Polychlorinated Biphenyls of Groundwater Wells

Parameter	Units	RDL	Reference Criteria (ULA)	MW-1	MW-1 - DUP	MW-2	MW-3	MW-4
				4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022	4-Aug-2022
Polychlorinated Biphenyls (PCBs)				Year 10	Year 10	Year 10	Year 10	Year 10
PCBs								
Aroclor 1016	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1221	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1232	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1242	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1248	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1254	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1260	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1262	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1268	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0
Polychlorinated Biphenyls [PCBs], total	µg/L	1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:

Reference Criteria Site-specific Upper Limit of Acceptability (ULA)

RDL - Reported detection limit

NC - Not calculated

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

TABLE D-6

PIN-D

Year 10 2022

QA/QC of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1 - DUP	RPD
			4-Aug-2022	4-Aug-2022	
QA/QC			Year 10	Year 10	
General Chemistry					
Physical Tests					
Conductivity	µS/cm	2.0	479	476	0.63%
Hardness (as CaCO3), dissolved	mg/L	0.50	264	262	0.76%
pH	pH units	0.10	7.85	7.95	1.27%
Total Suspended Solids (TSS)	mg/L	3.0	<3.0	<3.0	N/A
Total Dissolved Solids (TDS)	mg/L	10	296	300	1.34%
Total Dissolved Solids (TDS), calculated	mg/L	1.0	285	282	1.06%
Anions and Nutrients					
Chloride	mg/L	0.50	8.45	7.99	5.60%
Fluoride	mg/L	0.020	<0.020	<0.020	N/A
Nitrate (as N)	mg/L	0.020	6.83	6.56	4.03%
Nitrate + Nitrite (as N)	mg/L	0.0500	6.83	6.56	4.03%
Nitrite (as N)	mg/L	0.010	<0.010	<0.010	N/A
Sulfate (as SO4)	mg/L	0.30	28.7	27.7	3.55%
Alkalinity					
Bicarbonate (as HCO3)	mg/L	1.0	256	254	0.78%
Carbonate (as CO3)	mg/L	1.0	<1.0	<1.0	N/A
Hydroxide (as OH)	mg/L	1.0	<1.0	<1.0	N/A
Total (as CaCO3)	mg/L	2.0	210	209	0.48%
Ion Balance					
Anion Sum	meq/L	0.10	5.52	5.45	1.28%
Cation Sum	meq/L	0.10	5.47	5.44	0.55%
Ion Balance (APHA)	%	0.010	0.455	0.092	N/A
Ion Balance (cations/anions)	%	0.010	99.10	99.80	N/A

TABLE D-6

PIN-D

Year 10 2022

QA/QC of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1 - DUP	RPD
			4-Aug-2022	4-Aug-2022	
QA/QC			Year 10	Year 10	
Metals					
Total Metals					
Aluminum, Total	mg/L	0.003	0.01	0.0119	17.35%
Antimony, Total	mg/L	0.0001	0.00026	0.00026	0.00%
Arsenic, Total	mg/L	0.0001	0.00021	0.00022	4.65%
Barium, Total	mg/L	0.0001	0.0208	0.0209	0.48%
Beryllium, Total	mg/L	0.00002	<0.000020	<0.000020	N/A
Bismuth, Total	mg/L	0.00005	<0.000050	<0.000050	N/A
Boron, Total	mg/L	0.01	0.014	0.015	6.90%
Cadmium, Total	mg/L	0.000005	<0.0000050	0.0000099	N/A
Calcium, Total	mg/L	0.05	55.1	53	3.89%
Cesium, Total	mg/L	0.00001	<0.000010	<0.000010	N/A
Chromium, Total	mg/L	0.0005	<0.00050	<0.00050	N/A
Cobalt, Total	mg/L	0.0001	<0.00010	<0.00010	N/A
Copper, Total	mg/L	0.0005	0.00081	0.00095	15.91%
Iron, Total	mg/L	0.01	0.025	0.039	43.75%
Lead, Total	mg/L	0.00005	0.000147	0.000195	28.07%
Lithium, Total	mg/L	0.001	<0.0010	<0.0010	N/A
Magnesium, Total	mg/L	0.005	35.5	35.4	0.28%
Manganese, Total	mg/L	0.0001	0.00074	0.00095	24.85%
Molybdenum, Total	mg/L	0.00005	0.000632	0.000652	3.12%
Nickel, Total	mg/L	0.0005	0.00065	0.00065	0.00%
Phosphorus, Total	mg/L	0.05	<0.050	<0.050	N/A
Potassium, Total	mg/L	0.05	0.777	0.781	0.51%
Rubidium, Total	mg/L	0.0002	<0.00020	<0.00020	N/A
Selenium, Total	mg/L	0.00005	0.000147	0.000145	1.37%
Silicon, Total	mg/L	0.1	1.04	1.05	0.96%
Silver, Total	mg/L	0.00001	<0.000010	<0.000010	N/A
Sodium, Total	mg/L	0.05	4.27	4.39	2.77%
Strontium, Total	mg/L	0.0002	0.0292	0.0296	1.36%
Sulfur, Total	mg/L	0.5	10.3	10.6	2.87%
Tellurium, Total	mg/L	0.0002	<0.00020	<0.00020	N/A
Thallium, Total	mg/L	0.00001	0.000084	0.000079	6.13%
Thorium, Total	mg/L	0.0001	<0.00010	<0.00010	N/A
Tin, Total	mg/L	0.0001	<0.00010	<0.00010	N/A
Titanium, Total	mg/L	0.0003	<0.00030	<0.00030	N/A
Tungsten, Total	mg/L	0.0001	<0.00010	<0.00010	N/A
Uranium, Total	mg/L	0.00001	0.00221	0.00218	1.37%
Vanadium, Total	mg/L	0.0005	<0.00050	<0.00050	N/A
Zinc, Total	mg/L	0.003	<0.0030	<0.0030	N/A
Zirconium, Total	mg/L	0.0002	<0.00020	<0.00020	N/A

TABLE D-6

PIN-D

Year 10 2022

QA/QC of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1 - DUP	RPD
			4-Aug-2022	4-Aug-2022	
QA/QC			Year 10	Year 10	
Dissolved Metals					
Aluminum, Dissolved	mg/L	0.001	0.0022	0.0019	14.63%
Antimony, Dissolved	mg/L	0.0001	0.00025	0.00026	3.92%
Arsenic, Dissolved	mg/L	0.0001	0.00016	0.00016	0.00%
Barium, Dissolved	mg/L	0.0001	0.0218	0.0216	0.92%
Beryllium, Dissolved	mg/L	0.00002	<0.000020	<0.000020	N/A
Bismuth, Dissolved	mg/L	0.00005	<0.000050	<0.000050	N/A
Boron, Dissolved	mg/L	0.01	0.014	0.014	0.00%
Cadmium, Dissolved	mg/L	0.000005	<0.0000050	<0.0000050	N/A
Calcium, Dissolved	mg/L	0.05	51.5	52.2	1.35%
Cesium, Dissolved	mg/L	0.00001	<0.000010	<0.000010	N/A
Chromium, Dissolved	mg/L	0.0005	<0.00050	<0.00050	N/A
Cobalt, Dissolved	mg/L	0.0001	<0.00010	<0.00010	N/A
Copper, Dissolved	mg/L	0.0002	0.00081	0.00079	2.50%
Iron, Dissolved	mg/L	0.03	<0.030	<0.030	N/A
Lead, Dissolved	mg/L	0.00005	<0.000050	<0.000050	N/A
Lithium, Dissolved	mg/L	0.001	<0.0010	<0.0010	N/A
Magnesium, Dissolved	mg/L	0.005	32.8	32.1	2.16%
Manganese, Dissolved	mg/L	0.005	<0.00500	<0.00500	N/A
Molybdenum, Dissolved	mg/L	0.00005	0.00062	0.000573	7.88%
Nickel, Dissolved	mg/L	0.0005	0.00066	0.00074	11.43%
Phosphorus, Dissolved	mg/L	0.05	<0.050	<0.050	N/A
Potassium, Dissolved	mg/L	0.05	0.77	0.781	1.42%
Rubidium, Dissolved	mg/L	0.0002	<0.00020	<0.00020	N/A
Selenium, Dissolved	mg/L	0.00005	0.000143	0.000126	12.64%
Silicon, Dissolved	mg/L	0.05	0.968	0.962	0.62%
Silver, Dissolved	mg/L	0.00001	<0.000010	<0.000010	N/A
Sodium, Dissolved	mg/L	0.05	4.18	4.13	1.20%
Strontium, Dissolved	mg/L	0.0002	0.028	0.0274	2.17%
Sulfur, Dissolved	mg/L	0.5	10.2	9.96	2.38%
Tellurium, Dissolved	mg/L	0.0002	<0.00020	<0.00020	N/A
Thallium, Dissolved	mg/L	0.00001	0.000067	0.000071	5.80%
Thorium, Dissolved	mg/L	0.0001	<0.00010	<0.00010	N/A
Tin, Dissolved	mg/L	0.0001	<0.00010	<0.00010	N/A
Titanium, Dissolved	mg/L	0.0003	<0.00030	<0.00030	N/A
Tungsten, Dissolved	mg/L	0.0001	<0.00010	<0.00010	N/A
Uranium, Dissolved	mg/L	0.00001	0.0019	0.00192	1.05%
Vanadium, Dissolved	mg/L	0.0005	<0.00050	<0.00050	N/A
Zinc, Dissolved	mg/L	0.001	0.0012	0.0011	8.70%
Zirconium, Dissolved	mg/L	0.0002	<0.00020	<0.00020	N/A

TABLE D-6

PIN-D

Year 10 2022

QA/QC of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1 - DUP	RPD
			4-Aug-2022	4-Aug-2022	
QA/QC			Year 10	Year 10	
PHCs					
Volatile Organic Compounds (VOCs) - BTEX					
Benzene	µg/L	0.5	<0.50	<0.50	N/A
Ethylbenzene	µg/L	0.50	<0.50	<0.50	N/A
Toluene	µg/L	0.5	<0.50	<0.50	N/A
Xylene, m+p-	µg/L	0.50	<0.50	<0.50	N/A
Xylene, o-	µg/L	0.5	<0.50	<0.50	N/A
Xylenes, total	µg/L	0.75	<0.75	<0.75	N/A
BTEX, total	µg/L	1.2	<1.2	<1.2	N/A
Hydrocarbons					
F1 (C6-C10)	µg/L	100	<100	<100	N/A
F2 (C10-C16)	µg/L	100	<100	<100	N/A
F3 (C16-C34)	µg/L	100	<100	<100	N/A
F4 (C34-C50)	µg/L	250	<250	<250	N/A
F1-BTEX	µg/L	250	<250	<250	N/A
Hydrocarbons, total (C6-C50)	µg/L	400	<400	<400	N/A
PCBs					
PCBs					
Aroclor 1016	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1221	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1232	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1242	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1248	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1254	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1260	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1262	µg/L	1.0	<1.0	<1.0	N/A
Aroclor 1268	µg/L	1.0	<1.0	<1.0	N/A
Polychlorinated Biphenyls (PCBs), total	µg/L	1.0	<1.0	<1.0	N/A

Notes:
RDL - Reported detection limit
RPD - Relative percent difference
N/A - Not applicable

RPD > 50%

TABLE D-7

PIN-D

Year 10 2022

Historical General Chemistry of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1	MW-2	MW-2	MW-2 - Duplicate	MW-2	MW-3	MW-3 - Duplicate	MW-3	MW-3 - Duplicate	MW-4	Average	Standard Deviation	ULA
			Franz	SLR	Franz	Franz	Franz	SLR	Franz	Franz	Arcadis	Arcadis	SLR			
			2015	2019	2013	2015	2015	2019	2013	2013	2017	2017	2019			
Historical General Chemistry																
Colour	TCU	2	6.8	7	3.6	4.9	39	3	3.8	2.7	-	-	3	8.2	11.7	43.2
Conductivity	µS/cm	1	370	401	520	270	270	289	730	730	380	410	375	431	164	924
Total Dissolved Solids	mg/L	10	190	375	NA	150	140	46	500	490	220	240	220	257	151	709
Fluoride (F)	mg/L	0.1	<0.050	<0.1	0.061	0.066	0.064	<0.1	<0.050	<0.050	-	-	<0.1	0.1	0.0	0.1
Orthophosphate (P)	mg/L	0.01	<0.0030	<0.01	0.003	0.014	0.013	<0.01	<0.0030	0.0032	-	-	<0.01	0.01	0.01	0.03
pH	pH	-	7.79	8.23	8.01	8.69	8.7	8.25	7.99	7.92	8.05	8.05	8.34	8.18	0.30	9.07
Total Suspended Solids	mg/L	10	2.7	289	NA	270	300	120	0.5	0.46	4	3.3	140	113	130	504
Sulfate (SO4)	mg/L	1	8.6	12	130	12	12	14	190	200	56	59	35	66	73	285
Chloride (Cl) [1]	mg/L	1	5.7	6.1	22	7.1	7.2	8.7	18	19	5.3	6.7	7.2	10.3	6.2	28.8
Nitrate (as N)	mg/L	0.1	<0.010	1.18	<0.0030	<0.010	<0.010	0.46	<0.0030	0.005	<0.010	<0.010	1.19	0.71	0.58	2.45
Nitrite (as N)	mg/L	0.01	1.6	<0.01	0.31	0.38	0.39	0.014	1	1	1.8	1.9	<0.01	0.93	0.70	3.05
Hardness (as CaCO3)	mg/L	0.5	190	203	260	120	120	150	370	390	210	220	229	224	89	491

Notes:

Reference Criteria - Site-specific Upper Limit of Acceptability (ULA)

RDL - Refers to laboratory detection limit, which may vary between sample locations and event

2019 RDL used. Changes between monitoring events.

[1] 2017 RDL

TCU - True colour unit

ULA - Upper Limits of Acceptability, calculated using the average + three (3) standard deviations of all available data. Only calculated for parameters with three or more data points of detectable concentrations.

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

TABLE D-8

PIN-D
Year 10 2022

AECOM

Historical Metal Concentrations of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1	MW-2	MW-2	MW-2 - Duplicate	MW-2	MW-3	MW-3 - Duplicate	MW-3	MW-3 - Duplicate	MW-4	MW-4 - Duplicate	Average	Standard Deviation	ULA
			Franz	SLR	Franz	Franz	Franz	SLR	Franz	Franz	Arcadis	Arcadis	SLR	SLR			
Historical Metals			2015	2019	2013	2015	2015	2019	2013	2013	2017	2017	2019	2019			
Total Metals																	
Aluminum, Total	mg/L	0.003	0.011	0.291	0.0333	4	3.5	1.98	0.0209	0.0195	0.011	0.037	0.767	0.728	0.950	1.432	5.245
Antimony, Total	mg/L	0.0005	<0.0006	<0.0005	0.000027	<0.0006	0.0006	<0.0005	0.000081	0.000079	<0.0006	<0.0006	0.00064	0.00063	0.00034	0.00031	0.00127
Arsenic, Total	mg/L	0.0001	0.00026	0.00033	0.000194	0.0034	0.0031	0.00132	0.000131	0.000112	0.00057	0.00022	0.00056	0.00079	0.00092	0.00114	0.00435
Barium, Total	mg/L	0.001	0.015	0.0188	0.0394	0.065	0.062	0.0455	0.0305	0.0311	0.016	0.017	0.0487	0.0466	0.036	0.018	0.089
Beryllium, Total	mg/L	0.0001	<0.001	<0.0001	<0.00001	<0.001	<0.001	0.00033	<0.00001	<0.00001	<0.001	<0.001	0.00014	0.00013	0.00020	0.00011	0.00054
Bismuth, Total	mg/L	0.001	<0.005	<0.001	<0.000005	<0.005	<0.005	<0.001	<0.000005	0.000005	-	-	<0.001	<0.001	-	-	-
Boron, Total	mg/L	0.05	<0.02	<0.05	<0.05	<0.02	<0.02	<0.05	<0.05	<0.05	0.033	0.031	<0.05	<0.05	-	-	-
Cadmium, Total	mg/L	0.00001	<0.00002	0.000069	0.000008	0.000074	0.000061	0.000043	0.000012	0.000009	<0.00002	<0.00002	0.000021	0.000018	0.000035	2.70093E-05	0.000116
Calcium, Total	mg/L	0.00005	40	45.7	23	19	18	24.5	68.9	62.4	37	42	46.6	44.4	39.29166667	16.21898205	87.948613
Chromium, Total	mg/L	0	<0.001	0.0065	0.0015	0.0031	0.0027	0.0134	<0.0001	0.00015	0.0013	0.0035	0.0053	0.0062	0.004365	0.003814013	0.015807
Cobalt, Total	mg/L	0.0002	<0.0003	0.00031	0.000364	0.0027	0.0025	0.00183	0.00019	0.000204	<0.0003	<0.0003	0.0007	0.0007	0.001055333	0.001009434	0.0040836
Copper, Total	mg/L	0.0005	0.0032	0.0268	0.00729	0.015	0.012	0.0224	0.00311	0.00308	0.0027	0.0081	0.0194	0.0155	0.011548333	0.008315837	0.0364958
Iron, Total	mg/L	0.01	<0.06	0.461	0.0407	7.1	6.5	3.23	0.0228	0.0191	0.57	0.15	1.3	1.36	1.886690909	2.608435042	9.711996
Lead, Total	mg/L	0.0002	0.00026	0.00105	0.000132	0.0098	0.0087	0.0052	0.000101	0.000095	0.0028	0.00051	0.00246	0.00347	0.00288	0.00339	0.01306
Lithium, Total	mg/L	0.002	<0.02	<0.002	0.00165	<0.02	<0.02	0.005	0.00138	0.00163	<0.02	<0.02	0.0032	0.0037	0.00276	0.001449703	0.0071091
Magnesium, Total	mg/L	0.00005	21	21.5	41.1	20	20	21.5	49.2	49.6	28	32	27.3	30.3	30.125	10.9407599	62.94728
Manganese, Total	mg/L	0.001	<0.004	0.0126	0.0629	0.14	0.13	0.118	0.0264	0.0272	0.0082	0.0017	0.0521	0.0521	0.057381818	0.050254867	0.2081464
Molybdenum, Total	mg/L	0.001	0.00052	<0.001	0.0017	0.0017	0.0016	0.0042	0.00079	0.000842	0.00096	0.00099	0.0013	0.0012	0.001436545	0.000995735	0.0044237
Nickel, Total	mg/L	0.001	0.0015	0.0062	0.00598	0.0045	0.004	0.0116	0.00194	0.00202	0.0023	0.0041	0.005	0.0029	0.004336667	0.002778722	0.0126728
Potassium, Total	mg/L	0.05	0.6	0.637	1.54	2.6	2.5	2.62	1.32	1.34	1	3.4	1.21	1.3	1.67225	0.889679628	4.3412889
Selenium, Total	mg/L	0.0001	<0.0002	0.0001	0.000225	0.00038	0.00037	0.00018	0.000355	0.000325	<0.0002	<0.0002	0.00011	<0.0001	0.000255625	0.000116694	0.0006057
Silicon, Total	mg/L	0.1	0.78	-	0.823	11	10	-	1.17	1.04	1	1.1	-	-	3.364125	4.414384488	16.607278
Silver, Total	mg/L	0.00002	<0.0001	<0.00002	<0.000005	<0.0001	<0.0001	<0.00002	<0.000005	<0.000005	<0.0001	<0.0001	<0.00002	<0.00002	-	-	-
Sodium, Total	mg/L	0.00005	2.8	2.43	8.18	16	16	34.2	8.09	8.21	3.4	6.1	7.01	7.13	9.9625	8.805368326	36.378605
Strontium, Total	mg/L	0.001	<0.02	0.0203	0.0545	0.037	0.036	0.047	0.0599	0.0587	0.027	0.033	0.0539	0.0554	0.043881818	0.013786429	0.0852411
Sulfur, Total	mg/L	0.2	2.7	-	40.2	3.1	3.1	-	70.4	70.2	18	24	-	-	28.9625	28.57606079	114.69068
Thallium, Total	mg/L	0.00001	<0.0002	0.000041	0.000014	0.00023	0.00022	0.000128	0.000033	0.000033	<0.0002	<0.0002	0.000046	0.000048	8.81111E-05	8.388E-05	0.0003398
Tin, Total	mg/L	0.005	<0.001	<0.005	<0.0002	0.0011	0.0011	<0.005	<0.0002	<0.0002	<0.001	<0.001	<0.005	<0.005	-	-	-
Titanium, Total	mg/L	0.005	<0.001	0.0073	0.00119	0.092	0.089	0.0715	<0.0005	<0.0005	0.0032	0.0015	0.0287	0.0234	0.03531	0.038266387	0.1501092
Uranium, Total	mg/L	0.0001	0.00074	0.00097	0.00411	0.0023	0.0021	0.0023	0.00694	0.0068	0.0015	0.0023	0.00216	0.00216	0.00287	0.00205	0.00901
Vanadium, Total	mg/L	0.005	<0.001	<0.005	0.00023	0.0078	0.0069	<0.005	<0.0002	0.0002	<0.001	<0.001	<0.005	<0.005	0.004	0.004	0.016
Zinc, Total	mg/L	0.005	0.0091	0.118	0.00064	0.05	0.042	0.049	0.00095	0.00081	0.037	0.067	0.0146	0.0105	0.0333	0.035095335	0.138586
Zirconium, Total	mg/L	0.0001	<0.003	0.00046	<0.0001	<0.003	0.0035	0.00092	<0.0001	<0.0001	-	-	0.0006	0.00053	0.00120	0.00130	0.00509
Dissolved Metals																	
Aluminum, Dissolved	mg/L	0.003	0.0043	0.0043	0.0279	0.0073	0.0074	0.0102	0.0173	0.0208	0.0047	0.0044	0.0053	0.004	0.010	0.008	0.034
Antimony, Dissolved	mg/L	0.0005	<0.0006	<0.0005	0.000025	<0.0006	<0.0006	<0.0005	0.000086	0.000095	<0.0006	<0.0006	0.0005	<0.0005	0.0001765	0.000217897	0.0008302
Arsenic, Dissolved	mg/L	0.0001	<0.0002	0.00023	0.000153	0.00031	0.00027	0.00031	0.000134	0.00013	<0.0002	<0.0002	0.00023	0.00025	0.00022	0.00007	0.00044
Barium, Dissolved	mg/L	0.001	0.015	0.0158	0.0383	0.012	0.012	0.0128	0.0306	0.0306	0.015	0.017	0.0324	0.0317	0.021933333	0.00982523	0.051409
Beryllium, Dissolved	mg/L	0.0001	<0.001	<0.0001	<0.00001	<0.001	<0.001	<0.0001	<0.00001	<0.00001	<0.001	<0.001	<0.0001	<0.0001	-	-	-
Bismuth, Dissolved	mg/L	0.001	<0.005	<0.001	<0.000005	<0.005	<0.005	<0.001	<0.000005	0.000013	-	-	<0.001	<0.001	-	-	-
Boron, Dissolved	mg/L	0.05	<0.02	<0.05	<0.05	<0.02	<0.02	<0.05	<0.05	<0.05	0.031	0.034	<0.05	<0.05	-	-	-
Cadmium, Dissolved	mg/L	0.00001	<0.00002	<0.00001	0.000013	<0.00002	<0.00002	<0.00001	0.000013	0.000012	<0.00002	<0.00002	<0.00001	<0.00001	1.26667E-05	5.7735E-07	0.000014
Calcium, Dissolved	mg/L	0.00005	40	43.3	27.1	17	17	11.3	68.5	67.5	38	39	31.8	32	36.04166667	18.02954436	90.1303
Chromium, Dissolved	mg/L	0	<0.001	0.0012	<0.0001	<0.001	<0.001	0.0011	<0.0001	<0.0001	<0.001	<0.001	0.0014	<0.001	0.001	0.00015	0.00169
Cobalt, Dissolved	mg/L	0.0002	<0.0003	<0.0002	0.000371	<0.0003	<0.0003	<0.0002	0.000218	0.00024	<0.0003	<0.0003	<0.0002	<0.0002	0.000276333	8.27184E-05	0.0005245
Copper, Dissolved	mg/L	0.0005	0.0015	0.005	0.00202	0.0013	0.00095	0.00596	0.00263	0.0029	0.0016	0.0019	0.00144	0.00175	0.00241	0.00154	0.00705
Iron, Dissolved	mg/L	0.01	<0.06	0.0141	0.0016	<0.06	<0.06	<0.005	0.0037	0.0033	<0.06	<0.06	0.0099	<0.005	0.007	0.005	0.022
Lead, Dissolved	mg/L	0.0002	<0.0002	0.00032	0.00002	<0.0002	<0.0002	<0.0002	0.000014	0.000033	<0.0002	<0.0002	0.00024	<0.0002	0.0001254	0.0001441	0.0005577
Lithium, Dissolved	mg/L	0.002	<0.02	<0.002	0.00151	<0.02	<0.02	0.003	0.0017	0.00147	<0.02	<0.02	0.0031	0.0029	0.00228	0.00079506	0.0046652
Magnesium, Dissolved	mg/L	0.00005	21	21.6	44.1	20	20	13.9	50.3	53.3	28	30	23.8	23.7	29.14166667	12.92583448	67.91917
Manganese, Dissolved	mg/L	0.001	<0.004	0.0019	0.0612	0.0068	0.0066	0.0151	0.0268	0.0286	<0.004	<0.004	0.004	0.0033	0.017144444	0.019315027	0.0750895
Mercury, Dissolved	mg/L	0.00001	-	<0.00001	-	-	-	<0.00001	-	-	-	-	-	-	-	-	-
Molybdenum, Dissolved	mg/L	0.001	0.00046	<0.001	0.00185	0.00085	0.00081	0.0037	0.000772	0.000894	0.00084	0.00077	0.0012	0.0012	0.001213273	0.000899115	0.0039106
Nickel, Dissolved	mg/L	0.001	0.001	0.004	0.00347	<0.0005	<0.0005	0.0017	0.00186	0.00215	0.0016	0.003	0.0029	<0.001	0.002408889	0.000984777	0.0053632
Potassium, Dissolved	mg/L	0.05	0.59	0.594	1.54	0.98	0.94	1.54	1.31	1.36	1.7	3.1	1.12	1.03	1.317	0.664370379	3.3101111
Selenium, Dissolved	mg/L	0.0001	<0.0002	<0.0001	0.000241	<0.0002	<0.0002	0.00011	0.000337	0.000328	<0.0002	<0.0002	<0.0001	<0.0001	0.000254	0.000105309	0.0005699
Silicon, Dissolved	mg/L	0.1	0.77	-	0.898	0.64	0.64	-	1.14	1.11	1	1.1	-	-	0.91225	0.20791602	1.5359981
Silver, Dissolved	mg/L	0.00002	<0.0001	<0.00002	<0.000005	<0.0001	<0.0001	<0.0002	<0.000005	<0.000005	<0.0001	<0.0001	<0.00002	<0.00002	-	-	-
Sodium, Dissolved	mg/L	0.00005	2.6	2.79	8.7	9.1	9.2	23.7	8.25	8.64	4.4	6.3	5.33	4.15	7.763333333	5.588425267	24.528609
Strontium, Dissolved	mg/L	0.001	<0.02	0.0212	0.0538	0.028	0.028	0.0385	0.0567	0.0576	0.028	0.032	0.0527	0.0517	0.040745455	0.013866677	0.0823455
Sulfur, Dissolved	mg/L	0.2	2.7	-	4.25	2.7	2.7	-	68.2	74.3	20	24	-	-	24.85625	29.86875383	114.46251
Thallium, Dissolved	mg/L	0.00001	<0.0002	0.000027	0.000013	<0.0002	<0.0002	0.000013	0.000033	0.000034	<0.0002	<0.0002	<0.00001	<0.00001	0.000024	1.03923E-05	0.00006
Tin, Dissolved	mg/L	0.005	<0.001	<0.005	<0.0002	<0.001	<0.001	<0.005	<0.0002	<0.0002	<0.001	<0.001	<0.005	<0.005	-	-	-
Titanium, Dissolved	mg/L	0.005	<0.001	<0.005	<0.0005	<0.001	<0.001	<0.005	<0.0005	<0.0005	<0.001	<0.001	<0.005	<0.005	-	-	-
Uranium, Dissolved	mg/L	0.0001	0.00065	0.00091	0.00438	0.00063	0.00059	0.00147	0.00709	0.00714	0.0015	0.0019	0.00176	0.00167	0.00247	0.00239	0.00965
Vanadium, Dissolved	mg/L	0.005	<0.001	<0.005	0.00021	<0.001	<0.001	<0.005	0.00023	0.00022	<0.001	<0.001	<0.005	<0.005	0.000220	0.000010	0.000250
Zinc, Dissolved	mg/L	0.005	0.008	0.0454	0.0027	<0.003	<0.003	<0.005	0.0021	0.0023	0.033	0.04	<0.005	<0.005	0.019	0.020	0.078
Zirconium, Dissolved	mg/L	0.0001	<0.003	0.00018	<0.0001	<0.003	<0.003	<0.0001	0.00012	0.0001	-	-	<0.0001	<0.0001	0.000133333	4.16333E-05	0.0002582

Notes:

Reference Criteria - Site-specific Upper Limit of Acceptability (ULA)

ULA - Upper Limits of Acceptability, calculated using the average + three (3) standard deviations of all available data. Only calculated for parameters with three or more data points of detectable concentrations.

RDL - Refers to laboratory detection limit, which may vary between sample locations and event. 2020 RDL presented.

Exceeds Respective Reference Criteria

Detection Limit Exceeds Reference Criteria

TABLE D-9

PIN-D
Year 10 2022

Historical PHC and Volatile Concentrations of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1	MW-2	MW-2 - Duplicate	MW-2	MW-2 - Duplicate	MW-2	MW-3	MW-3 - Duplicate	MW-3	MW-3 - Duplicate	Average	Standard Deviation	ULA
			Franz	SLR	Franz	Franz	Franz	Franz	SLR	Franz	Franz	Arcadis	Arcadis			
			2015	2019	2013	2013	2015	2015	2019	2013	2013	2017	2017			
Historical PHCs and VOCs																
Benzene	µg/L	0.4	<0.40	-	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.40	<0.40	<0.40	All <RDL	All <RDL	All <RDL
Toluene	µg/L	0.4	<0.40	-	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.40	<0.40	<0.40	All <RDL	All <RDL	All <RDL
Ethylbenzene	µg/L	0.4	<0.40	-	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.40	<0.40	<0.40	All <RDL	All <RDL	All <RDL
o-xylene	µg/L	0.4	<0.40	-	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.40	<0.40	<0.40	All <RDL	All <RDL	All <RDL
p+m-xylene	µg/L	0.8	<0.80	-	<0.80	<0.80	<0.80	<0.80	-	<0.80	<0.80	<0.80	<0.80	All <RDL	All <RDL	All <RDL
Total Xylenes	µg/L	0.8	<0.80	-	<0.80	<0.80	<0.80	<0.80	-	<0.80	<0.80	<0.80	<0.80	All <RDL	All <RDL	All <RDL
F1 (C6-C10)	µg/L	100	<100	-	<100	<100	<100	<100	-	<100	<100	<100	<100	All <RDL	All <RDL	All <RDL
F1 (C6-C10) - BTEX	µg/L	100	<100	<25	<100	<100	<100	<100	<25	<100	<100	<100	<100	All <RDL	All <RDL	All <RDL
F2 (C10-C16)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	All <RDL	All <RDL	All <RDL
F3 (C16-C34)	µg/L	200	-	-	<200	<200	-	-	-	<200	<200	-	-	All <RDL	All <RDL	All <RDL
F4 (C34-C50)	µg/L	200	-	-	<200	<200	-	-	-	<200	<200	-	-	All <RDL	All <RDL	All <RDL

Notes:
Reference Criteria - Site-specific Upper Limit of Acceptability (ULA)
ULA - Upper Limits of Acceptability, calculated using the average + three (3) standard deviations of all available data. Only calculated for parameters with three or more data points of detectable concentrations.
RDL - Refers to laboratory detection limit, which may vary between sample locations and event. 2020 RDL presented.

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

TABLE D-10

PIN-D
Year 10 2022

Historical PCB Concentrations of Groundwater Wells

Parameter	Units	RDL	MW-1	MW-1	MW-2	MW-2	MW-2 - Duplicate	MW-2	MW-3	MW-3 - Duplicate	MW-3	MW-3 - Duplicate	Average	Standard Deviation	ULA
			Franz	SLR	Franz	Franz	Franz	SLR	Franz	Franz	Arcadis	Arcadis			
			2015	2019	2013	2015	2015	2019	2013	2013	2017	2017			
Historical PCBs															
Aroclor 1016	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1221	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1232	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1242	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1248	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1254	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1260	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1262	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Aroclor 1268	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL
Polychlorinated Biphenyls, total	mg/L	0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	All <RDL	All <RDL	All <RDL

Notes:

Reference Criteria Site-specific Upper Limit of Acceptability (ULA)

RDL - Refers to laboratory detection limit, which may vary between sample locations and event. 2019 RDL presented.

Exceeds Reference Criteria
Detection Limit Exceeds Reference Criteria

Appendix E

Historical Soil Sample Tables

TABLE E-1

PIN-D
Year 10 2022

AECOM

Baseline Soil Metal Concentrations from NHWL Footprint

Sample ID	Depth (m)	Arsenic	Cadmium	Cobalt	Chromium	Copper	Nickel	Lead	Zinc
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
11-0400	0 - 0.1	3	ND	11	ND	ND	14	7	ND
11-0401	0 - 0.1	3	ND	9	1	ND	15	5	ND
11-0402	0.4 - 0.5	3	ND	32	2	6	12	16	ND
11-0403	0 - 0.1	3	ND	13	2	5	9	8	ND
11-0404	0.4 - 0.5	3	ND	16	3	10	11	11	ND
11-0405	0 - 0.1	1	ND	6	2	8	4	5	ND
11-0406	0.4 - 0.5	2	ND	12	2	8	8	7	ND
11-0407	0 - 0.1	2	ND	19	2	ND	10	11	ND
11-0408	0.4 - 0.5	12	ND	6	3	5	14	7	ND
11-0409	0 - 0.1	3	ND	13	4	8	13	9	ND
11-0410	0.4 - 0.5	6	ND	12	2	ND	14	8	ND
11-0411	0.4 - 0.5	6	ND	7	2	ND	10	5	ND

Notes
ND - Non-Detect

TABLE E-2

PIN-D
Year 10 2022

Historical ESG [1] Geochemical Assessment Site-Wide Soil Metal Concentrations

Sample ID	Depth (m)	Arsenic	Cadmium	Cobalt	Chromium	Copper	Nickel	Lead	Zinc
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
09-30960/61	0.2	2.1	ND	8.3	21	24	14	ND	24
09-30962	0.1	ND	ND	7.6	ND	27	11	ND	20
09-30963	0.1	ND	ND	ND	ND	14	6	ND	ND
09-30964	0	ND	ND	ND	22	34	11	ND	16
09-30965	0	ND	ND	ND	ND	12	ND	ND	ND
09-30966	0.3	ND	ND	7.3	21	26	12	ND	18
09-30967	0.1	1.5	ND	5.9	ND	30	8	ND	ND
09-30968	0.1	1.3	ND	ND	ND	6.5	7.7	ND	ND
09-30969	0	ND	ND	ND	ND	ND	ND	ND	ND
09-30970/71	0.2	ND	ND	ND	ND	20	ND	ND	ND
09-30972	0.1	ND	ND	5.3	ND	21	7.9	ND	ND
09-30973	0.1	1.3	ND	ND	ND	29	6.1	ND	ND
09-30974	0.1	1.4	ND	ND	ND	25	5.1	ND	19
09-30975	0.2	1.5	ND	5.2	ND	19	7.7	ND	ND
09-30976	0.2	1.2	ND	5.1	ND	17	8	ND	ND
09-30977	0.1	ND	ND	5.2	ND	5.9	5.8	ND	17
09-30978	0.1	2.3	ND	5.6	ND	18	7.5	ND	ND
09-30979	0.1	ND	ND	ND	ND	8.5	ND	ND	ND
09-30980/81	0.1	1.4	ND	ND	ND	14	ND	ND	ND
09-30982	0.1	ND	ND	ND	ND	10	5.1	ND	ND
09-30983	0	ND	ND	ND	ND	21	5.4	ND	ND
09-30984	0.1	2	ND	5.7	ND	49	10	ND	17
09-30985	0.1	ND	ND	ND	ND	6.2	ND	ND	ND
09-30986	0.2	ND	ND	ND	ND	8.4	5.3	ND	ND
09-30987	0.1	ND	ND	ND	ND	40	ND	ND	ND
09-30988	0.1	4	ND	5	ND	12	8	ND	ND
09-30989	0	2.4	ND	6.8	ND	24	11	ND	17
09-30990/91	0.1	ND	ND	ND	ND	5.6	ND	ND	ND
09-30992	0.2	1.1	ND	ND	ND	10	ND	ND	ND
09-30993	0.1	ND	ND	ND	ND	5.2	5.2	ND	ND
09-30994	0	ND	ND	ND	ND	16	7.6	ND	ND
09-30995	0.1	ND	ND	ND	ND	ND	ND	ND	ND
09-30996	0	1.1	ND	5.2	ND	26	7.9	ND	ND
09-30997	0	1.6	ND	5.3	ND	26	9.4	ND	ND
09-30998	0	ND	ND	ND	ND	12	5.6	ND	16
09-30999	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31000/01	0	2.9	ND	8.8	30	26	16	ND	30
09-31002	0.1	3.3	ND	ND	ND	16	6.4	ND	ND
09-31003	0.1	2.1	ND	5	ND	17	9	ND	ND
09-31004	0.1	1.4	ND	ND	ND	16	7.4	ND	ND
09-31037	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31038	0.2	2.3	ND	7	24	17	13	ND	22
09-31039	0.1	3	ND	9.1	34	18	13	ND	ND
09-31040/41	0	ND	ND	ND	ND	17	6.2	ND	ND
09-31042	0	ND	ND	ND	ND	11	ND	ND	19
09-31043	0.1	ND	ND	5.8	ND	52	7.4	ND	ND

Notes:

[1] Environmental Sciences Group (ESG) of the Royal Military College of Canada (RMC); background geochemical assessment conducted at PIN-D in 2009.

ND - Non-Detect
Terrain Unit: Cc

TABLE E-3

PIN-D
Year 10 2022

Historical ESG Geochemical Assessment Site-Wide Soil Metal Concentrations

Sample ID	Depth (m)	Arsenic	Cadmium	Cobalt	Chromium	Copper	Nickel	Lead	Zinc
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
09-31005	0.1	1.7	ND	ND	ND	7.3	6.5	ND	ND
09-31006	0.1	1.6	ND	ND	ND	12	6	ND	ND
09-31007	0.1	1.1	ND	ND	ND	15	5.7	ND	ND
09-31008	0.2	ND	ND	ND	ND	5.5	ND	ND	ND
09-31009	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31010/11	0.1	ND	ND	ND	ND	5.3	ND	ND	ND
09-31012	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31013	0.1	1.7	ND	ND	ND	17	7.9	ND	ND
09-31014	0	1.2	ND	ND	ND	ND	ND	ND	ND
09-31015	0	2.1	ND	5.8	ND	15	8.6	ND	17
09-31016	0.1	2.7	ND	ND	ND	13	7.1	ND	18
09-31017	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31018	0.1	2.1	ND	7	ND	23	9.4	ND	17
09-31019	0.1	1.4	ND	ND	ND	18	7.3	ND	ND
09-31020/21	0	1.2	ND	ND	ND	10	6.2	ND	ND
09-31022	0.1	1.3	ND	ND	ND	11	5.6	ND	ND
09-31023	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31024	0.1	ND	ND	ND	ND	7.8	ND	ND	16
09-31025	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31026	0.1	1.5	ND	ND	ND	18	7.1	ND	ND
09-31027	0	ND	ND	ND	ND	6.2	ND	ND	ND
09-31028	0	ND	ND	ND	ND	8.8	5.7	ND	18
09-31029	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31030/31	0.2	ND	ND	ND	ND	10	ND	ND	ND
09-31032	0.2	ND	ND	ND	ND	21	5	ND	ND
09-31033	0.1	ND	ND	ND	ND	14	ND	ND	ND
09-31034	0	ND	ND	ND	ND	9	5.5	ND	16
09-31035	0	1.1	ND	ND	ND	15	ND	ND	16
09-31036	0	ND	ND	ND	ND	6.4	5.1	ND	ND
09-31044	0	2.6	ND	6.3	ND	27	9.5	ND	28
09-31045	0	1.8	ND	ND	ND	6.5	8.1	ND	ND
09-31046	0	ND	ND	ND	ND	6.5	5.9	ND	ND
09-31047	0.2	ND	ND	ND	ND	ND	ND	ND	ND
09-31048	0	1.4	ND	9.3	27	16	16	ND	26
09-31049	0	ND	ND	ND	ND	ND	5.5	ND	ND
09-31050/51	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31052	0	2.3	ND	ND	ND	21	ND	ND	ND
09-31053	0.1	1.3	ND	5.8	ND	25	8.9	ND	ND
09-31054	0.2	ND	ND	ND	ND	9	ND	ND	ND
09-31055	0.2	ND	ND	ND	ND	12	5.5	ND	ND
09-31056	0.1	ND	ND	ND	ND	5.4	ND	ND	ND
09-31057	0.1	ND	ND	ND	ND	ND	ND	ND	ND
09-31058	0.1	2.9	ND	6.2	ND	23	9.5	ND	ND
09-31059	0.1	1.2	ND	5.9	ND	19	10	ND	ND

Notes:

[1] Environmental Sciences Group (ESG) of the Royal Military College of Canada (RMC); background geochemical assessment conducted at PIN-D in 2009.

ND - Non-Detect
Terrain Unit: Nnh

TABLE E-4

PIN-D
Year 10 2022

Historical Baseline PHC Soil Analytics from NHWL Footprint

Sample ID	Depth (m)	Depth (cm)	Benzene	Toluene	Ethylbenzene	Xylenes	F1	F1-BTEX	F2	F3	F4
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
11-0400	0 - 0.1	0-10	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0401	0 - 0.1	0-10	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0402	0.4 - 0.5	40-50	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0403	0 - 0.1	0-10	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0404	0.4 - 0.5	40-50	ND	ND	ND	ND	ND	ND	62	63	ND
11-0405	0 - 0.1	0-10	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0406	0.4 - 0.5	40-50	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0407	0 - 0.1	0-10	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0408	0.4 - 0.5	40-50	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-0409	0 - 0.1	0-10	ND	ND	ND	ND	ND	ND	30	120	ND
11-0410	0.4 - 0.5	40-50	ND	ND	ND	ND	ND	ND	42	57	ND
11-0411	0.4 - 0.5	40-50	ND	ND	ND	ND	ND	ND	61	62	ND

Notes:
ND - Non-Detect

TABLE E-5

PIN-D
Year 10 2022

Historical Baseline PCB Soil Analytics from NHWL Footprint

Sample ID	Depth (m)	Depth (cm)	Total PCBs
			mg/kg
11-0400	0 - 0.1	0-10	ND
11-0401	0 - 0.1	0-10	ND
11-0402	0.4 - 0.5	40-50	ND
11-0403	0 - 0.1	0-10	ND
11-0404	0.4 - 0.5	40-50	ND
11-0405	0 - 0.1	0-10	ND
11-0406	0.4 - 0.5	40-50	ND
11-0407	0 - 0.1	0-10	ND
11-0408	0.4 - 0.5	40-50	ND
11-0409	0 - 0.1	0-10	ND
11-0410	0.4 - 0.5	40-50	ND
11-0411	0.4 - 0.5	40-50	ND
Notes:			
ND - Non-Detect			

Appendix F

Laboratory Certificate of Analysis

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EO2206342**	Page	: 1 of 7
Client	: **AECOM Canada Ltd.**	Laboratory	: Edmonton - Environmental
Contact	: Jessica Stepney	Account Manager	: Pamela Toledo
Address	: 101 - 18817 Stony Plain Rd. NW Edmonton AB Canada T5S 0C2	Address	: 9450 - 17 Avenue NW Edmonton AB Canada T6N 1M9
Telephone	: 780-486-5921	Telephone	: +1 780 413 5227
Project	: 60686962	Date Samples Received	: 10-Aug-2022 17:27
PO	: ----	Date Analysis Commenced	: 11-Aug-2022
C-O-C number	: 20-1009580	Issue Date	: 19-Aug-2022 08:37
Sampler	: ----		
Site	: PIN-D		
Quote number	: 2022 Price List - Prairies		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Drake	Lab Analyst	Inorganics, Edmonton, Alberta
Austin Wasylyshyn	Lab Analyst	Metals, Edmonton, Alberta
Dan Nguyen	Team Leader - Inorganics	Inorganics, Edmonton, Alberta
Dan Nguyen	Team Leader - Inorganics	Metals, Edmonton, Alberta
Daniel Nguyen	Lab Assistant	Inorganics, Edmonton, Alberta
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Jessica Maitland	Lab Assistant	Inorganics, Edmonton, Alberta
Kari Mulroy	Lab Supervisor - Environmental	Organics, Edmonton, Alberta
Remy Gatabazi	Lab Analyst	Organics, Edmonton, Alberta
Sobhithan Pillay		Inorganics, Edmonton, Alberta
Yan Zhang	Lab Analyst	Organics, Edmonton, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW1	MW2	MW3	MW4	QA/QC
					Client sampling date / time	04-Aug-2022 11:00	04-Aug-2022 12:30	04-Aug-2022 14:00	04-Aug-2022 16:30	04-Aug-2022
						EO2206342-001	EO2206342-002	EO2206342-003	EO2206342-004	EO2206342-005
						Result	Result	Result	Result	Result
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		264	151	212	277	262
solids, total dissolved [TDS]	----	E162	10	mg/L		296	154	226	362	300
solids, total suspended [TSS]	----	E160	3.0	mg/L		<3.0	<3.0	<3.0	<3.0	<3.0
conductivity	----	E100	2.0	µS/cm		479	281	408	544	476
pH	----	E108	0.10	pH units		7.85	8.13	7.96	8.02	7.95
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L		256	161	188	222	254
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
alkalinity, total (as CaCO3)	----	E290	2.0	mg/L		210	132	154	182	209
solids, total dissolved [TDS], calculated	----	EC103	1.0	mg/L		285	157	241	328	282
Anions and Nutrients										
chloride	16887-00-6	E235.Cl	0.50	mg/L		8.45	6.09	6.40	8.71	7.99
fluoride	16984-48-8	E235.F	0.020	mg/L		<0.020	<0.020	<0.020	0.067	<0.020
nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L		6.83	0.442	4.53	2.43	6.56
nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		28.7	20.2	48.0	96.9	27.7
nitrate + nitrite (as N)	----	EC235.N+N	0.0500	mg/L		6.83	0.442	4.53	2.43	6.56
Ion Balance										
anion sum	----	EC101	0.10	meq/L		5.52	3.26	4.58	6.08	5.45
cation sum	----	EC101	0.10	meq/L		5.47	3.18	4.43	5.78	5.44
ion balance (APHA)	----	EC101	0.010	%		0.455	1.24	1.66	2.53	0.092
ion balance (cations/anions)	----	EC101	0.010	%		99.1	97.5	96.7	95.1	99.8
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0100	0.0217	0.0124	0.0312	0.0119
antimony, total	7440-36-0	E420	0.00010	mg/L		0.00026	<0.00010	0.00023	0.00051	0.00026
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00021	0.00034	0.00016	0.00023	0.00022
barium, total	7440-39-3	E420	0.00010	mg/L		0.0208	0.00882	0.0166	0.0378	0.0209
beryllium, total	7440-41-7	E420	0.000020	mg/L		<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		0.014	0.010	0.033	0.042	0.015

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW1	MW2	MW3	MW4	QA/QC
					Client sampling date / time	04-Aug-2022 11:00	04-Aug-2022 12:30	04-Aug-2022 14:00	04-Aug-2022 16:30	04-Aug-2022
						EO2206342-001	EO2206342-002	EO2206342-003	EO2206342-004	EO2206342-005
						Result	Result	Result	Result	Result
Total Metals										
cadmium, total	7440-43-9	E420	0.0000050	mg/L		<0.0000050	0.0000138	0.0000188	0.0000170	0.0000099
calcium, total	7440-70-2	E420	0.050	mg/L		55.1	20.2	41.9	55.0	53.0
cesium, total	7440-46-2	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	0.00174	<0.00050
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00081	0.00090	0.00131	0.00283	0.00095
iron, total	7439-89-6	E420	0.010	mg/L		0.025	0.022	0.034	0.035	0.039
lead, total	7439-92-1	E420	0.000050	mg/L		0.000147	0.000112	0.000176	0.000056	0.000195
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	0.0039	<0.0010
magnesium, total	7439-95-4	E420	0.0050	mg/L		35.5	27.8	30.5	35.2	35.4
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00074	0.00255	0.00088	0.0106	0.00095
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000632	0.00125	0.000849	0.00199	0.000652
nickel, total	7440-02-0	E420	0.00050	mg/L		0.00065	0.00065	0.00085	0.00233	0.00065
phosphorus, total	7723-14-0	E420	0.050	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050
potassium, total	7440-09-7	E420	0.050	mg/L		0.777	0.528	0.963	1.67	0.781
rubidium, total	7440-17-7	E420	0.00020	mg/L		<0.00020	<0.00020	<0.00020	0.00108	<0.00020
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000147	0.000109	0.000117	0.000241	0.000145
silicon, total	7440-21-3	E420	0.10	mg/L		1.04	0.70	0.93	3.04	1.05
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		4.27	3.58	3.91	5.09	4.39
strontium, total	7440-24-6	E420	0.00020	mg/L		0.0292	0.0174	0.0311	0.0849	0.0296
sulfur, total	7704-34-9	E420	0.50	mg/L		10.3	7.36	18.0	30.5	10.6
tellurium, total	13494-80-9	E420	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
thallium, total	7440-28-0	E420	0.000010	mg/L		0.000084	0.000040	0.000097	0.000023	0.000079
thorium, total	7440-29-1	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.00030	mg/L		<0.00030	<0.00030	<0.00030	0.00069	<0.00030
tungsten, total	7440-33-7	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	0.00011	<0.00010
uranium, total	7440-61-1	E420	0.000010	mg/L		0.00221	0.00173	0.00222	0.00538	0.00218
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: MW1	MW2	MW3	MW4	QA/QC
					Client sampling date / time: 04-Aug-2022 11:00	04-Aug-2022 12:30	04-Aug-2022 14:00	04-Aug-2022 16:30	04-Aug-2022
					EO2206342-001	EO2206342-002	EO2206342-003	EO2206342-004	EO2206342-005
					Result	Result	Result	Result	Result
Total Metals									
zirconium, total	7440-67-7	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0022	0.0044	0.0019	0.0022	0.0019
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00025	<0.00010	0.00022	0.00040	0.00026
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00016	0.00024	0.00011	0.00018	0.00016
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0218	0.00895	0.0140	0.0423	0.0216
beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.014	<0.010	0.031	0.040	0.014
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	0.0000056	<0.0000050
calcium, dissolved	7440-70-2	E421	0.050	mg/L	51.5	19.4	39.8	54.9	52.2
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	0.00080	<0.00050
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00081	0.00077	0.00118	0.00178	0.00079
iron, dissolved	7439-89-6	E421	0.030	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	0.0038	<0.0010
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	32.8	24.9	27.4	33.9	32.1
manganese, dissolved	7439-96-5	E421	0.00500	mg/L	<0.00500	<0.00500	<0.00500	0.0108	<0.00500
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000620	0.00116	0.000796	0.00170	0.000573
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00066	0.00055	0.00066	0.00180	0.00074
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.770	0.523	0.997	1.79	0.781
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	<0.00020	<0.00020	0.00021	0.00104	<0.00020
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000143	0.000118	0.000108	0.000238	0.000126
silicon, dissolved	7440-21-3	E421	0.050	mg/L	0.968	0.642	0.875	2.64	0.962
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L	4.18	3.42	3.81	4.82	4.13
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0280	0.0164	0.0284	0.0866	0.0274
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	10.2	7.00	17.0	32.2	9.96

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW1	MW2	MW3	MW4	QA/QC
					Client sampling date / time	04-Aug-2022 11:00	04-Aug-2022 12:30	04-Aug-2022 14:00	04-Aug-2022 16:30	04-Aug-2022
						EO2206342-001	EO2206342-002	EO2206342-003	EO2206342-004	EO2206342-005
						Result	Result	Result	Result	Result
Dissolved Metals										
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		0.000067	0.000022	0.000083	0.000021	0.000071
thorium, dissolved	7440-29-1	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.00030	mg/L		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.00190	0.00147	0.00202	0.00537	0.00192
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E421	0.0010	mg/L		0.0012	<0.0010	0.0011	0.0017	0.0011
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field
Volatile Organic Compounds [BTEXS+MTBE]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, o-	95-47-6	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylenes, total	1330-20-7	E611A	0.75	µg/L		<0.75	<0.75	<0.75	<0.75	<0.75
BTEX, total	----	E611A	1.2	µg/L		<1.2	<1.2	<1.2	<1.2	<1.2
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%		85.9	83.0	84.8	83.4	83.1
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%		94.5	94.7	94.7	90.3	94.0
Hydrocarbons										
F1 (C6-C10)	----	E581.F1	100	µg/L		<100	<100	<100	<100	<100
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250
hydrocarbons, total (C6-C50)	----	EC581	400	µg/L		<400	<400	<400	<400	<400
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%		98.7	99.6	96.9	99.7	94.1

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: MW1	MW2	MW3	MW4	QA/QC
					Client sampling date / time: 04-Aug-2022 11:00	04-Aug-2022 12:30	04-Aug-2022 14:00	04-Aug-2022 16:30	04-Aug-2022
					EO2206342-001	**EO2206342-002**	**EO2206342-003**	**EO2206342-004**	**EO2206342-005**
					Result	Result	Result	Result	Result
Hydrocarbons Surrogates									
dichlorotoluene, 3,4-	97-75-0	E581.F1	1.0	%	107	105	98.3	99.0	101
Polychlorinated Biphenyls									
Aroclor 1016	12674-11-2	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1221	11104-28-2	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1232	11141-16-5	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1242	53469-21-9	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1248	12672-29-6	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1254	11097-69-1	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1260	11096-82-5	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1262	37324-23-5	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1268	11100-14-4	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
polychlorinated biphenyls [PCBs], total	----	E685	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Polychlorinated Biphenyls Surrogates									
decachlorobiphenyl	2051-24-3	E685	1.0	%	91.9	82.3	90.2	81.8	93.6

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **EO2206342**	Page	: 1 of 17
Client	: **AECOM Canada Ltd.**	Laboratory	: Edmonton - Environmental
Contact	: Jessica Stepney	Account Manager	: Pamela Toledo
Address	: 101 - 18817 Stony Plain Rd. NW Edmonton AB Canada T5S 0C2	Address	: 9450 - 17 Avenue NW Edmonton, Alberta Canada T6N 1M9
Telephone	: 780-486-5921	Telephone	: +1 780 413 5227
Project	: 60686962	Date Samples Received	: 10-Aug-2022 17:27
PO	: ----	Issue Date	: 19-Aug-2022 08:38
C-O-C number	: 20-1009580		
Sampler	: ----		
Site	: PIN-D		
Quote number	: 2022 Price List - Prairies		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE										
MW1	E235.Cl	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
MW2	E235.Cl	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
MW3	E235.Cl	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
MW4	E235.Cl	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
QA/QC	E235.Cl	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
MW1	E235.F	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
MW2	E235.F	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW3	E235.F	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW4	E235.F	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QA/QC	E235.F	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW1	E235.NO3	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW2	E235.NO3	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW3	E235.NO3	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW4	E235.NO3	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrate in Water by IC										
HDPE QA/QC	E235.NO3	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	8 days	× EHTR-FM
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW1	E235.NO2	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW2	E235.NO2	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW3	E235.NO2	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW4	E235.NO2	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrite in Water by IC										
HDPE QA/QC	E235.NO2	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	8 days	× EHTR-FM
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW1	E235.SO4	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW2	E235.SO4	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW3	E235.SO4	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW4	E235.SO4	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE QA/QC	E235.SO4	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW1	E421	04-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	180 days	11 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW2	E421	04-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	180 days	11 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW3	E421	04-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	180 days	11 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW4	E421	04-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	180 days	11 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QA/QC	E421	04-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	180 days	11 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW1	E581.F1	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW2	E581.F1	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW3	E581.F1	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW4	E581.F1	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) QA/QC	E581.F1	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	9 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW1	E601	04-Aug-2022	11-Aug-2022	14 days	7 days	✓	11-Aug-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW2	E601	04-Aug-2022	11-Aug-2022	14 days	7 days	✓	11-Aug-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW3	E601	04-Aug-2022	11-Aug-2022	14 days	7 days	✓	11-Aug-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW4	E601	04-Aug-2022	11-Aug-2022	14 days	7 days	✓	11-Aug-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) QA/QC	E601	04-Aug-2022	11-Aug-2022	14 days	7 days	✓	11-Aug-2022	40 days	0 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW1	E290	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW2	E290	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW3	E290	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE MW4	E290	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QA/QC	E290	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	8 days	✓
Physical Tests : Conductivity in Water										
HDPE MW1	E100	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE MW2	E100	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE MW3	E100	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE MW4	E100	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE QA/QC	E100	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	8 days	✓
Physical Tests : pH by Meter										
HDPE MW2	E108	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	3.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW3	E108	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	3.25 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE MW4	E108	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	3.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QA/QC	E108	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	3.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW1	E108	04-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	5.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE MW1	E162	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE MW2	E162	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE MW3	E162	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE MW4	E162	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QA/QC	E162	04-Aug-2022	----	----	----		11-Aug-2022	7 days	8 days	✓
Physical Tests : TSS by Gravimetry										
HDPE MW1	E160	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry										
HDPE										
MW2	E160	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry										
HDPE										
MW3	E160	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry										
HDPE										
MW4	E160	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry										
HDPE										
QA/QC	E160	04-Aug-2022	----	----	----		11-Aug-2022	7 days	7 days	✓
Polychlorinated Biphenyls : PCB Aroclors by GC-ECD										
Amber glass/Teflon lined cap										
MW1	E685	04-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	40 days	1 days	✓
Polychlorinated Biphenyls : PCB Aroclors by GC-ECD										
Amber glass/Teflon lined cap										
MW2	E685	04-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	40 days	1 days	✓
Polychlorinated Biphenyls : PCB Aroclors by GC-ECD										
Amber glass/Teflon lined cap										
MW3	E685	04-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	40 days	1 days	✓
Polychlorinated Biphenyls : PCB Aroclors by GC-ECD										
Amber glass/Teflon lined cap										
MW4	E685	04-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	40 days	1 days	✓
Polychlorinated Biphenyls : PCB Aroclors by GC-ECD										
Amber glass/Teflon lined cap										
QA/QC	E685	04-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	40 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) MW1	E420	04-Aug-2022	16-Aug-2022	----	----		16-Aug-2022	180 days	12 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) MW2	E420	04-Aug-2022	16-Aug-2022	----	----		16-Aug-2022	180 days	12 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) MW3	E420	04-Aug-2022	16-Aug-2022	----	----		16-Aug-2022	180 days	12 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) MW4	E420	04-Aug-2022	16-Aug-2022	----	----		16-Aug-2022	180 days	12 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) QA/QC	E420	04-Aug-2022	16-Aug-2022	----	----		16-Aug-2022	180 days	13 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW1	E611A	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW2	E611A	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW3	E611A	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW4	E611A	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
QA/QC	E611A	04-Aug-2022	12-Aug-2022	----	----		12-Aug-2022	14 days	9 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	597715	2	34	5.8	5.0	✓
BTEX by Headspace GC-MS	E611A	599507	1	19	5.2	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	599506	1	19	5.2	5.0	✓
Chloride in Water by IC	E235.Cl	598237	1	19	5.2	5.0	✓
Conductivity in Water	E100	597714	2	38	5.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	602827	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	598234	1	16	6.2	5.0	✓
Nitrate in Water by IC	E235.NO3	598238	1	17	5.8	5.0	✓
Nitrite in Water by IC	E235.NO2	598235	1	17	5.8	5.0	✓
pH by Meter	E108	597713	2	40	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	598236	1	19	5.2	5.0	✓
TDS by Gravimetry	E162	598243	2	33	6.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	604213	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	598070	1	19	5.2	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	597715	2	34	5.8	5.0	✓
BTEX by Headspace GC-MS	E611A	599507	1	19	5.2	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	599506	1	19	5.2	5.0	✓
CCME PHCs - F2-F4 by GC-FID	E601	597880	1	10	10.0	5.0	✓
Chloride in Water by IC	E235.Cl	598237	1	19	5.2	5.0	✓
Conductivity in Water	E100	597714	2	38	5.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	602827	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	598234	1	16	6.2	5.0	✓
Nitrate in Water by IC	E235.NO3	598238	1	17	5.8	5.0	✓
Nitrite in Water by IC	E235.NO2	598235	1	17	5.8	5.0	✓
PCB Aroclors by GC-ECD	E685	606598	1	13	7.6	5.0	✓
pH by Meter	E108	597713	2	40	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	598236	1	19	5.2	5.0	✓
TDS by Gravimetry	E162	598243	2	33	6.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	604213	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	598070	1	19	5.2	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	597715	2	34	5.8	5.0	✓
BTEX by Headspace GC-MS	E611A	599507	1	19	5.2	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	599506	1	19	5.2	5.0	✓
CCME PHCs - F2-F4 by GC-FID	E601	597880	1	10	10.0	5.0	✓
Chloride in Water by IC	E235.Cl	598237	1	19	5.2	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Conductivity in Water	E100	597714	2	38	5.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	602827	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	598234	1	16	6.2	5.0	✓
Nitrate in Water by IC	E235.NO3	598238	1	17	5.8	5.0	✓
Nitrite in Water by IC	E235.NO2	598235	1	17	5.8	5.0	✓
PCB Aroclors by GC-ECD	E685	606598	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	598236	1	19	5.2	5.0	✓
TDS by Gravimetry	E162	598243	2	33	6.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	604213	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	598070	1	19	5.2	5.0	✓
Matrix Spikes (MS)							
BTEX by Headspace GC-MS	E611A	599507	1	19	5.2	5.0	✓
Chloride in Water by IC	E235.Cl	598237	1	19	5.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	602827	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	598234	1	16	6.2	5.0	✓
Nitrate in Water by IC	E235.NO3	598238	1	17	5.8	5.0	✓
Nitrite in Water by IC	E235.NO2	598235	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	598236	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	604213	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Edmonton - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Edmonton - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
TSS by Gravimetry	E160 Edmonton - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Edmonton - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Chloride in Water by IC	E235.Cl Edmonton - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Edmonton - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC	E235.NO2 Edmonton - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 Edmonton - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Edmonton - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 Edmonton - Environmental	Water	APHA 2320 B (mod)	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.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Metals in Water by CRC ICPMS	E420 Edmonton - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Edmonton - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
CCME PHC - F1 by Headspace GC-FID	E581.F1 Edmonton - Environmental	Water	CCME PHC in Soil - Tier 1	CCME Fraction 1 (F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
CCME PHCs - F2-F4 by GC-FID	E601 Edmonton - Environmental	Water	CCME PHC in Soil - Tier 1	Sample extracts are analyzed by GC-FID for CCME hydrocarbon fractions (F2-F4).
BTEX by Headspace GC-MS	E611A Edmonton - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PCB Aroclors by GC-ECD	E685 Vancouver - Environmental	Water	EPA 8082A (mod)	PCB Aroclors are analyzed by GC-ECD
Dissolved Hardness (Calculated)	EC100 Edmonton - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Edmonton - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
TDS in Water (Calculation)	EC103 Edmonton - Environmental	Water	APHA 1030E (mod)	Total Dissolved Solids is calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Edmonton - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
F1-BTEX	EC580 Edmonton - Environmental	Water	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).
Sum F1 to F4 (C6-C50)	EC581 Edmonton - Environmental	Water	CCME PHC in Soil - Tier 1	Hydrocarbons, total (C6-C50) is the sum of CCME Fractions F1(C6-C10), F2(C10-C16), F3(C16-C34), and F4(C34-C50). F4G-sg is not used within this calculation due to overlap with other fractions.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Metals Water Filtration	EP421 Edmonton - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
VOCs Preparation for Headspace Analysis	EP581 Edmonton - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 Edmonton - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.
PCB Aroclors Extraction	EP685 Vancouver - Environmental	Water	EPA 3510C (mod)	PCBs are extracted using an organic solvent liquid-liquid extraction.The hexane extract undergoes one or more of the following clean-up procedures (if required): florisil clean-up, silica gel clean-up, sulphur clean-up and/or sulphuric acid clean-up.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EO2206342**	Page	: 1 of 18
Client	: AECOM Canada Ltd.	Laboratory	: Edmonton - Environmental
Contact	: Jessica Stepney	Account Manager	: Pamela Toledo
Address	: 101 - 18817 Stony Plain Rd. NW Edmonton AB Canada T5S 0C2	Address	: 9450 - 17 Avenue NW Edmonton, Alberta Canada T6N 1M9
Telephone	: 780-486-5921	Telephone	: +1 780 413 5227
Project	: 60686962	Date Samples Received	: 10-Aug-2022 17:27
PO	: ----	Date Analysis Commenced	: 11-Aug-2022
C-O-C number	: 20-1009580	Issue Date	: 19-Aug-2022 08:38
Sampler	: ----		
Site	: PIN-D		
Quote number	: 2022 Price List - Prairies		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Drake	Lab Analyst	Edmonton Inorganics, Edmonton, Alberta
Austin Wasylyshyn	Lab Analyst	Edmonton Metals, Edmonton, Alberta
Dan Nguyen	Team Leader - Inorganics	Edmonton Inorganics, Edmonton, Alberta
Dan Nguyen	Team Leader - Inorganics	Edmonton Metals, Edmonton, Alberta
Daniel Nguyen	Lab Assistant	Edmonton Inorganics, Edmonton, Alberta
Janice Leung	Supervisor - Organics Instrumentation	Vancouver Organics, Burnaby, British Columbia
Jessica Maitland	Lab Assistant	Edmonton Inorganics, Edmonton, Alberta
Kari Mulroy	Lab Supervisor - Environmental	Edmonton Organics, Edmonton, Alberta
Remy Gatabazi	Lab Analyst	Edmonton Organics, Edmonton, Alberta
Sobhithan Pillay		Edmonton Inorganics, Edmonton, Alberta
Yan Zhang	Lab Analyst	Edmonton Organics, Edmonton, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 597713)											
EO2206309-010	Anonymous	pH	----	E108	0.10	pH units	5.11	5.07	0.04	Diff <2x LOR	----
Physical Tests (QC Lot: 597714)											
EO2206309-010	Anonymous	conductivity	----	E100	1.0	µS/cm	1.3	1.3	0.01	Diff <2x LOR	----
Physical Tests (QC Lot: 597715)											
EO2206309-010	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 598070)											
EO2206342-001	MW1	solids, total suspended [TSS]	----	E160	3.0	mg/L	<3.0	<3.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 598213)											
EO2206342-002	MW2	pH	----	E108	0.10	pH units	8.13	8.12	0.123%	3%	----
Physical Tests (QC Lot: 598214)											
EO2206342-002	MW2	conductivity	----	E100	2.0	µS/cm	281	281	0.00%	10%	----
Physical Tests (QC Lot: 598215)											
EO2206342-002	MW2	alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	132	130	1.91%	20%	----
Physical Tests (QC Lot: 598243)											
EO2206296-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	564	576	2.11%	20%	----
Physical Tests (QC Lot: 600896)											
EO2206342-003	MW3	solids, total dissolved [TDS]	----	E162	20	mg/L	226	228	0.879%	20%	----
Anions and Nutrients (QC Lot: 598234)											
EO2206346-005	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.586	0.617	5.15%	20%	----
Anions and Nutrients (QC Lot: 598235)											
EO2206346-005	Anonymous	nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 598236)											
EO2206346-005	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	690	694	0.612%	20%	----
Anions and Nutrients (QC Lot: 598237)											
EO2206346-005	Anonymous	chloride	16887-00-6	E235.Cl	0.50	mg/L	114	112	1.27%	20%	----
Anions and Nutrients (QC Lot: 598238)											
EO2206346-005	Anonymous	nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L	0.207	0.207	0.145%	20%	----
Total Metals (QC Lot: 604213)											
EO2206342-001	MW1	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0100	0.0103	0.0003	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00026	0.00026	0.000009	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00021	0.00020	0.000007	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 604213) - continued											
EO2206342-001	MW1	barium, total	7440-39-3	E420	0.00010	mg/L	0.0208	0.0208	0.248%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.014	0.015	0.0006	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0000050	0.0000060	0.0000010	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	55.1	53.1	3.74%	20%	----
		cesium, total	7440-46-2	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00081	0.00080	0.00001	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.025	0.025	0.0005	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.000147	0.000145	0.000003	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	35.5	35.7	0.459%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00074	0.00077	0.00004	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000632	0.000656	3.65%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00065	0.00083	0.00018	Diff <2x LOR	----
		phosphorus, total	7723-14-0	E420	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.777	0.778	0.136%	20%	----
		rubidium, total	7440-17-7	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.000147	0.000158	0.000011	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.04	1.05	1.20%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	4.27	4.36	2.02%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.0292	0.0299	2.36%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	10.3	10.7	3.34%	20%	----
		tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	0.000084	0.000075	0.000009	Diff <2x LOR	----
		thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00221	0.00218	1.26%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 604213) - continued											
EO2206342-001	MW1	zirconium, total	7440-67-7	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 602827)											
EO2206332-009	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.388	0.388	0.0201%	20%	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00017	0.00015	0.00002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00070	0.00070	0.0000003	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0555	0.0570	2.70%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	0.000038	0.000030	0.000008	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.023	0.023	0.0006	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000380	0.0000339	0.0000041	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	19.4	18.9	2.55%	20%	----
		cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	0.00088	0.00091	0.00002	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.0121	0.0122	0.852%	20%	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00437	0.00443	1.48%	20%	----
		iron, dissolved	7439-89-6	E421	0.030	mg/L	0.605	0.614	1.46%	20%	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000308	0.000317	0.000009	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	3.90	3.93	0.728%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00500	mg/L	1.02	1.01	0.184%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000332	0.000332	0.00000006	Diff <2x LOR	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00474	0.00483	0.00009	Diff <2x LOR	----
		phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	0.210	0.203	0.006	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	10.8	10.7	0.654%	20%	----
		rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00262	0.00255	2.88%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000459	0.000500	0.000041	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	4.01	4.11	2.44%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	0.000014	0.000012	0.000001	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	3.47	3.45	0.705%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0440	0.0452	2.83%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	2.29	2.28	0.01	Diff <2x LOR	----
		tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		thorium, dissolved	7440-29-1	E421	0.00010	mg/L	0.00044	0.00044	0.000002	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00900	0.00869	3.47%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 602827) - continued											
EO2206332-009	Anonymous	titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.0300	0.0311	3.75%	20%	----
		tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000118	0.000119	0.757%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00186	0.00198	0.00012	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0034	0.0033	0.0001	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	0.00251	0.00250	0.592%	20%	----
Volatile Organic Compounds (QC Lot: 599507)											
EO2206342-001	MW1	benzene	71-43-2	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 599506)											
EO2206342-001	MW1	F1 (C6-C10)	----	E581.F1	100	µg/L	<100	<100	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 597714)						
conductivity	----	E100	1	µS/cm	1.3	----
Physical Tests (QCLot: 597715)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 598070)						
solids, total suspended [TSS]	----	E160	3	mg/L	<3.0	----
Physical Tests (QCLot: 598214)						
conductivity	----	E100	1	µS/cm	1.3	----
Physical Tests (QCLot: 598215)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 598243)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 600896)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 598234)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 598235)						
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 598236)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 598237)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 598238)						
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Total Metals (QCLot: 604213)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 604213) - continued						
cesium, total	7440-46-2	E420	0.00001	mg/L	<0.000010	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
phosphorus, total	7723-14-0	E420	0.05	mg/L	<0.050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
rubidium, total	7440-17-7	E420	0.0002	mg/L	<0.00020	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
tellurium, total	13494-80-9	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
thorium, total	7440-29-1	E420	0.0001	mg/L	<0.00010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
tungsten, total	7440-33-7	E420	0.0001	mg/L	<0.00010	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
zirconium, total	7440-67-7	E420	0.0002	mg/L	<0.00020	----
Dissolved Metals (QCLot: 602827)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 602827) - continued						
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	<0.000010	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	<0.00020	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	<0.00010	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----
Volatile Organic Compounds (QCLot: 599507)						
benzene	71-43-2	E611A	0.5	µg/L	<0.50	----
BTEX, total	----	E611A	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 599507) - continued						
ethylbenzene	100-41-4	E611A	0.5	µg/L	<0.50	----
toluene	108-88-3	E611A	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611A	0.3	µg/L	<0.30	----
Hydrocarbons (QCLot: 597880)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----
F3 (C16-C34)	----	E601	250	µg/L	<250	----
F4 (C34-C50)	----	E601	250	µg/L	<250	----
Hydrocarbons (QCLot: 599506)						
F1 (C6-C10)	----	E581.F1	100	µg/L	<100	----
Polychlorinated Biphenyls (QCLot: 606598)						
Aroclor 1016	12674-11-2	E685	1	µg/L	<1.0	----
Aroclor 1221	11104-28-2	E685	1	µg/L	<1.0	----
Aroclor 1232	11141-16-5	E685	1	µg/L	<1.0	----
Aroclor 1242	53469-21-9	E685	1	µg/L	<1.0	----
Aroclor 1248	12672-29-6	E685	1	µg/L	<1.0	----
Aroclor 1254	11097-69-1	E685	1	µg/L	<1.0	----
Aroclor 1260	11096-82-5	E685	1	µg/L	<1.0	----
Aroclor 1262	37324-23-5	E685	1	µg/L	<1.0	----
Aroclor 1268	11100-14-4	E685	1	µg/L	<1.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 597713)									
pH	----	E108	----	pH units	6 pH units	102	97.0	103	----
Physical Tests (QCLot: 597714)									
conductivity	----	E100	1	µS/cm	1412 µS/cm	94.5	90.0	110	----
Physical Tests (QCLot: 597715)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	108	85.0	115	----
Physical Tests (QCLot: 598070)									
solids, total suspended [TSS]	----	E160	3	mg/L	150 mg/L	108	85.0	115	----
Physical Tests (QCLot: 598213)									
pH	----	E108	----	pH units	6 pH units	102	97.0	103	----
Physical Tests (QCLot: 598214)									
conductivity	----	E100	1	µS/cm	1412 µS/cm	102	90.0	110	----
Physical Tests (QCLot: 598215)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	100	85.0	115	----
Physical Tests (QCLot: 598243)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	97.9	85.0	115	----
Physical Tests (QCLot: 600896)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	100	85.0	115	----
Anions and Nutrients (QCLot: 598234)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 598235)									
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	92.9	90.0	110	----
Anions and Nutrients (QCLot: 598236)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	91.8	90.0	110	----
Anions and Nutrients (QCLot: 598237)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	94.2	90.0	110	----
Anions and Nutrients (QCLot: 598238)									
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	94.8	90.0	110	----
Total Metals (QCLot: 604213)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	105	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	102	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 604213) - continued									
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	108	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	103	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	103	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	104	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	103	80.0	120	----
cesium, total	7440-46-2	E420	0.00001	mg/L	0.05 mg/L	101	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	103	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	97.2	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	101	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	106	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	108	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
phosphorus, total	7723-14-0	E420	0.05	mg/L	10 mg/L	110	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
rubidium, total	7440-17-7	E420	0.0002	mg/L	0.1 mg/L	106	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	99.4	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	97.4	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	95.8	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	103	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	102	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	94.4	80.0	120	----
tellurium, total	13494-80-9	E420	0.0002	mg/L	0.1 mg/L	94.4	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	99.6	80.0	120	----
thorium, total	7440-29-1	E420	0.0001	mg/L	0.1 mg/L	95.3	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	97.5	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	103	80.0	120	----
tungsten, total	7440-33-7	E420	0.0001	mg/L	0.1 mg/L	103	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	104	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	99.1	80.0	120	----
zirconium, total	7440-67-7	E420	0.0002	mg/L	0.1 mg/L	95.9	80.0	120	----
Dissolved Metals (QCLot: 602827)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	107	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 602827) - continued									
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	103	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	107	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	96.6	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	91.1	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	99.1	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	102	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	105	80.0	120	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	0.05 mg/L	99.2	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	101	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	106	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	101	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	94.6	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	100	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	101	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	98.4	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	106	80.0	120	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	99.7	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	0.1 mg/L	107	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	103	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	103	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	86.8	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	99.9	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	92.1	80.0	120	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	0.1 mg/L	105	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	94.0	80.0	120	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	0.1 mg/L	86.2	80.0	120	----
tin, dissolved	7440-31-5	E421	----	mg/L	0.5 mg/L	99.0	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	102	80.0	120	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	0.1 mg/L	94.9	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	94.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	106	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	96.2	80.0	120	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	93.9	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Volatile Organic Compounds (QCLot: 599507)									
benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	87.1	70.0	130	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	101	70.0	130	----
toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	81.1	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	107	70.0	130	----
xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	101	70.0	130	----
Hydrocarbons (QCLot: 597880)									
F2 (C10-C16)	----	E601	100	µg/L	3260 µg/L	105	70.0	130	----
F3 (C16-C34)	----	E601	250	µg/L	6340 µg/L	108	70.0	130	----
F4 (C34-C50)	----	E601	250	µg/L	4970 µg/L	111	70.0	130	----
Hydrocarbons (QCLot: 599506)									
F1 (C6-C10)	----	E581.F1	100	µg/L	2750 µg/L	86.8	70.0	130	----
Polychlorinated Biphenyls (QCLot: 606598)									
Aroclor 1260	11096-82-5	E685	1	µg/L	5 µg/L	115	65.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 598234)										
EO2206346-005	Anonymous	fluoride	16984-48-8	E235.F	0.984 mg/L	1 mg/L	98.4	75.0	125	----
Anions and Nutrients (QCLot: 598235)										
EO2206346-005	Anonymous	nitrite (as N)	14797-65-0	E235.NO2	0.469 mg/L	0.5 mg/L	93.8	75.0	125	----
Anions and Nutrients (QCLot: 598236)										
EO2206346-005	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 598237)										
EO2206346-005	Anonymous	chloride	16887-00-6	E235.Cl	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 598238)										
EO2206346-005	Anonymous	nitrate (as N)	14797-55-8	E235.NO3	2.46 mg/L	2.5 mg/L	98.6	75.0	125	----
Total Metals (QCLot: 604213)										
EO2206342-002	MW2	aluminum, total	7429-90-5	E420	0.192 mg/L	0.2 mg/L	96.0	70.0	130	----
		antimony, total	7440-36-0	E420	0.0196 mg/L	0.02 mg/L	98.0	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0200 mg/L	0.02 mg/L	99.9	70.0	130	----
		barium, total	7440-39-3	E420	0.0199 mg/L	0.02 mg/L	99.5	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0410 mg/L	0.04 mg/L	102	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00974 mg/L	0.01 mg/L	97.4	70.0	130	----
		boron, total	7440-42-8	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00409 mg/L	0.004 mg/L	102	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		cesium, total	7440-46-2	E420	0.0100 mg/L	0.01 mg/L	100	70.0	130	----
		chromium, total	7440-47-3	E420	0.0399 mg/L	0.04 mg/L	99.8	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0197 mg/L	0.02 mg/L	98.3	70.0	130	----
		copper, total	7440-50-8	E420	0.0194 mg/L	0.02 mg/L	97.3	70.0	130	----
		iron, total	7439-89-6	E420	1.97 mg/L	2 mg/L	98.5	70.0	130	----
		lead, total	7439-92-1	E420	0.0192 mg/L	0.02 mg/L	96.0	70.0	130	----
		lithium, total	7439-93-2	E420	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0199 mg/L	0.02 mg/L	99.3	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		nickel, total	7440-02-0	E420	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		phosphorus, total	7723-14-0	E420	10.4 mg/L	10 mg/L	104	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 604213) - continued										
EO2206342-002	MW2	potassium, total	7440-09-7	E420	3.98 mg/L	4 mg/L	99.4	70.0	130	----
		rubidium, total	7440-17-7	E420	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		selenium, total	7782-49-2	E420	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
		silicon, total	7440-21-3	E420	9.48 mg/L	10 mg/L	94.8	70.0	130	----
		silver, total	7440-22-4	E420	0.00409 mg/L	0.004 mg/L	102	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		sulfur, total	7704-34-9	E420	19.1 mg/L	20 mg/L	95.6	70.0	130	----
		tellurium, total	13494-80-9	E420	0.0380 mg/L	0.04 mg/L	94.9	70.0	130	----
		thallium, total	7440-28-0	E420	0.00388 mg/L	0.004 mg/L	96.9	70.0	130	----
		thorium, total	7440-29-1	E420	0.0162 mg/L	0.02 mg/L	80.9	70.0	130	----
		tin, total	7440-31-5	E420	0.0196 mg/L	0.02 mg/L	98.3	70.0	130	----
		titanium, total	7440-32-6	E420	0.0410 mg/L	0.04 mg/L	102	70.0	130	----
		tungsten, total	7440-33-7	E420	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		uranium, total	7440-61-1	E420	0.00403 mg/L	0.004 mg/L	101	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0990 mg/L	0.1 mg/L	99.0	70.0	130	----
		zinc, total	7440-66-6	E420	0.363 mg/L	0.4 mg/L	90.8	70.0	130	----
		zirconium, total	7440-67-7	E420	0.0430 mg/L	0.04 mg/L	107	70.0	130	----
Dissolved Metals (QCLot: 602827)										
EO2206332-010	Anonymous	aluminum, dissolved	7429-90-5	E421	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0200 mg/L	0.02 mg/L	99.9	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0211 mg/L	0.02 mg/L	106	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0394 mg/L	0.04 mg/L	98.6	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00861 mg/L	0.01 mg/L	86.1	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.110 mg/L	0.1 mg/L	110	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00409 mg/L	0.004 mg/L	102	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		cesium, dissolved	7440-46-2	E421	0.00984 mg/L	0.01 mg/L	98.4	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0388 mg/L	0.04 mg/L	97.1	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0197 mg/L	0.02 mg/L	98.5	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0197 mg/L	0.02 mg/L	98.3	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.93 mg/L	2 mg/L	96.5	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0176 mg/L	0.02 mg/L	87.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0998 mg/L	0.1 mg/L	99.8	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 602827) - continued										
EO2206332-010	Anonymous	manganese, dissolved	7439-96-5	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0192 mg/L	0.02 mg/L	96.0	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0387 mg/L	0.04 mg/L	96.6	70.0	130	----
		phosphorus, dissolved	7723-14-0	E421	10.4 mg/L	10 mg/L	104	70.0	130	----
		potassium, dissolved	7440-09-7	E421	3.78 mg/L	4 mg/L	94.5	70.0	130	----
		rubidium, dissolved	7440-17-7	E421	0.0198 mg/L	0.02 mg/L	99.2	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0463 mg/L	0.04 mg/L	116	70.0	130	----
		silicon, dissolved	7440-21-3	E421	8.62 mg/L	10 mg/L	86.2	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00367 mg/L	0.004 mg/L	91.7	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	19.6 mg/L	20 mg/L	97.9	70.0	130	----
		tellurium, dissolved	13494-80-9	E421	0.0420 mg/L	0.04 mg/L	105	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00362 mg/L	0.004 mg/L	90.6	70.0	130	----
		thorium, dissolved	7440-29-1	E421	0.0177 mg/L	0.02 mg/L	88.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0195 mg/L	0.02 mg/L	97.4	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		tungsten, dissolved	7440-33-7	E421	0.0182 mg/L	0.02 mg/L	90.8	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.356 mg/L	0.4 mg/L	89.0	70.0	130	----
		zirconium, dissolved	7440-67-7	E421	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
Volatile Organic Compounds (QCLot: 599507)										
EO2206342-002	MW2	benzene	71-43-2	E611A	92.7 µg/L	100 µg/L	92.7	50.0	140	----
		ethylbenzene	100-41-4	E611A	87.4 µg/L	100 µg/L	87.4	50.0	140	----
		toluene	108-88-3	E611A	72.8 µg/L	100 µg/L	72.8	50.0	140	----
		xylene, m+p-	179601-23-1	E611A	201 µg/L	200 µg/L	100	50.0	140	----
		xylene, o-	95-47-6	E611A	90.9 µg/L	100 µg/L	90.9	50.0	140	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 1009580

Canada Toll Free: 1 800 668 9878

Page 1 of 1

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Report To	Contact and company name below will appear on the final report
Company:	Aecom Canada Ltd
Contact:	Jessica Stepney
Phone:	1-780-248-6562
	Company address below will appear on the final report
Street:	101, 18817 Stony plain Rd
City/Province:	Edmonton AB
Postal Code:	T5S 0C2
Invoice To	Same as Report To ☒ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Reports / Recipients

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Jessica.Stepney@Aecom.com

Email 2: Alysha.Selinger@Aecom.com

Email 3: Rory.McNeil@Aecom.com

Invoice Recipients

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Jessica.Stepney@Aecom.com

Email 2: CANSSC.E-Billing@Aecom.com

Turnaround Time (TAT) Requested

☒ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information

ALS Account # / Quote #:	Q89810
Job #:	60686962
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 # (ALS use only):

ALS Contact: **Sampler:**

Analysis Request

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

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Total Metals (P)	Dissolved Metals (F/P)	PHC: F1-F4(+BTEX) (P)	Major Anions (P)	TDS (P)	TSS (P)	PCB (P)	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	MW1	04-Aug-22	11:00	GW	10	X	X	X	X	X	X	X			
	MW2	04-Aug-22	12:30	GW	10	X	X	X	X	X	X	X			
	MW3	04-Aug-22	14:00	GW	10	X	X	X	X	X	X	X			
	MW4	04-Aug-22	16:30	GW	10	X	X	X	X	X	X	X			
	DA/DC	04-Aug-22	—	GW	10	X	X	X	X	X	X	X			

Environmental Division
Edmonton
Work Order Reference
EO2206342

Telephone : +1 780 413 5227

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

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

CCME Guidelines

Site: PIN-D

SAMPLE RECEIPT DETAIL

Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS

Submission Comments identified on Sample Receipt Notific

Cooler Custody Seals Intact: ☐ YES ☐ N/A Samp

INITIAL COOLER TEMPERATURES °C

6.1

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date: Aug 7/22	Time:	Received by:	Date: Aug 10	Time:	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 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.**

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