2019 Groundwater and Soil Vapour Monitoring Report
Great West Adventure Park
North Half of Section 17-038-27 W4M

PRESENTED TO

The City of Red Deer

July 24, 2020
ISSUED FOR USE
FILE: SWM.SWOP04071-01.001

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EXECUTIVE SUMMARY

The City of Red Deer (The City) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct the 2019 groundwater and vapour monitoring program at the former landfill located beneath the Great West Adventure Park (GWAP), located within Lot 1 MR Plan 8322386, within the north half of Section 17-038-27 W4M, in Red Deer, Alberta hereafter referred to as “the site”. The objective of the monitoring program is to identify potential environmental concerns related to former operations at the site.

Tetra Tech’s scope of work for the 2019 monitoring and sampling program at the GWAP site included conducting semi-annual events of groundwater and vapour monitoring, annual groundwater sampling, updating the hazard quotients, reviewing and updating previous recommendations for the site, and preparing an annual report.

The groundwater monitoring network at the site consists of five monitoring wells (MW-01 to MW-05). Monitoring wells were in good condition during the 2019 events. All of the monitoring wells are screened through the native sand and gravel into the shale bedrock. MW-03 is also screened through the sand fill.

The vapour monitoring network consists of two vapour monitoring wells; VW-01 located near the north end of site and VW-02 in the southwest corner of the site. The vapour wells were in good condition during the 2019 monitoring events.

Based upon the work conducted at the site, Tetra Tech has developed the following conclusions:

- The groundwater elevations in 2019 indicated that the inferred groundwater flow direction was to the northeast. The average horizontal hydraulic gradients at the site were 0.002 m/m in June 2019 and 0.001 m/m in December 2019. This is consistent with observations made historically. Groundwater elevations in 2019 were overall slightly lower than groundwater elevations measured previously in 2013.

- Routine groundwater chemistry parameters and dissolved metals concentrations that exceeded the Alberta Tier 1 Guidelines at one or more monitoring wells in 2019 included total dissolved solids, chloride, aluminum, arsenic, cadmium, copper, iron, manganese, and selenium. The measured concentrations of these parameters were generally consistent with previous results and background/up-gradient concentrations and may reflect natural groundwater quality or may be elevated due to inadequate filtration. Possible exceptions are the dissolved metal concentrations at MW-02, in particular cadmium and arsenic.

- During the 2019 sampling events, chloride concentrations greater than the Alberta Tier 1 Guidelines (120 mg/L) were measured at all monitoring wells. Chloride concentrations at most wells have increased since the 2013 sampling event. Chloride concentrations were greatest at up-gradient well MW-01 and are likely due to road salt use in the area and are not interpreted to be related to landfill impacts.

- Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons (PHC) fractions F1 to F2, adsorbable organic halides (AOX), volatile fatty/carboxylic acids, and volatile organic compounds (VOCs) in 2019 were less than the analytical detection limits at all monitoring wells.

- Concentrations of BTEX, hydrocarbons, and VOCs in all soil vapour samples were less than the soil vapour screening criteria.

- Siloxanes were detected in sample VW-02 greater than the laboratory detection limit; however, there are no screening criteria for these compounds and the concentrations are not identified as a concern.

- The estimated individual and cumulative risks and hazards associated with the soil vapour samples collected in December 2019 did not exceed the corresponding target risk and hazard levels.

- The previous Phase II Environmental Site Assessment recommended evaluating if surface water samples from the Red Deer River would be valuable to assess potential impacts from site groundwater on the river water quality. Based on the concentrations measured in the groundwater samples, surface water samples are not recommended. Due to the high volume of water flowing in the Red Deer River (a year-around average of approximately 75 m^3/s[1]), leaching of groundwater from the site would have little to no appreciable effect on the river water quality. Similarly, the Environmental Risk Management Plan recommended determining whether the Water Treatment Plant (WTP) is susceptible to impact from the site, and if so, reviewing the results of the site work with the WTP. Due to the high flow rate in the Red Deer River, appreciable impacts to the river quality are not expected, and subsequently no impacts would be expected to the WTP, located across the river to the northeast, either via river flow or via migration through gravel deposits beneath the riverbed.

Based upon the results of the groundwater and vapour monitoring program in 2019, there are no clear indications of significant impacts related to the former landfill operations at most monitoring well locations. However, there appear to be residual impacts in the groundwater and buried landfill waste remains in place beneath the site, therefore ongoing risk management is required. Risk management is recommended to include: additional assessment; ongoing monitoring; and administrative actions. The following recommendations are made according to these risk management elements:

- Additional Assessment
  - Available data does not suggest there is a significant concern with regards to soil vapours in the vicinity of the Riverbend Village apartments. However for due diligence, based on the presence of buried waste and proximity of the apartments, confirmation of soil vapour concentrations in this site area is recommended with installation of one additional vapour monitoring probe between the waste footprint and the apartments.
  - Determine the status of the Red Deer BMX club water well located at the site. Confirm if the water well is being used, the purpose of the well, and the water quality. If water quality information is not available, a groundwater sample is recommended to be obtained as identified below.
- Ongoing Monitoring
  - Conduct an additional groundwater monitoring and sampling event in 2020 to confirm dissolved metals concentrations at MW-02.
    - The event should include water levels at all wells.
    - Sampling should include routine water chemistry and dissolved metals at MW-02. If the concentrations of dissolved arsenic and cadmium at MW-02 are less than guidelines and indicate the 2019 results were anomalous, Tetra Tech recommends discontinuing the groundwater monitoring and sampling activities at the site. If the concentrations are confirmed and remain greater that the referenced guidelines, a qualitative evaluation of risks should be made to evaluate the potential concern, if any, these concentrations pose to the adjacent Red Deer River.
  - If the Red Deer BMX club well exists and can be monitored/sampled, include it in the proposed monitoring event for water levels. If chemistry data is not available, include sampling of the BMX club well in the proposed event.
  - Upon installation of the proposed vapour probe proximate to the Riverbend Village apartments, conduct one round of well monitoring to focus on the potential presence of landfill gas. The monitoring is proposed to include the headspaces of all gas and water wells for methane using a GEM monitor. The potential requirement for analytical testing at this new well would be determined based on the results of the monitoring, should indications of elevated methane be noted.

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[1] Alberta River Basins. Rivers.alberta.ca.

- Administrative Actions
  - Utilize the revised generic mitigative measures when evaluating applications for development within the setback.
  - Ensure that the site is clearly identified within the City’s Land Use Bylaw and appropriate administrative requirements are met for the site in accordance with City policies.

Further to the above recommendations, as noted the site remains an historical landfill. It presently appears to be well maintained and capped. The City should review this status on an ongoing basis to ensure that the cover remains intact and drainage remains positive; repairs or maintenance should be undertaken as required to maintain the site.

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of The City of Red Deer and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than The City of Red Deer, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

The City of Red Deer (The City) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct the 2019 groundwater and vapour monitoring program at the former landfill located beneath the Great West Adventure Park (GWAP), located within Lot 1 MR Plan 8322386, within the north half of Section 17-038-27 W4M, in Red Deer, Alberta hereafter referred to as "the site". The objective of the monitoring program is to identify potential environmental concerns related to former operations at the site.

1.1 Scope of Work

Tetra Tech's scope of work for the 2019 monitoring and sampling program at the GWAP site included the following activities:

- Conducting semi-annual events of groundwater and vapour monitoring, including measuring headspace vapours and groundwater levels within each monitoring well and observing monitoring well integrity.
- Conducting groundwater sampling:
  - Purging shallow groundwater monitoring wells and deep groundwater monitoring wells until practically dry or until a minimum of three well volumes had been removed and allowing the water levels in the wells to recover.
  - Measuring field parameters (pH, electrical conductivity [EC], and water temperature) at the time of sampling.
  - Collecting groundwater samples from each well and submitting the samples for laboratory chemical analyses.
- Conducting soil vapour sampling:
  - Collecting vapour samples into Summa canisters for analysis.
  - Collecting vapour samples for siloxanes analysis into thermal desorption (TD) tubes.
  - Collecting one duplicate vapour sample for quality assurance/quality control (QA/QC) purposes.
- Conducting monitoring well repairs at select wells.
- Updating the hazard quotients prepared during previous reporting using the 2019 monitoring and sampling results.
- Evaluating and updating the previous recommendations.
- Preparing an annual report summarizing the field activities undertaken for the year and interpreting the groundwater and soil vapour analytical results.

The report was completed under Tetra Tech's Limitations on the Use of this Document for conducting environmental work. A copy of these conditions is provided in Appendix A. Cross-sections that were prepared using the wells included in the monitoring program are included in Appendix B (from Tiamat Environmental Consultants Ltd, [Tiamat] 2014a).

1.2 Pre-1972 Landfill Program

The scope of work for the monitoring program was based on the proposal submitted by Tetra Tech on January 11, 2019, to The City to conduct environmental monitoring services for the pre-1972 landfill sites. The proposal was submitted in accordance with the Request for Proposal (RFP) No. 1090-2018-261 issued by The City on November 30, 2018, and Addendum 01 issued by The City on January 7, 2019. This report documents the scope and findings for the GWAP site.

The objective of the overall project for the pre-1972 Landfills was to:

- Confirm and implement the prior recommendations, as per the RFP;
- Consult with the regulator on amendments to the program, as required;
- Conduct environmental monitoring and sampling for each of the eight sites, as outlined in the RFP recommendations, while incorporating any approved recommendations;
- Update the hazard quotients for each site; and
- Prepare an environmental monitoring report for each of the eight sites.

The eight pre-1972 landfill sites include:

- GWAP;
- Lindsay Thurber Comprehensive High School;
- McKenzie Trails Recreation Area;
- Montfort;
- Red Deer College;
- Red Deer Motors;
- Riverside Heavy Dry Waste Site; and
- Riverside Light Industrial Park.

Each site is summarized in a separate report. This report is focused on the GWAP site. It includes a description of the site geology and hydrogeology, the results of the 2019 monitoring activities at the site, and an interpretation and evaluation of the collected data.

2.0 BACKGROUND INFORMATION

2.1 General Information

The site is located within the north half of Section 17-038-27 W4M, within Lot 1 MR Plan 8322386. The site is zoned P1 – Parks and Recreation and is located within the community of Riverside Meadows. The site is located on the west bank of the Red Deer River, east of Kerry Wood Drive and North of Taylor Drive. The Red Deer River is adjacent to the southeastern portion of the site and flows in a northeasterly direction. A general site location plan is shown on Figure 1. The site has been developed and includes a BMX biking track, a small building, a parking lot, a boat launch, and a pedestrian/biking trail. The surrounding land use consists of residential housing, Fairview Elementary School, as well as commercial land use. Natural areas of the site consist of grasses and trees. Figure 2 shows the site location with surrounding land use.

2.2 Site History

Municipal records indicate that the waste disposal at the site occurred between approximately 1923 and 1947 (approximately 24 years). This would indicate that the estimated age of the waste material would be approximately 73 to 97 years old. Records indicate that the municipal solid waste (MSW) was disposed of after gravel mining in the area which was associated with a former commercial timber business.

Historical MSW disposal was identified during the Phase II Environmental Site Assessment (ESA) beneath a portion of the BMX track and a portion of the public parking lot. A separate waste area was identified off site, adjacent to the Riverbend Village apartments parking lot to the northeast. Estimated waste areas are identified on Figure 2. The MSW encountered during the Phase II ESA was a mixture of plastics, paper, metal, wires, and glass amongst a mix of sand, clay, and gravels. The Phase II ESA estimated the total area of buried waste at approximately 3,970 m^2, to a maximum depth of 4.6 m below ground surface (mbgs) (Tiamat 2014a). The largest footprint of waste is estimated to be located underneath the BMX track facility.

Results of the 2014 Phase II ESA (Tiamat 2014a) indicated that surface materials of sod, sand, and loam were overlying clay, sand, and gravel fill material. The fill was estimated to be 0.6 m to 6.6 m deep. Waste was encountered at six testholes and was typically under a thin layer of sod. The deepest waste was encountered at TH-11 and TH-12, at 4.6 mbgs and 5.5 mbgs and overlying native clay and sand. These testholes were located in the central area of the BMX track. The cross-sections completed by Tiamat (Tiamat 2014a) indicate that where encountered, the top of the shale bedrock was found at approximately 5 mbgs.

2.3 Historical Groundwater Monitoring and Investigation Summary

In 2013, Tiamat completed a Phase II ESA, which consisted of advancing 23 testholes with depths ranging from 2.7 m below grade (mbg) to 6.6 mbg. Waste was observed in six of the testholes during the drilling program. Five monitoring wells were installed (MW-01 to MW-05) along with two soil vapour wells (VW-01 and VW-02). In August 2013, groundwater monitoring and sampling was completed at all monitoring wells.

Previous reports prepared by Tiamat for the site include the following:

- Phase I Environmental Site Assessment, Historic Waste Disposal Site, Great West Adventure Park, The City of Red Deer. September 24, 2013 (Tiamat 2013).
- Phase II Environmental Site Assessment, Historic Waste Disposal Site, Great West Adventure Park, The City of Red Deer. February 12, 2014 (Tiamat 2014a).
- Environmental Risk Management Plan, Historic Waste Disposal Site, Great West Adventure Park, The City of Red Deer. December 3, 2014 (Tiamat 2014b).

The results of the Phase II ESA conducted by Tiamat in 2014 indicated the following:

- Historical records indicate the present configuration of the site has been unchanged. The site is currently zoned as a municipal reserve (1MR).
- Historical information suggests the disposal of household sanitary waste materials started pre-1923 until 1947 by the Village of North Red Deer. Other available information suggested that disposal activity commenced on or about 1916 and ended by 1947. After that, the village of North Red Deer was amalgamated within The City in January 1948.
- At the time of the report preparation, records indicated there were not any outstanding environmental concerns with the site.

- The historical waste disposal areas have been redeveloped as public recreational activities, green spaces, and a multi-family apartment building. Presently, there are no obvious activities on the adjacent lands that are interpreted as an environmental concern relative to the site.

The recommendations of the program were as follows, as identified in the Phase II (Tiamat 2014a):

- Continue to monitor groundwater elevations and soil vapour data biannually for one hydrogeological cycle.
- Determine if surface water sampling should be included to predict groundwater flow patterns and the impacts of potential leachate could have on the Red Deer River water quality.
- Collect an additional set of soil vapour and groundwater analytical data, groundwater elevations, and volatile headspace measurement during the winter months to determine seasonal changes in soil vapour concentrations.
- Review the results of the soil vapour sampling with the Riverbend Village apartments and install an additional soil vapour and groundwater monitoring well within the proximity of the apartments to determine any risk to the apartment building tenants.
- Review all new data and update the site risk management plan (RMP) with all new information and findings.

The recommendations of the RMP (Tiamat 2014b) were as follows:

- A risk review should be completed for the site using the updated groundwater analytical data. The review should be based on river flow, geometry and characteristics to determine if The City Water Treatment Plant (WTP) is susceptible to any effects from the historic waste disposal. The WTP is located northeast of the site, across the river.
- The above findings should be reviewed with the WTP to determine if leachate constituents could impact the WTP.
- Information in the preliminary quantitative risk assessment (PQRA) should be updated as new site information is obtained.
- A review of the RMP should be completed when the PQRA information is updated, if there are changes to the chemicals of potential concern (COPCs).
- The RMP should be reviewed and updated at five-year intervals.

2.4 Monitoring Well Network

The groundwater monitoring network at the site consists of five monitoring wells (MW-01 to MW-05). Monitoring wells were in good condition during the 2019 events. All of the monitoring wells are screened to the bottom of the well through the native sand and gravel into the shale bedrock. MW-03 is also screened through the sand fill. Monitoring well completion details are summarized in Table 1.

The vapour monitoring network consists of two vapour monitoring wells; VW-01 located near the north end of site and VW-02 in the southwest corner of the site. The vapour wells were in good condition during the 2019 monitoring events.

Groundwater and vapour monitoring well locations are shown on Figure 2.

3.0 SITE SETTING

The following section presents an overview of the regional and local setting for the site.

3.1 Geology

The following sections summarize the regional and local geology.

3.1.1 Geological Setting and Stratigraphy

The City and site are located within the Red Deer River drainage basin with principal drainage via the Red Deer River located east of the site. The river has incised the uplands with gentle slopes to the east and west of the river in the vicinity of the site.

The geology in the river valley is characterized by fluvial surficial sediments deposited by the Red Deer River, overlying shale and sandstone bedrock of the Paskapoo Formation.

Key elements of the geological setting are presented below from Tiamat's 2013 Phase I ESA report (Tiamat 2013):

"The fertile black soil in the region (Penhold Loam) is of alluvial lacustrine origin. The Penhold Loam is a well-drained fine sandy loam classified as Chernozemic. It is generally stone free and in natural areas, is typically 1.5 m thick, more or less.

The Quaternary deposits consist of drift deposits of clay, silt, gravel and sand. Published information indicates the banks of the Red Deer River comprise of dirty gravel with thickness ranging from 6 to 12 m, more or less.

In the valley, lies preglacial Saskatchewan gravels and sand. Terrace gravels hydraulically connected to the Red Deer River are a known resource of groundwater. Surficial soils comprise largely of poorly to moderately sorted sand, silt and gravel with a varying amount of clay. The fluvial sediments generally have obscure bedding planes. Medium to coarse sized gravel with cross-bedded sand have been documented.

The Tertiary bedrock consists of sequences of alternating shales and sandstones of the Paskapoo Formation. The Paskapoo Formation underlies the gravel sediments. This non-marine bedrock is composed of mudstone, siltstone and sandstone. The formation of the Rocky Mountains subjected the Paskapoo Formation to a regional stress-induced fracture pattern."

3.1.2 Local Geology

Based on the Phase II ESA results, GWAP consisted of 0.6 m to 6.6 m of fill material, consisting of a mixture of sod, sand and loam, overlying clay, sand, and gravel. Testholes with observed waste consisted of up to 4.6 m of waste, with often minimal soil cover on top. Waste material was situated on top of a native clay and sand layer, overlying a shale bedrock, encountered between 2.6 m to 5.8 m depths. Monitoring wells MW-01 to MW-05 at the site are screened through multiple stratigraphy's, including sand fill, native sand and gravel, and shale bedrock.

3.2 Hydrogeology

The following sections summarize the regional and local hydrogeology.

3.2.1 Regional Hydrogeology

The regional hydrogeology is most influenced by the presence of the river sediments situated within the valley along the Red Deer River and a bedrock valley trending north-northeast in the vicinity of the site.

Key elements of the hydrogeological setting are presented below from Tiamat's 2013 Phase I ESA report (Tiamat 2013):

"A significant buried valley and aquifer resource trending northeastward through the city has been partially mapped and lies in the SE 28-38-27 W4M (MacKenzie Trail and Riverside). This buried valley extends to a depth of 21 m, more or less and may extend to the south into north portions of 21-28-27 W4M." Mapping by the Alberta Geological Survey (Andriashek 2018) shows the valley approximately 1,500 m southeast of the site, trending in a north-northeast direction, however the width of the valley is not defined.

"The dominant type of near-surface groundwater in the Paskapoo Formation in the area of assessment is sodium bicarbonate. Notable concentrations of sodium sulphate type groundwater have also been reported. The quality of groundwater for potable use is generally suitable to depths of 300 m on the west side of Red Deer and decreases to 90 m, more or less in the east.

Areas of recharge (downward flow) in unsaturated heterogeneous sediments include most areas above the river and creek valleys, whereas; the river valleys will generally exhibit discharge. The distribution of groundwater in the area can also be influenced by the local geology, topographic relief, areas of artesian flow, springs and reasonable yielding water source wells.

Numerous permanent surface water features within The City of Red Deer and vicinity include Red Deer River, Waskasoo Creek, Gaetz Lakes, Hazlett Lake, Bower Ponds (result of formerly mining gravel resources), various sloughs in the fringe areas of the city and an assortment of other smaller creeks and springs."

The regional groundwater flow is expected to follow the bedrock topography and will be influenced by the varying distribution of sediments in the river valley, which will have been deposited in various historical channels since filled in under varying depositional environments. Further, the river is in hydrologic connection with the adjacent sediments, and therefore seasonal changes in river stage will affect the local groundwater flow patterns (magnitude and direction). In seasons of higher river flow, bank storage will occur whereas in seasons of lower flow (such as late summer/fall), the storage will be released.

3.2.2 Local Hydrogeology

The Red Deer River is located on the southeast side of the site and flows in a northerly direction. Shallow groundwater is assumed to flow parallel to or towards the river.

3.3 Groundwater Resource Usage

A search of the Alberta Water Well Database for groundwater users within a 1 km radius of the site, identified18 groundwater wells; 8 of the wells are listed as for domestic use, 1 is listed as for industrial use, 1 is listed as other, and 8 are listed as for unknown use, 7 of which have been decommissioned (AEP 2019b).

The nearest water well is located on site and is drilled to 7.5 mbg. The well was drilled in 1986 and was donated to the Red Deer BMX club. The proposed well use is listed as other, however the current status and use of this well is not known. The water wells within a 1 km radius of site range from 7.5 mbg to 58 mbg. The status and use of the surrounding groundwater wells were not confirmed and they were not field verified.

Information for groundwater wells within 1 km of the GWAP is provided in Appendix C.

4.0 CONCEPTUAL SITE MODEL

The selection of remediation guidelines is based on the conceptual site model (CSM), which outlines the rationale of the selection of applicable exposure pathways and indicates which soil and groundwater exposure-specific remediation guidelines should apply. This evaluation is based on guidance presented in the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines; AEP 2019a).

A CSM was developed for the site and includes the following items:

- Description of any identified environmental issues including a description of processes or activities undertaken at or near the site and a listing of COPCs identified in earlier investigations.
- Description of known and reported historical releases, including locations and status of any subsequent ESAs and remediation.
- Identification of applicable exposure pathways and receptors.

4.1 Chemicals of Potential Concern

Based on the information provided in historical reporting, and on typical COPCs in an MSW setting such as this, the COPCs for the groundwater component of the site include:

- Inorganic parameters and nutrients (e.g., ammonia, chloride, and total dissolved solids [TDS]);
- Metals;
- Petroleum hydrocarbons (PHCs);
- Volatile organic compounds (VOCs); and
- Other indicator parameters, such as biological oxygen demand (BOD) and chemical oxygen demand (COD).

The COPCs for the soil vapour component of the site include:

- VOCs;
- Methane;
- BTEX and PHCs; and
- Siloxanes.

Amongst these COPCs, the soluble ones are expected to migrate into the soils towards the groundwater table (e.g., BTEX, PHC fractions F1 and F2, and chloride) while others will bind to the soil particles and are not expected to migrate deeply (i.e., metals).

4.2 Land Use

The Alberta Tier 1 Guidelines are subdivided by land use: natural area, agricultural, residential/parkland, and commercial/ industrial. The site is currently zoned as P1 – Parks and Recreation. The site is surrounded by residential and commercial land to the north, the Red Deer River to the east, Taylor Drive followed by parkland to the southwest, and Kerry Wood Drive and Fairview Elementary school to the west. As such, the site land use was considered parkland.

4.3 Grain Size Designation

The Alberta Tier 1 Guidelines are developed for both coarse-grained and fine-grained soils. Fine-grained soils are defined as having a median-grain size of less than or equal to 75 µm; coarse-grained soils have a median-grain size of greater than 75 µm. Where both fine- and coarse-grained strata are present, the dominant soil particle size is determined by the stratum governing horizontal and vertical migration to a receptor.

During the Phase II ESA, the majority of materials at the site (both fill and native) were observed to be coarse-grained; thus, coarse-grained guidelines have been used.

4.4 Exposure Pathways and Receptors

4.4.1 Human Receptors and Pathways

Human receptors assumed to be present on commercial and residential/ parkland areas include adult workers, adult and child visitors, adult and child residents, and park users. The following human exposure pathways were considered when developing and implementing remediation guidelines:

- Direct soil contact.
- Groundwater ingestion (drinking water).
- Vapour inhalation.
- Off-site surface migration (wind or water erosion).

These pathways are briefly discussed individually below.

4.4.1.1 Direct Soil Contact – Human Pathway

The direct soil contact pathway is considered to be applicable to all land uses except in natural areas. Direct contact implies that humans can come in direct contact with contaminated soil via incidental ingestion, dermal contact, or inhalation of airborne soil particles. Since the land use for this site is considered parkland, this pathway is considered to be applicable.

4.4.1.2 Drinking Water (Groundwater Ingestion)

Water-bearing units with a saturated hydraulic conductivity of greater than 1.0 x 10^{-6} m per second (m/sec) are considered to comprise a potential domestic use aquifer (DUA) (AEP 2019a). To eliminate this pathway, the presence of greater than 5 m of unimpacted, unfractured, saturated, fine-grained material with an assumed bulk (vertical) hydraulic conductivity of less than 1.0 x 10^{-7} m/sec must exist below the proven depth of contaminated material. This is required to ensure that the impacted material is isolated from potential underlying DUAs.

A search was conducted of the Alberta Water Well Database. Two water wells were identified within 500 m of the site (including the well at the BMX club) and are listed as other and unknown uses. The DUA pathway has been included as investigations to eliminate the DUA pathway have not been completed.

4.4.1.3 Inhalation

The inhalation pathway considers the migration of volatile contaminants (e.g., BTEX, PHC fractions F1 and F2, and VOCs) released from the soil and/or groundwater into living or working spaces of buildings where humans may be exposed through inhalation. The inhalation pathway is applicable to all land uses except natural areas. Since the current land use is considered parkland, there is a potential for the infiltration of vapours into park buildings and subsequent inhalation by the inhabitants. Therefore, the inhalation pathway is applicable in this assessment.

4.4.1.4 Off-site Surface Migration by Wind or Water Erosion

The off-site surface migration pathway considers migration of contaminated soil from the site to an adjacent site of more sensitive land use via wind or water erosion. This pathway applies to commercial and industrial sites only and is not applicable to the site as the site is surrounded by residential land and the Red Deer River.

4.4.2 Ecological Receptors and Pathways

Ecological receptors at a typical contaminated site span a range of trophic levels, including soil-dependent organisms (e.g., plants and soil invertebrates) and higher-order consumers (e.g., terrestrial and avian wildlife and livestock). This pathway is applicable to the land use for this assessment.

4.4.2.1 Direct Soil Contact – Ecological Pathway

Plants and soil invertebrates may come into direct contact with contaminants in soil or shallow groundwater. This pathway is applicable to all land uses; therefore, it is considered for evaluation in this assessment.

4.4.2.2 Freshwater Aquatic Life

The freshwater aquatic life (FAL) pathway is applicable if a surface waterbody is present less than 300 m from the site. The nearest surface waterbody is the Red Deer River, located immediately adjacent to the east site of the site; therefore, the FAL pathway would be applicable to the site.

4.4.2.3 Nutrient and Energy Cycling

The nutrient and energy cycling pathway consider the microbial functioning of the soil including carbon nitrogen cycling and is, therefore, applicable to all land uses.

4.4.3 Exposure Pathway Summary

To establish the appropriate guidelines for the site, the most sensitive land use was used. The receptors are a combination of the degree of potential exposure, the exposure pathway, and the contaminant of concern. Human receptor exposures applicable to the site include the direct soil contact and inhalation pathways. The ecological receptor exposures applicable to the site include direct soil contact, FAL, and nutrient and energy cycling.

4.5 Soil Vapour

As recommended by Alberta Environment and Parks, the soil vapour results obtained during this investigation were compared to the Canadian Council of Minister of the Environment (CCME) document *A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours* (CCME 2014). Generic soil vapour guidelines, that could indicate whether there are potential risks to indoor air from vapours in the soil, have been prepared using the default parameters outlined in the 2014 CCME protocol. The parameters used in the calculation of the generic soil vapour guidelines can be found in Table 6 to Table 9. The equations and model assumptions were taken directly from the CCME 2014 document. While the CCME does not publish soil vapour screening criteria, the approach used to calculate soil guidelines for the vapour inhalation pathway is used to derive the soil vapour screening criteria.

4.5.1 Indoor Air Risk Calculations

The Alberta Tier 2 Guidelines (AEP 2019c) include human toxicity reference values (TRVs) for inhalation (Table A-7). For non-carcinogens, the inhalation TRV represents the concentration of the chemical of concern considered unlikely to cause adverse human health effects after a lifetime of continuous exposure, referred to as the inhalation tolerable concentration (ITC). For carcinogens, the inhalation TRV is referred to as the inhalation unit risk (IUR) and can be used to determine a risk-specific concentration (RSC). To ensure that the incremental lifetime cancer risk of an individual does not exceed 1 in 100,000 (1×10^{-5}) after a lifetime of continuous exposure, the RSC is calculated (as per Health Canada 2012, PQRA Guidance) as follows:

$$\text{RSC (mg/m}^3\text{)} = 1 \times 10^{-5}/\text{IUR}$$

Continuous exposure is expressed as an exposure term (ET), which is unitless. The ET for residential land use is 1 (AEP 2019c) based on 24 hours/day, 7 days/week, and 52 weeks/year. The ET is used to determine appropriate soil vapour screening levels. Soil vapour screening levels were calculated (as per Health Canada 2012, PQRA Guidance) using the equation below:

$$\text{Vapour Screening Level (mg/m}^3\text{)} = \text{(ITC or RSC)/ET}$$

4.5.2 Methane and Explosive Risks

Landfill gas (LFG) can be generated from the degradation of wastes under anaerobic conditions. Methane gas can migrate through the ground and enter structures through porous concrete, joints, or fractures in foundations. When present, methane is considered a safety concern due to its explosive risk when it is in an atmosphere at concentrations between 5% and 15% by volume in air, in the presence of an ignition source. At concentrations less than 5% (the lower explosive limit [LEL]) and above 15% (the upper explosive limit), methane is not explosive. Methane on its own is not considered a health risk, although it can represent a concern if it is present at very high concentrations which could displace oxygen and present a risk of asphyxiation.

There are not guidelines for methane as part of the Alberta Tier 1 framework. However, for reference, the Standards for Landfills in Alberta identify maximum methane concentrations proximate to approved landfills, and Alberta Health Services have provided guidance for methane (in conjunction with well headspace pressures that would constitute a driving force); however, that document has not been issued in a final format.

4.6 Overall Guidelines

Groundwater concentrations at the site were compared to the Alberta Tier 1 Guidelines under residential land use for coarse-grained soils (AEP 2019a).

Soil vapour analytical results were compared to A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours under residential land use for both slab-on-grade and basement for coarse-grained soils (CCME 2014).

5.0 GROUNDWATER MONITORING AND SAMPLING PROGRAM

A discussion of the methods used for the fieldwork and laboratory testing, is presented in the following sections. In 2019, Tetra Tech conducted the groundwater monitoring event on June 26, 2019, and a groundwater monitoring and sampling event on December 4, 2019.

5.1 Field Program

Groundwater monitoring consisted of measuring combustible vapour concentrations (CVCs) and VOCs in monitoring well headspace and measuring static groundwater levels in each monitoring well using an electronic water level indicator semi-annually (June and December).

The methodology for groundwater monitoring and sampling included the following:

- Observing the integrity of each well and noting drainage and site conditions near the well that may have an effect on monitoring results or groundwater quality.
- Measuring the VOC and CVCs in each well using an RKI Eagle Hydrocarbon Surveyor II (RKI) calibrated to hexane and isobutylene operated in methane elimination mode.
- Measuring liquid levels in each monitoring well with an interface probe and recording total depths confirming absence of light non-aqueous phase liquids (NAPL).
- Recording field data on standardized forms as documented in Tetra Tech standard operating practices.
- Purging each monitoring well requiring sampling using dedicated polyethylene bailers or Waterra tubing with inertial pump foot valves of at least three well volumes of water, or until the well was practically dry.

Following the completion of groundwater monitoring and purging, groundwater samples were collected from the wells to be sampled using the procedures identified below:

- Groundwater samples were collected from five monitoring wells (MW-01, MW-02, MW-03, MW-04, and MW-05). Samples were collected and placed into appropriate laboratory supplied, sterile glass and plastic vials and bottles for the required analytical package. If required, samples were filtered and/or preserved in the field.
- Field measurements were taken for pH, EC, and temperature at the time of sampling.
- Samples were submitted in coolers with ice to ALS Laboratories (ALS) in Calgary, Alberta for laboratory chemical analysis under a chain of custody (COC) documentation.

More information on the analytical program is provided in Section 5.2. The groundwater monitoring well locations are shown on Figure 2.

5.2 Analytical Program

The analytical program for the groundwater monitoring wells was developed based on the recommendations of previous reports and is summarized below:

- BTEX and PHC fractions F1 and F2.
- VOCs.
- Total Kjeldahl nitrogen (TKN).

- Routine and dissolved metals.
- Dissolved organic Carbon (DOC).
- Ammonia.
- Phosphorus.
- Adsorbable organic halides (AOX).
- Volatile fatty acids.

6.0 VAPOUR MONITORING AND SAMPLING PROGRAM

A discussion of the methods used for the fieldwork and laboratory testing is presented in the following sections. In 2019, Tetra Tech conducted a vapour monitoring event on June 26, 2019, and a vapour monitoring and sampling event on December 4, 2019.

6.1 Field Program

Vapour monitoring consisted of measuring and recording soil gas pressure, composition (methane, carbon dioxide, oxygen, hydrogen sulphide, and balance) on a percent volumetric basis and groundwater elevation, biannually (June and December).

The soil vapour probes were inspected for visible signs of damage and the position of the sampling labcock was noted. Soil gas pressure was recorded using a digital manometer. Once the soil gas pressure measurement was recorded, the soil gas probe was purged of three well volumes of air, or until readings stabilized. The two soil vapour probes on site are small diameter soil gas probes (1'' wells) and they were purged directly with the GEM landfill gas analyzer.

After purging, gas composition measurements for methane, carbon dioxide, oxygen, balance gas, and hydrogen sulphide were recorded using the GEM analyzer. After recording soil gas concentrations, the probe/well depths and water levels were measured and recorded to confirm the water level within the probe was beneath the screened portion of the soil gas probe (i.e., the probe was not blinded).

A leak detection test was completed to ensure the vapour probe was sealed properly. The test was completed using helium gas a tracer to inspect the testing probe and apparatus for any leaks. If there was a leak beyond the acceptable range (2% of helium concentration), the connections were tightened, and the leak test was conducted again.

Sampling of the soil vapour probes was based on the methodology of the CCME sampling guidelines, and is summarized as follows:

- Prior to collecting the soil vapour probe samples, wells were purged of three well volumes, or until headspace readings stabilized.
- 1.4 L Summa vacuum canisters were used for sample collection at the soil vapour probe monitoring locations.
- Sample data was recorded on the provided sample tag for each canister.
- Sample tubing that was used to connect the canister to the soil vapour probe was low in VOCs and only used once to prevent sample contamination.

- When beginning sample collection, the end cap was removed, and a 60-minute flow controller was attached to the canister. Start time was recorded on the sample tag.
- When sampling was complete, the valve was closed, and the flow controller was removed. The end time was recorded on the sample tag.
- The protective end cap was replaced back on the canister.
- Canisters, flow controllers, and pressure gauges were placed in the original shipping container and returned to the laboratory under COC.
- Soil vapour probe sampling ports were returned to the closed position and the wells were securely locked.

The vapour samples were submitted to ALS for chemical analysis. A duplicate sample was collected during the vapour sampling event for QA/QC purposes. More information on the analytical program is provided in Section 6.2.

The vapour monitoring well locations are shown on Figure 2.

6.2 Analytical Program

The analytical program for the vapour sampling is summarized below:

- VOCs.
- Matrix gases including oxygen, carbon dioxide, methane, and nitrogen.
- BTEX and PHCs.
- Siloxanes.

7.0 RESULTS AND DISCUSSION

This section presents the results of the fieldwork conducted in 2019 at GWAP and discussions of these results.

7.1 Groundwater Well Headspace Monitoring

Tetra Tech monitored five groundwater monitoring wells (MW-01 to MW-05) during each monitoring event for measurements of CVCs and VOC concentrations in well headspace using an RKI Eagle 2. The results of well headspace monitoring at vapour-specific monitoring wells are provided in Section 7.5.

During the June 2019 monitoring events, CVCs ranged from non-detect at MW-05 to 300 parts per million (ppm) at MW-03. VOCs were non-detect at most wells and measured 1 ppm at both MW-03 and MW-05. During the December 2019 monitoring event, CVCs ranged from 5 ppm at MW-04 and MW-05 to 35 ppm at MW-03. VOC concentrations were non-detect at all monitoring wells in December.

CVC measurements at up-gradient monitoring well MW-01 in June (45 ppm) and December (10 ppm) were less than the concentration measured in 2013 (155 ppm). The measured concentrations may be related to the screen of the well installed in fill material or due to equipment variability and are not necessarily be related to buried waste or environmental impacts.

The volatile and combustible headspace concentrations for 2019 are presented in Table 1. Methane measurements at the vapour wells are summarized in Section 7.5.

7.2 Groundwater Elevations

The measured groundwater levels and calculated groundwater elevations for 2019 are presented in Table 1.

Figure 3 presents the groundwater elevation trends (hydrographs) for the groundwater monitoring wells. Figure 3 shows that groundwater elevations decreased at all monitoring wells in 2019 from the groundwater elevations measured in 2013.

The average depth to groundwater in the monitoring wells was 2.59 mbg in June 2019 and 2.66 mbg in December 2019. The interpreted contoured elevations for the monitoring wells suggest the groundwater flow was to the northeast in June 2019 and December 2019. The groundwater elevations and contours and are shown on Figure 4 and Figure 5. The inferred groundwater flow in 2013 was also to the northeast (Tiamat 2014a).

The average horizontal gradients were 0.002 m/m in June 2019 and 0.001 m/m in December 2019.

7.3 Groundwater Field Parameters

Field measurements for pH, EC, and temperature in December 2019 are shown in Table 2. A discussion of the results of the field tests is summarized in this section.

Groundwater temperatures ranged from 2.49°C (MW-05) to 5.52°C (MW-02).

Field pH values ranged from 6.15 (MW-01) to 7.98 (MW-05). Field pH values were generally less than the laboratory pH values. The field pH at MW-01 (6.15) was less than the Tier 1 Guidelines range of 6.5 to 8.5.

In 2019, field EC measurements ranged from 753 µs/cm (MW-05) to 1,058 µs/cm (MW-02). Field EC results were generally less than the laboratory measured EC results and varied considerably, which may be due to differences in sample temperatures and limitations of field equipment.

7.4 Laboratory Results

The groundwater analytical data for 2019 is summarized in Table 2. The 2019 laboratory analytical reports are included in Appendix D.

Background Water Quality

MW-01 and MW-05 (up-gradient wells) were used to determine background groundwater quality.

In 2019, concentrations of TDS, chloride, dissolved iron, and dissolved manganese at the background wells were greater than the referenced guidelines. Concentrations of chloride, dissolved iron, and dissolved manganese at the site were greatest at up-gradient well MW-01. This may be due to the well screen being installed in sand fill material and suggest anoxic groundwater conditions. Elevated chloride concentrations are common in an urban setting due to the use of road salt. Manganese and iron concentrations greater than the Alberta Tier 1 Guidelines are also not necessarily an indication of groundwater quality impacts, unless other anthropogenic indicator parameters (e.g., petroleum hydrocarbons, solvents or other biodegradable compounds) are detected.

Concentrations of dissolved aluminum and various other dissolved metals exceeded the Alberta Tier 1 Guidelines at monitoring well MW-05 in 2019. The pH of the sample was near-neutral, and the elevated aluminum concentration suggests incomplete filtering of the sample occurred; therefore, the dissolved metal concentrations at MW-05 are likely not a proper reflection of in-situ concentrations or of environmental concern.

Routine Water Chemistry Parameters

In December 2019, TDS concentrations ranged from 765 mg/L (MW-05) to 965 mg/L (MW-02). TDS concentrations at all monitoring wells were greater than the Alberta Tier 1 Guidelines (500 mg/L). Historical analytical results are included in Appendix E.

Elevated TDS concentrations often occur in groundwater as a result of the dissolution of naturally occurring salts in the glacial tills of Alberta, and do not necessarily indicate groundwater quality impact related to the former operations at the site.

Chloride is often considered a useful parameter to assess groundwater quality impacts associated with landfills, as chloride is generally present in elevated concentrations in leachate and is a mobile and conservative (non-reactive) ion. Chloride does not enter into reactions as a non-reactive ion, does not adsorb significantly onto mineral surfaces, or form complexes with other ions. Chloride concentrations in 2019 were greater than Alberta Tier 1 Guidelines at all monitoring wells. Concentrations ranged from 141 mg/L at MW-05 to 267 mg/L at MW-01. MW-01 and MW-05 are both located up-gradient of the historical waste areas. Concentrations at these wells in 2013 were 40 mg/L (MW-01) and 210 mg/L (MW-05). In 2019, monitoring well MW-01 (up-gradient) had the greatest chloride concentration at the site. Given the age of the waste and the decades of leaching and attenuation, the chloride concentrations are not attributed to the former landfill and are more likely due to road salt use in the area.

Concentrations of ammonia at all wells were generally consistent with 2013 results and were all less than the Tier 1 Guidelines. Ammonia is used as a leachate indicator parameter and is often elevated in groundwater if there is impact from MSW landfill leachate. The measured ammonia concentrations do not indicate an obvious impact to groundwater quality. Concentrations ranged from less than the analytical detection limit at MW-04 to 0.338 mg-N/L at MW-02.

Concentrations of all other routine chemistry parameters were less than the Alberta Tier 1 Guidelines and were generally consistent with results obtained previously in 2013.

Dissolved Metals

Iron and manganese are redox-sensitive parameters that can help determine whether the groundwater quality is affected by biodegradation reactions, for instance related to landfill leachate. The biodegradation process leads to a low redox status, which will dissolve iron and manganese and iron oxides present in soil and increase concentrations in groundwater. The dissolved iron and dissolved manganese concentrations were greater than the Alberta Tier 1 Guidelines at most monitoring wells during the sampling event in 2019, except for monitoring well MW-04 (down-gradient). Dissolved iron and manganese concentrations were not analyzed at MW-01 and MW-02 in 2013, but concentrations at the other wells were consistent with historical results.

Up-gradient monitoring wells MW-01 and MW-05 contained concentrations of dissolved iron and manganese greater than the Alberta Tier 1 Guidelines. These wells are not anticipated to be affected by biodegradation associated with landfill leachate, and the dissolved manganese and iron concentrations are interpreted to be related to natural groundwater conditions.

Concentrations of dissolved boron, which is often present in landfill leachate, were at an order of magnitude less than the guideline for all monitoring wells in 2019.

Concentrations of dissolved arsenic and dissolved cadmium were greater than the Alberta Tier 1 Guidelines at MW-02 (down-gradient). Arsenic is known to be strongly adsorbed onto iron(hydr)oxides, and when manganese and iron dissolve, arsenic will also go into solution (Hem 1992). The concentrations of arsenic are likely correlated to the presence of dissolved iron. Dissolved arsenic and cadmium were not previously analyzed at MW-02;

however, the concentration of dissolved arsenic at MW-03 (adjacent to waste footprint) in 2013 was greater than the current Tier 1 Guidelines (0.005 mg/L). The concentrations of dissolved cadmium at MW-03, MW-04, and MW-05 in 2013 ranged from 0.029 mg/L (MW-05) to 0.058 mg/L (MW-04) and were greater than the 2019 Tier 1 Guidelines (0.00037 mg/L).

Dissolved selenium concentrations greater than the Tier 1 Guidelines (0.002 mg/L) were measured at MW-04 and MW-05 (down-gradient and up-gradient, respectively) in 2019. The dissolved selenium concentrations were consistent with historical results and may be naturally occurring. The measured concentrations are in the same order of magnitude at the Tier 1 Guidelines and not necessarily of concern.

Organic Parameters

Concentrations of BTEX, PHC fractions F1 and F2, AOX, volatile fatty/carboxylic acids, and VOCs were less than the analytical detection limits at all locations (and corresponding guidelines), which is consistent with historical results.

7.5 Vapour Monitoring Results

The soil vapour monitoring results are presented in Table 3.

Pressures at vapour well VW-01 and VW-02 were negligible during at both monitoring events in 2019.

Concentrations of methane and carbon monoxide were less than the instrument detection limits in 2019. Concentrations of carbon dioxide, oxygen, and the balance gas were consistent during the four monitoring events. The vapour wells were dry in 2019 indicating the wells were not blinded.

7.6 Vapour Analytical Results

Table 4 summarizes the soil vapour chemical results collected for 2019 and compares them to the soil vapour screening criteria protective of vapour intrusion into indoor air. The 2019 laboratory analytical reports are included in Appendix D.

BTEX and PHC fractions F1 and F2 (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use for coarse-grained soil. BTEX, and/or PHC aliphatic and aromatic fractions that comprise F1 and F2 were detected at concentrations greater than the analytical detection limits in samples VW-01, 19DUP01 (duplicate of VW01), and VW-02. However, soil vapour concentrations were between 21 and 60,800 times less than the soil vapour screening criteria, which are protective of vapour intrusion into indoor air.

Siloxanes do not have TRVs for inhalation and were, therefore, not compared against the vapour screening criteria. Concentrations of dodecamethylcyclohexasiloxane and dodecamethylpentasiloxane in sample VW-02 were detected greater than the analytical detection limit but do not appear to be significant as the results were less than five times the detection limit. Siloxanes were not detected at concentrations greater than the analytical detection limits in VW-01.

Naphthalene was not detected at concentrations greater than the analytical detection limit.

Methane concentrations were measured at a maximum concentration of 13.5 ppm (VW-01). VOCs (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use, coarse-grained soil. Several parameters were detected greater than the analytical detection limits in samples VW-01, VW-02, and 19DUP01. However, soil vapour concentrations were between 16 and 41,000 times less than the soil vapour screening criteria, which are protective of vapour intrusion into indoor air.

Further discussion and recommendations regarding the vapour monitoring network are provided in Section 9.0.

7.7 Quality Assurance/Quality Control Methods

7.7.1 Methods

Tetra Tech's QA/QC procedures include reviewing the data collected for precision and accuracy and following the appropriate field protocols.

The field procedures for QA/QC involved:

- Changing nitrile gloves between sample collections;
- Using sample containers provided by the laboratory;
- Cleaning monitoring and sampling tools between sample locations;
- Filling sample containers for PHC analysis with no headspace (air) when the containers were closed;
- Collecting a duplicate vapour sample during the sampling program; and
- Documenting field procedures and sampling activities.

7.7.2 Results

The QA/QC results are included in Table 5. The duplicate sample was submitted for analysis of the same parameters as the original sample.

The duplicate analysis is compared by relative percent difference (RPD). The RPD is calculated using the following equation:

$$\mathrm{RPD} = \frac{(V_1 - V_2)}{\frac{(V_1 + V_2)}{2}} * 100\%$$

Where:

V_1 = Parent Sample

V_2 = Duplicate Sample

Chemical parameters were considered as having passed the QA/QC reproducibility procedure if the RPD was less than or equal to 20%, indicating a close correlation between the sample-duplicate pair.

RPD values were not calculated if one or both of the sample-duplicate concentrations were between the reportable detection limit (RDL) and five times the RDL. In these cases, chemical parameters were still considered as having passed the QA/QC reproducibility procedure if the sample duplicate concentration difference was less than one RDL value.

Duplicate RPDs were less than 20% for all the reportable concentrations. Based on the QA/QC results, the sample methods and results are considered acceptable.

8.0 HAZARD QUOTIENT CALCULATIONS

Using the soil vapour screening levels described above and the soil vapour sampling results, estimated cancer risks (for carcinogens) and estimated hazard quotients (for non-carcinogens) were calculated for the site.

Estimated risks were calculated by dividing the soil vapour concentration by the corresponding soil vapour screening level for carcinogenic effects and multiplying the ratio by the target risk level of 1 x 10^{-5}. Similarly, the estimated hazard quotients (HQ) represent the soil vapour concentration divided by the corresponding soil vapour screening level for non-carcinogenic effects.

Risk estimates for non-carcinogenic COPCs are defined as HQ. Hazard quotients are calculated based on a ratio of the estimated exposure and the toxicity reference values identified as the tolerable daily intake (TDI) or tolerable concentration (TC) according to the following equation:

$$\text{Hazard Quotient} = \frac{\text{Estimated Daily Dose (mg/kg-day or mg/m}^3\text{)}}{\text{Tolerable Daily Intake (mg/kg-day) or Tolerable Concentration (mg/m}^3\text{)}}$$

Non-carcinogenic risk characterization in the assessment was completed for all COPCs.

When the HQ is greater than the target risk value, the scenario poses a potential concern and requires further evaluation or risk management. It is important to note that HQs greater than the target risk value do not necessarily indicate that adverse health effects will occur. This is because of the conservative assumptions used in estimating concentrations and in setting the target values. HQ that are less than the target risk value indicate that exposure is within acceptable levels and no further risk management is necessary. HQ greater than the target risk value suggest that further investigation or risk management (e.g., remediation) may be warranted.

For non-carcinogens, the cumulative target risk value used was 1.0. This target risk value accounts for additional exposure to the chemicals of concern from sources other than the site. Therefore, the cumulative target risk value of 1.0 represents an allocation of 20% of a person's daily exposure from site sources and the remaining 80% would come from other sources. Other sources of exposure include ambient air, household products, and soil and water contact from locations other than the site.

For carcinogens, the risk of cancer is assumed to be proportional to dose with the assumption that any exposure results in a nonzero probability of risk. Carcinogenic risk probabilities were calculated by multiplying the estimated exposure level by the route-specific cancer slope factor (SF) or unit risk factor (URF) for each carcinogen:

$$R = E \text{ X } SF \text{ (or URF)}$$

Where:

R = Estimated individual excess lifetime cancer risk;

E = Exposure level for each chemical of potential concern (mg/kg/day or mg/m^3); and

SF = Route- and chemical-specific SF $(mg/kg/day)^{-1}$ or URF $((mg/m^3)^{-1})$.

Risk probabilities determined for each carcinogen were also considered to be additive over all exposure pathways so that an overall risk of cancer was estimated for each group of potentially exposed receptors.

When assessing risks posed by exposure to carcinogenic substances, Health Canada and other regulatory agencies assume that any level of exposure is associated with some hypothetical cancer risk. As a result, it is necessary for regulatory agencies to specify an acceptable risk level. Per Health Canada guidance (2010a, 2010b), cancer risks are deemed essentially negligible where the estimated cumulative incremental lifetime cancer risk is less than or equal to 1 in 100,000 (1 x 10^{-5}).

For this evaluation, target risk and hazard levels were determined in accordance with Alberta Tier 2 Guidelines. For carcinogens, the cumulative target risk level is 1 x 10^{-5}, as this value is considered by Health Canada to represent a negligible risk. For non-carcinogens a cumulative target hazard level of 1 is used as potential exposures that result in hazard indices equal to or less than 1 signify negligible potential for adverse health effects. Each sampling location was screened individually for every chemical detected.

The cumulative risk levels for carcinogens in the samples collected ranged between 4.9 x 10^{-7} and 6.3 x 10^{-7}. The cumulative hazard levels identified in the samples collected for the non-carcinogens ranged between 0.004 and 0.024. Table 6 summarizes the properties of the compounds being assessed. Table 7 summarizes the soil properties used for the calculations. Table 8 summarizes the building properties used for the calculations, and Table 9 presents the generic soil vapour criteria calculated. Table 10 presents the estimated risk and hazard for the volatile compounds that were detected in soil vapour.

As shown in Table 10, the estimated cumulative risks and hazards associated with the soil vapour samples collected in December 2019 did not exceed the corresponding target risk and hazard levels in any of the samples collected.

9.0 EVALUATION OF SITE CONDITIONS

9.1 Summary of Site Conditions

Based on the 2019 and historical data for the site, there is no evidence that there are significant concerns related to the former landfill operations at GWAP. However, the site does contain buried landfill waste and some risk management measures are required. Further, there are several elements of the site assessment data requiring further confirmation as detailed below.

MW-02, situated hydraulically down-gradient from the site, contained concentrations of dissolved arsenic and cadmium greater than the referenced guideline. It is recommended to collect an additional groundwater sample from MW-02 in 2020 to confirm the concentrations of dissolved arsenic and cadmium, as they may be related to the presence of landfill leachate. If the concentrations measured in 2019 are confirmed and remain greater than the referenced guidelines, a qualitative evaluation of risks should be made to evaluate the potential concern, if any, these concentrations pose to the adjacent Red Deer River.

Water well searches identified that there may be a water well at the site, owned by the Red Deer BMX club. The current status of this well is not known, and further recommendations are presented in Section 10.0 to confirm the well's purpose and current use, if any. Based on that information, further recommendations may be required to limit well use.

The previous Phase II ESA recommended evaluating if surface water samples from the Red Deer River would be valuable to assess potential impacts from site groundwater on the river water quality. Based on the concentrations measured in the groundwater samples, surface water samples are not recommended. Due to the high volume of water flowing in the Red Deer River (a year-around average of approximately 75 m^3/s^2), leaching of groundwater from the site would have little to no appreciable effect on the river water quality. Similarly, the ERMP recommended determining whether the WTP is susceptible to impact from the site, and if so, reviewing the results of the site work with the WTP. Due to the high flow rate in the Red Deer River, appreciable impacts to the river quality are not

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[2] Alberta River Basins. Rivers.alberta.ca.

expected, and subsequently no impacts would be expected to the WTP, located across the river to the northeast, either via river flow or via migration through gravel deposits beneath the riverbed.

Based on the soil vapour results, there are no obvious concerns at the locations sampled. However, vapour well VW-02 in particular provides limited value, as it is located away from the areas of historical waste disposal and there is presently no vapour well in the vicinity of the Riverbend Village apartments. The Phase II ESA provided recommendations for additional assessment proximate to the Riverbend Village apartments. Based on the borehole logs of TH-19 and TH-20 from the Phase II ESA (located south of the Apartments), minimal waste was observed in the boreholes, consisting of mostly glass and wood fragments within soil fill. Although a PHC odour was noted, the results of the soil sample collected from the identified odorous portion contained concentrations of PHCs and VOCs considerably less than guidelines. At the groundwater monitoring well installed hydraulically down-gradient of this site area (MW-04), the inferred redox conditions were oxic; concentrations of leachate indicator parameters (including ammonia, dissolved boron, and PHC parameters) did not indicate obvious concerns, and VOCs were not detected. The available data does not suggest there is a significant concern with regards to soil vapours in this area of the site, however, for due diligence, based on the presence of buried waste and proximity of the apartments, confirmation of soil vapour concentrations in this site area is recommended with an additional vapour monitoring probe (refer to Section 10.0).

9.2 Review of Mitigative Measures from Risk Management Plan

The 2014 RMP presented a proposed site-specific environmental risk management plan as a tool to assist with the review of future subdivision applications on lands lying within the regulated setback distance from the site (300 m). The focus was on potential ingress of soil gas for COPCs with a HQ greater than 1.0. Residential land use was considered most sensitive, and exposure ratings for other land uses (e.g., school, public institutions, commercial complexes) were considered to not be greater than residential; however, unique exceptions would have to be reviewed and addressed on a site-specific basis (Tiamat, 2014). Further, underground utility workers and subsurface utility infrastructure were considered relevant to potential exposure.

The 2014 RMP applied a 10x factor of safety to the HQ to address uncertainties. Hazard quotients from the RMP ranged up to 566 (including the 10x factor of safety). Based on these, the RMP then provided recommended generic mitigative measures based on the calculated HQs, ranging from passive to active measures, recognizing that the ultimate approach would require a design professional for the proposed development.

Following the 2014 RMP, CCME released the document "*A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours*" (CCME 2014), designed to provide guidance for developing site-appropriate soil vapour quality guidelines. The guidelines developed using the methods outlined in the CCME document were used for this current study, and are included with the vapour sampling results in Table 4. Hazard quotients were calculated using estimated dose (based on concentrations measured at the site) and divided by tolerable daily intake. Soil vapour concentrations from the Phase II ESA conducted in 2013 were not compared to soil vapour quality guidelines, however spot checks of five target compounds with the highest HQs in the 2013 work (benzene, tetrachloroethylene, chloromethane, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene) identified that none of the 2013 concentrations would have unacceptable HQs using the updated CCME methodology.

The 2014 RMP was prepared concurrent to RMPs at several other former City landfills, and a common set of mitigative measures was applied based on the HQs. Subsequent to the 2014 RMP and to the release of the CCME Protocol document, The City undertook additional assessment at another former City Landfill (Montfort); as part of that work, their consultant XCG Consulting Limited (XCG) revised the 2014 RMP criteria ranges for each generic mitigative measure category to include a Cancer Risk range to allow comparison of the 2014 RMP ranges with the

HQ and Cancer Risks calculated by XCG[3]. From that work, XCG identified the following generic mitigative measures for developments within a 300 m setback of these landfills (based on Tiamat, 2014), and these have been adopted for this site:

Passive Measures

1. Passive Measures – Level A: for Cancer Risk of > 1E^{-5} and < 5E^{-5} and/or HQ >0.2 and <1

   Compacted clay liner with a minimum thickness of 1m and confirmed maximum hydraulic conductivity of 10^{-6} cm/sec.

2. Passive Measures – Level B: for Cancer Risk of > 5E^{-5} and < 5E^{-4} and/or HQ >1 and <5.

   Synthetic liner with type of material, thickness and installation details dependent on the design professional.

3. Passive Measures – Level C: for Cancer Risk of > 5E^{-4} and < 1E^{-3} and/or HQ >5 and <50.

   Passive sub-slab depressurization (SSD) system with a minimum depressurization of 4 to 10 Pa. In some instances (such as a pervious subgrade), the actual depressurization necessary may require an active SSD or alternative active ventilation system.

Active Measures

Field verify the presence of the identified chemicals of concern and other potential chemicals in the soil gas state at the development site. If confirmed, determine the most appropriate manner to prevent soil vapour intrusion.

1. Active Measures – Level D: for Cancer Risk of > 1E^{-3} and < 2E^{-3} and/or HQ values >50 and <100.

   Active SSD must be configured to compensate for depressurization of the building and have adequate negative pressure gradients across the entire footprint of the foundation.

2. Active Measures - Level E: for Cancer Risk of >2E^{-3} and/or HQ values >100.

   Installation of geomembrane and active soil vapour extraction with system fault notification alarm.

Based on the 2019 program, the greatest hazard quotient calculated for the site was 0.008 (vs target hazard level of 0.2) and the greatest estimated cancer risk was 6.3 x 10^{-7}(vs target Risk of 1.0 x 10^{-5}). While development at the site is not currently proposed, for illustrative purposes, based on these HQ and cancer risk levels calculated from the 2019 vapour data no passive or active measures would be required for the site. It is noted that even if the 10x factor of safety is applied, mitigative measures would still not be required. It should also be notes that assumptions made in the calculations of hazard quotients and cancer risk above are inherently conservative and therefore applying a factor of safety is not needed.

Future applications for development within the setback are subject to review by The City. The developer's team would be responsible for reviewing and verifying the available data relative to their proposed development. The mitigative measures presented above are generic and can be used as a general guide for expectations by The City; ultimately, the developer's design engineer would be responsible for developing measures specific to the intended development based on the above or an appropriate equivalent. Protection of workers (e.g. construction and utility) should form part of any development plan.

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[3] XCG Consulting Limited, 2018. Vapour Intrusion Assessment and Environmental Monitoring Report, prepared for The City of Red Deer's Montfort Landfill.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the work conducted at the site, Tetra Tech has developed the following conclusions:

- The groundwater elevations in 2019 indicated that the inferred groundwater flow direction was to the northeast. The average horizontal hydraulic gradients at the site were 0.002 m/m in June 2019 and 0.001 m/m in December 2019. This is consistent with observations made historically. Groundwater elevations in 2019 were overall slightly lower than groundwater elevations measured previously in 2013.

- Routine groundwater chemistry parameters and dissolved metals concentrations that exceeded the Alberta Tier 1 Guidelines at one or more monitoring wells in 2019 included TDS, chloride, aluminum, arsenic, cadmium, copper, iron, manganese, and selenium. The measured concentrations of these parameters were generally consistent with previous results and background/up-gradient concentrations and may reflect natural groundwater quality or may be elevated due to inadequate filtration. Possible exceptions are the dissolved metal concentrations at MW-02, in particular cadmium and arsenic.

- During the 2019 sampling events, chloride concentrations greater than the Alberta Tier 1 Guidelines (120 mg/L) were measured at all monitoring wells. Chloride concentrations at most wells have increased since the 2013 sampling event. Chloride concentrations were greatest at up-gradient well MW-01 and are likely due to road salt use in the area, and are not interpreted to be related to landfill impacts.

- Concentrations of BTEX, PHC fractions F1 to F2, AOX, volatile fatty/carboxylic acids, and VOCs in 2019 were less than the analytical detection limits at all monitoring wells.

- Concentrations of BTEX, hydrocarbons, and VOCs in all soil vapour samples were less than the soil vapour screening criteria.

- Siloxanes were detected in sample VW-02 greater than the laboratory detection limit; however, there are no screening criteria for these compounds and the concentrations are not identified as a concern.

- The estimated individual and cumulative risks and hazards associated with the soil vapour samples collected in December 2019 did not exceed the corresponding target risk and hazard levels.

- The previous Phase II ESA recommended evaluating if surface water samples from the Red Deer River would be valuable to assess potential impacts from site groundwater on the river water quality. Based on the concentrations measured in the groundwater samples, surface water samples are not recommended. Due to the high volume of water flowing in the Red Deer River (a year-around average of approximately 75 m^3/s[4]), leaching of groundwater from the site would have little to no appreciable effect on the river water quality. Similarly, the ERMP recommended determining whether the WTP is susceptible to impact from the site, and if so, reviewing the results of the site work with the WTP. Due to the high flow rate in the Red Deer River, appreciable impacts to the river quality are not expected, and subsequently no impacts would be expected to the WTP, located across the river to the northeast, either via river flow or via migration through gravel deposits beneath the riverbed.

Based upon the results of the groundwater and vapour monitoring program in 2019, there are no clear indications of significant impacts related to the former landfill operations at most monitoring well locations. However, there appear to be residual impacts in the groundwater and buried landfill waste remains in place beneath the site, therefore ongoing risk management is required. Risk management is recommended to include: additional assessment; ongoing monitoring; and administrative actions. The following recommendations are made according to these risk management elements:

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[4] Alberta River Basins. Rivers.alberta.ca.

- Additional Assessment
  - Available data does not suggest there is a significant concern with regards to soil vapours in the vicinity of the Riverbend Village apartments. However for due diligence, based on the presence of buried waste and proximity of the apartments, confirmation of soil vapour concentrations in this site area is recommended with installation of one additional vapour monitoring probe between the waste footprint and the apartments.
  - Determine the status of the Red Deer BMX club water well located at the site. Confirm if the water well is being used, the purpose of the well, and the water quality. If water quality information is not available, a groundwater sample is recommended to be obtained as identified below.
- Ongoing Monitoring
  - Conduct an additional groundwater monitoring and sampling event in 2020 to confirm dissolved metals concentrations at MW-02.
    - The event should include water levels at all wells.
    - Sampling should include routine water chemistry and dissolved metals at MW-02. If the concentrations of dissolved arsenic and cadmium at MW-02 are less than guidelines and indicate the 2019 results were anomalous, Tetra Tech recommends discontinuing the groundwater monitoring and sampling activities at the site. If the concentrations are confirmed and remain greater that the referenced guidelines, a qualitative evaluation of risks should be made to evaluate the potential concern, if any, these concentrations pose to the adjacent Red Deer River.
  - If the Red Deer BMX club well exists and can be monitored/sampled, include it in the proposed monitoring event for water levels. If chemistry data is not available, include sampling of the BMX club well in the proposed event.
  - Upon installation of the proposed vapour probe proximate to the Riverbend Village apartments, conduct one round of well monitoring to focus on the potential presence of landfill gas. The monitoring is proposed to include the headspaces of all gas and water wells for methane using a GEM monitor. The potential requirement for analytical testing at this new well would be determined based on the results of the monitoring, should indications of elevated methane be noted.
- Administrative Actions
  - Utilize the revised generic mitigative measures when evaluating applications for development within the setback.
  - Ensure that the site is clearly identified within the City's Land Use Bylaw and appropriate administrative requirements are met for the site in accordance with City policies.

Further to the above recommendations, as noted the site remains an historical landfill. It presently appears to be well maintained and capped. The City should review this status on an ongoing basis to ensure that the cover remains intact and drainage remains positive; repairs or maintenance should be undertaken as required to maintain the site.

11.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

RM SIGNATURE:
RM APEGA ID #: 62764
DATE: 2020-07-27

PERMIT NUMBER: P013774
The Association of Professional Engineers and
Geoscientists of Alberta (APEGA)

/dm/sy

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TABLES

Table 1: Groundwater Elevations

Monitoring Well		**MW-01**	**MW-02**	**MW-03**	**MW-04**	**MW-05**
Total Drilled Depth (m)		4.3	4.3	3.7	4.4	5.5
Top of Screened Interval (mbg)		1.3	1.3	1.0	1.4	2.5
Bottom of Screened Interval (mbg)		4.3	4.3	3.7	4.4	5.5
Stick up (m)		0.86	-0.08	0.99	0.73	0.83
Ground Elevation (m)		853.81	852.77	852.75	852.76	854.31
TPC Elevation (m)		854.67	852.68	853.74	853.48	855.13
Depth to Groundwater (mBTPC)	Aug-13	1.99	2.00	1.51	2.61	3.34
	Jun-19	3.51	2.28	2.98	3.25	4.23
	Dec-19	3.76	2.36	3.18	3.10	4.22
Groundwater Elevation (m)	Aug-13	852.68	850.68	852.23	850.87	851.79
	Jun-19	851.16	850.40	850.76	850.24	850.91
	Dec-19	850.91	850.33	850.56	850.38	850.92
Combustible Vapour Concentrations* (CVCs) (ppm)	Jun-19	45	270	300	115	0
	Dec-19	10	10	35	5	5
Volatile Organic Compounds* (VOCs) (ppm)	Jun-19	0	0	1	0	1
	Dec-19	0	0	0	0	0

Notes:

mbg - metres below grade.

mBTPC - Metres below top of plastic pipe casing.

* Measured using an RKI Eagle II calibrated to hexane and isobutylene operated in methane-elimination mode.

Table 2: Groundwater Analytical Results

		Location Code	MW-01	MW-02	MW-03	MW-04	MW-05
		Sample Date	5-Dec-2019	5-Dec-2019	5-Dec-2019	5-Dec-2019	5-Dec-2019
		Lab Report Number	L2393423	L2393423	L2393423	L2393423	L2393423
		Laboratory ID	L2393423-1	L2393423-2	L2393423-3	L2393423-4	L2393423-5
Parameter	**Unit**	**Tier 1 Guideline** [1,2]					
Field Testing							
Field Temperature	°C	-	4.25	5.52	3.82	4.03	2.44
Field Electric Conductivity	µS/cm	-	757	1,058	957	846	753
Field Hydrocarbon Vapour	ppm	-	10	10	35	5	5
Field Organic Vapour	ppm	-	0	0	0	0	0
Field pH	pH Units	6.5 to 8.5	**6.15**	7.68	7.37	7.32	7.98
Routine							
pH	pH Units	6.5 to 8.5	7.62	7.72	7.71	7.68	7.76
Electrical Conductivity (EC)	µS/cm	-	1,590	1,590	1,560	1,290	1,220
Total Dissolved Solids (TDS)	mg/L	500	**923**	**965**	**951**	**823**	**765**
Hardness as $CaCO_3$	mg/L	-	611	638	635	581	512
Alkalinity (total as $CaCO_3$)	mg/L	-	427	560	520	441	492
Bicarbonate	mg/L	-	521	683	634	538	600
Carbonate	mg/L	-	<5.0	<5.0	<5.0	<5.0	<5.0
Hydroxide	mg/L	-	<5.0	<5.0	<5.0	<5.0	<5.0
Calcium	mg/L	-	173	177	178	166	144
Magnesium	mg/L	-	43.4	47.7	46.3	40.4	37
Potassium	mg/L	-	4.04	4.85	4.34	4.17	4.27
Sodium	mg/L	200	114	112	114	96.9	101
Chloride	mg/L	120	**267**	**233**	**234**	**162**	**141**
Fluoride	mg/L	1.5	<0.10	<0.10	<0.10	<0.10	<0.10
Phosphorus - Total	mg/L	-	1.27	12.5	4.26	1.33	6.69
Sulphate	mg/L	429 [3]	65.1	54.6	62.8	87.5	42.7
Ionic Balance	N/A	-	99.2	94.1	97.1	105	100
Nutrients							
Ammonia as N	mg/L	1.28 to 110 [6]	0.231	0.338	0.174	<0.050	0.082
Nitrate (as NO_3-N)	mg/L	3	<0.10	<0.10	<0.10	0.24	<0.10
Nitrite (as NO_2-N)	mg/L	0.20 [4]	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate and Nitrite (as N)	mg/L	-	<0.11	<0.11	<0.11	0.24	<0.11
Total Kjeldahl Nitrogen (TKN)	mg/L	-	3.1	40.9	5.1	2.3	11.3
Carbon							
Dissolved Organic Carbon (DOC)	mg/L	-	9.9	7.8	6.9	4.0	5.3
Dissolved Metals							
Aluminum	mg/L	0.026 to 0.050 [5]	0.0112	0.0157	<0.0050	0.0024	**0.248**
Antimony	mg/L	0.006	<0.00050	<0.00050	<0.00050	0.00011	0.00021
Arsenic	mg/L	0.005	0.00208	**0.00679**	0.00415	0.00019	0.00084
Barium	mg/L	1	0.224	0.257	0.239	0.122	0.151
Boron	mg/L	1.5	0.057	0.067	0.157	0.091	0.052
Cadmium	mg/L	0.00037 [3]	0.000049	**0.00377**	0.000035	0.00012	**0.00219**
Chromium	mg/L	0.05	<0.00050	<0.00050	<0.00050	<0.00010	0.00067
Copper	mg/L	0.007	<0.0010	<0.0010	<0.0010	0.00277	**0.00823**
Iron	mg/L	0.3	**7.59**	**6.80**	**4.52**	<0.010	**0.45**
Lead	mg/L	0.0070 [3]	<0.00025	<0.00025	<0.00025	0.000066	0.000738
Manganese	mg/L	0.05	**1.96**	**1.56**	**0.822**	0.00576	**0.0975**
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Nickel	mg/L	0.208 to 0.249 [3]	0.0082	0.0064	0.0042	0.00195	0.00327
Selenium	mg/L	0.002	<0.00025	<0.00025	<0.00025	**0.00357**	**0.00273**
Silver	mg/L	0.0001	<0.000050	<0.000050	<0.000050	<0.000010	<0.000010
Uranium	mg/L	0.015	0.00449	0.00243	0.00205	0.00351	0.00436
Zinc	mg/L	0.03	<0.0050	0.0161	<0.0050	0.0017	0.007
Organics							
AOX	mg/L	-	ND	ND	ND	ND	ND
Hydrocarbons							
Benzene	mg/L	0.005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Toluene	mg/L	0.021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Ethylbenzene	mg/L	0.0016	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes (m & p)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Xylene (o)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes Total	mg/L	0.02	<0.00071	<0.00071	<0.00071	<0.00071	<0.00071
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
F1 (C_6-C_{10})	mg/L	-	<0.10	<0.10	<0.10	<0.10	<0.10
F1 (C_6-C_{10}) - BTEX	mg/L	0.81	<0.10	<0.10	<0.10	<0.10	<0.10
F2 (C_{10}-C_{16})	mg/L	1.1	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Fatty/Carboxylic Acids							
Acetic Acid	mg/L	-	<10	<10	<10	<10	<10
Butyric Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0
Formic Acid	mg/L	-	<50	<50	<50	<50	<50
Hexanoic Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0
iso-Butyric Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0
Isovaleric acid	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0
Propionic Acid	mg/L	-	<5.0	<5.0	<5.0	<5.0	<5.0
Valeric Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:

[1] Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 198 pp. Referenced guidelines are for coarse-textured soils under Residential/Parkland land use.

[2] Alberta Environment and Parks (AEP). Environmental Quality Guidelines for Alberta Surface Waters. March 2018. Table 1 Surface water quality guidelines for the protection of freshwater aquatic life (PAL). Most conservative values applied (chronic or acute).

[3] Guideline varies with hardness. Values shown based on site hardness range of 512 mg/L to 635 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 141 mg/L to 267 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 6.15 to 7.98.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 6.15 to 7.98 and temperature range of 2.44°C to 5.52°C.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 2: Groundwater Analytical Results

		Location Code	MW-01	MW-02	MW-03	MW-04	MW-05
		Sample Date	5-Dec-2019	5-Dec-2019	5-Dec-2019	5-Dec-2019	5-Dec-2019
		Lab Report Number	L2393423	L2393423	L2393423	L2393423	L2393423
		Laboratory ID	L2393423-1	L2393423-2	L2393423-3	L2393423-4	L2393423-5
Parameter	**Unit**	**Tier 1 Guideline [1,2]**					
Volatile Organic Compounds (VOCs)							
Bromobenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromochloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromodichloromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bromoform	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
n-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
sec-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
tert-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon tetrachloride	mg/L	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Chlorobenzene	mg/L	0.0013	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	mg/L	0.018	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Chloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	mg/L	0.19	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromoethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dibromomethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichlorobenzene	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,4-Dichlorobenzene	mg/L	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,1-Dichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloroethane	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	mg/L	0.014	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloroethene (cis)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethene (trans)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloropropane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylene Chloride	mg/L	0.05	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
iso-Propylbenzene (cumene)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Tetrachloroethene	mg/L	0.01	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	mg/L	0.015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Trichloroethene	mg/L	0.005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl chloride	mg/L	0.0011	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

Notes:

[1] Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 198 pp. Referenced guidelines are for coarse-textured soils under Residential/Parkland land use.

[2] Alberta Environment and Parks (AEP). Environmental Quality Guidelines for Alberta Surface Waters. March 2018. Table 1 Surface water quality guidelines for the protection of freshwater aquatic life (PAL). Most conservative values applied (chronic or acute).

[3] Guideline varies with hardness. Values shown based on site hardness range of 512 mg/L to 635 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 141 mg/L to 267 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 6.15 to 7.98.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 6.15 to 7.98 and temperature range of 2.44°C to 5.52°C.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 3: Soil Vapour Monitoring Results

Parameter	Gas Well					
	VW-01			VW-02		
	Aug-13	Jun-19	Dec-19	Aug-13	Jun-19	Dec-19
Pressure (kPa)[1]	0.0	0.0	0.0	0.0	0.0	0.0
CH_4 (%)	0.0	0.0	0.0	0.0	0.0	0.0
CO (ppm)[2]		0.0	0.0		0.0	0.0
CO_2 (%)	2.1	2.7	0.3	1.7	0.0	0.1
O_2 (%)	13.4	17.5	21.0	19.9	20.1	22.2
Balance (% v/v)	84.6	79.8	78.7	78.5	79.8	77.7
Static Water Level (mbtoc)[3]		Dry	Dry		Dry	Dry
Depth to Bottom (m)[4]	3.70	3.36	3.51	2.70	3.37	3.50
Screen Interval Top (m)	2.7			2.4		
Screen Interval Bottom (m)	3.0			2.7		
Stick up (m)	0.76	0.63	0.68	1.08	0.96	1.06

Notes:

[1] Kpa - Kilopascal.

[2] ppm - Parts per million.

[3] mbtoc - Meters below top of casing.

[4] m- Meters

N/A - Not applicable - well can not be accessed to obtain measurement.

Table 4: Soil Vapour Analytical Results

	Location Code	**Generic Soil Vapour Criteria - Residential Coarse Grained [1]**	VW-01		VW-02
	Field ID		VW-01	19DUP01	VW-02
	Sample Date		4-Dec-2019	4-Dec-2019	4-Dec-2019
	Lab Report Number		L2393610	L2393610	L2393610
	Laboratory ID		L2393610-1 / L2393610-4	L2393610-3	L2393610-2 / L2393610-5
Parameter	**Unit**	**µg/m^3**			
Field Tests					
Air Volume	L		0.06	-	0.06
Initial Pressure	in Hg		-4.9	-4.9	-8.2
Aliphatic/Aromatic PHC Sub-Fractionation					
Aliphatics (C_6-C_8)	µg/m^3	740,737	22	17	43
Aliphatics (>C_8-C_{10})	µg/m^3	40,257	33	24	253
Aliphatics (>C_{10}-C_{12})	µg/m^3	40,257	27	25	292
Aliphatics (>C_{12}-C_{16})	µg/m^3	40,257	<30	<30	<30
Aromatics (>C_8-C_{10})	µg/m^3	805	<15	<15	<15
Aromatics (>C_{10}-C_{12})	µg/m^3	8,051	<15	<15	<15
Aromatics (>C_{12}-C_{16})	µg/m^3	8,051	<30	<30	<30
Linear and Cyclic Methyl Siloxanes					
Hexamethylcyclotrisiloxane, D3(CVMS)	µg/m^3	NG	<170	-	<170
Octamethylcyclotetrasiloxane, D4(CVMS)	µg/m^3	NG	<170	-	<170
Decamethylcyclopentasiloxane, D5(CVMS)	µg/m^3	NG	<170	-	<170
Dodecamethylcyclohexasiloxane, D6(CVMS)	µg/m^3	NG	<170	-	330
Hexamethyldisiloxane, MM(LVMS)	µg/m^3	NG	<170	-	<170
Octamethyltrisiloxane, MDM(LVMS)	µg/m^3	NG	<170	-	<170
Decamethyltetrasiloxane, MD2M(LVMS)	µg/m^3	NG	<170	-	<170
Dodecamethylpentasiloxane, MD3M(LVMS)	µg/m^3	NG	<170	-	370
Hydrocarbons					
Benzene	µg/m^3	195	<0.64	<0.64	9.47
Toluene	µg/m^3	124,220	<0.75	<0.75	2.04
Ethylbenzene	µg/m^3	34,330	<0.87	<0.87	<0.87
Xylenes (m & p)	µg/m^3	NG	<1.7	<1.7	3.0
Xylene (o)	µg/m^3	NG	<0.87	<0.87	1.05
Xylenes Total	µg/m^3	6,330	<2.0	<2.0	4.0
Styrene	µg/m^3	3,220	<0.85	<0.85	<0.85
F1 (C_6-C_{10})	µg/m^3	867,383	53	33	300
F2 (C_{10}-C_{16})	µg/m^3	52,495	61	63	421
Alcohol					
Isopropanol	µg/m^3	6,219	<2.5	<2.5	<2.5
High Level Fixed Gases					
Nitrogen	%	NG	72.6	75.8	74.1
Oxygen	%	NG	19.5	20.0	20.5
Carbon Dioxide	%	NG	1.40	1.43	0.064
Carbon Monoxide	%	NG	<0.050	<0.050	<0.050
Methane	%	NG	<0.050	<0.050	<0.050
Hydrocarbon Gases (C_1-C_5)					
Methane	%	NG	0.00135	<0.00010	0.00040
Ethane	%	NG	<0.00020	<0.00020	<0.00020
Ethene	%	NG	<0.00020	<0.00020	<0.00020
Propane	%	NG	<0.00020	<0.00020	<0.00020
Propene	%	NG	<0.00020	<0.00020	<0.00020
Butane	%	NG	<0.00020	<0.00020	<0.00020
Pentane	%	NG	<0.00020	<0.00020	<0.00020
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	µg/m^3	113	<2.6	<2.6	<2.6

Notes:

[1] Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours. Refer to Table 6 to Table 9 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

Table 4: Soil Vapour Analytical Results

Location Code		Generic Soil Vapour Criteria - Residential Coarse-Grained [1]	VW-01		VW-02
Field ID			VW-01	19DUP01	VW-02
Sample Date			4-Dec-2019	4-Dec-2019	4-Dec-2019
Lab Report Number			L2393610	L2393610	L2393610
Laboratory ID			L2393610-1 / L2393610-4	L2393610-3	L2393610-2 / L2393610-5
Parameter	**Unit**	**μg/m^3**			
Volatile Organic Compounds (VOCs)					
1,1,1-Trichloroethane	μg/m^3	1,693,510	<1.1	<1.1	<1.1
1,1,2,2-Tetrachloroethane	μg/m^3	11	<1.4	<1.4	<1.4
1,1,2-Trichloroethane	μg/m^3	7	<1.1	<1.1	<1.1
1,1-Dichloroethane	μg/m^3	430	<0.81	<0.81	<0.81
1,1-Dichloroethene	μg/m^3	6,470	<0.79	<0.79	<0.79
1,2,4-Trichlorobenzene	μg/m^3	365	<1.5	<1.5	<1.5
1,2,4-Trimethylbenzene	μg/m^3	2,235	<0.98	<0.98	<0.98
1,2-Dibromoethane	μg/m^3	590	<1.5	<1.5	<1.5
1,2-Dichlorobenzene	μg/m^3	7,072	<1.2	<1.2	<1.2
1,2-Dichloroethane	μg/m^3	24	<0.81	<0.81	<0.81
1,2-Dichloroethene (cis)	μg/m^3	242	<0.79	<0.79	<0.79
1,2-Dichloroethene (trans)	μg/m^3	245	<0.79	<0.79	<0.79
1,2-Dichloropropane	μg/m^3	135	<0.92	<0.92	<0.92
1,2-Dichlorotetrafluoroethane	μg/m^3	566,335	<1.4	<1.4	<1.4
1,3,5-Trimethylbenzene	μg/m^3	2,235	<0.98	<0.98	<0.98
1,3-Butadiene	μg/m^3	17	<0.44	<0.44	<0.44
1,3-Dichlorobenzene	μg/m^3	64	<1.2	<1.2	<1.2
1,3-Dichloropropene [cis]	μg/m^3	163	<0.91	<0.91	<0.91
1,3-Dichloropropene [trans]	μg/m^3	149	<0.91	<0.91	<0.91
1,4-Dichlorobenzene	μg/m^3	64	<1.2	<1.2	<1.2
1,4-Dioxane	μg/m^3	105	<0.72	<0.72	<0.72
1-Methyl-4 ethyl benzene	μg/m^3	14,461	<0.98	<0.98	<0.98
2-Butanone (MEK)	μg/m^3	167,364	<0.59	<0.59	1.43
2-Hexanone (MBK)	μg/m^3	1,053	<4.1	<4.1	<4.1
4-Methyl-2-pentanone (MIBK)	μg/m^3	103	<0.82	<0.82	<0.82
Acetone	μg/m^3	918,788	2.3	2.7	18.5
Allyl chloride	μg/m^3	32	<0.63	<0.63	<0.63
Benzyl chloride	μg/m^3	34	<1.0	<1.0	<1.0
Bromodichloromethane	μg/m^3	28	<1.3	<1.3	<1.3
Bromoform	μg/m^3	1,494	<2.1	<2.1	<2.1
Bromomethane	μg/m^3	173	<0.78	<0.78	<0.78
Carbon disulfide	μg/m^3	21,713	<0.62	<1.81	<0.62
Carbon tetrachloride	μg/m^3	113	<1.3	<1.3	<1.3
Chlorobenzene	μg/m^3	347	<0.92	<0.92	<0.92
Chloroethane	μg/m^3	31,019	<0.53	<0.53	<0.53
Chloroform	μg/m^3	27	1.70	1.52	<0.98
Chloromethane	μg/m^3	2,657	<0.41	<0.41	1.78
Cyclohexane	μg/m^3	201,510	<0.69	<0.69	<0.69
Dibromochloromethane	μg/m^3	4,750	<1.7	<1.7	<1.7
Dichlorodifluoromethane	μg/m^3	3,584	1.86	1.88	1.86
Ethyl acetate	μg/m^3	2,509	<0.72	<0.72	<0.72
Freon 113	μg/m^3	230,627	<1.5	<1.5	<1.5
Heptane	μg/m^3	14,461	1.41	1.25	<0.82
Hexachlorobutadiene	μg/m^3	51	<2.1	<2.1	<2.1
Hexane	μg/m^3	18,839	2.75	2.5	0.98
Isooctane	μg/m^3	14,917	<0.93	<0.93	<0.93
iso-Propylbenzene (cumene)	μg/m^3	14,461	<0.98	<0.98	<0.98
Methyl t-Butyl Ether (MTBE)	μg/m^3	1,153	<0.72	<0.72	<0.72
Methylene Chloride	μg/m^3	18,764	<0.69	<0.69	<0.69
Propene	μg/m^3	91,723	<0.34	<0.34	<0.34
Tetrachloroethene	μg/m^3	2,679	<1.4	<1.4	<1.4
Tetrahydrofuran	μg/m^3	62,828	<0.59	<0.59	1.53
Trichloroethene	μg/m^3	153	<1.1	<1.1	<1.1
Trichlorofluoromethane	μg/m^3	34,325	<1.1	<1.1	<1.1
Vinyl acetate	μg/m^3	6,586	<1.8	<1.8	<1.8
Vinyl bromide (bromoethene)	μg/m^3	94	<0.87	<0.87	<0.87
Vinyl chloride	μg/m^3	140	<0.51	<0.51	<0.51

Notes:

[1] Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours. Refer to Table 6 to Table 9 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

Table 5: Soil Vapour Quality Assurance/Quality Control Analytical Results

		Field ID	VW-01	19DUP01	RPD (%)
		Sample Date	4-Dec-2019	4-Dec-2019	
		Lab Report Number	L2393610	L2393610	
		Laboratory ID	L2393610-1 / L2393610-4	L2393610-3	
Parameter	**Unit**	**RDL**			
Field Tests					
Air Volume	L	0.01	0.06	-	-
Initial Pressure	in Hg	-30	-4.9	-4.9	-
Aliphatic/Aromatic PHC Sub-Fractionation					
Aliphatics (C_6-C_8)	$\mu g/m^3$	15	22	17	-
Aliphatics (>C_8-C_{10})	$\mu g/m^3$	15	33	24	-
Aliphatics (>C_{10}-C_{12})	$\mu g/m^3$	15	27	25	-
Aliphatics (>C_{12}-C_{16})	$\mu g/m^3$	30	<30	<30	-
Aromatics (>C_8-C_{10})	$\mu g/m^3$	15	<15	<15	-
Aromatics (>C_{10}-C_{12})	$\mu g/m^3$	15	<15	<15	-
Aromatics (>C_{12}-C_{16})	$\mu g/m^3$	30	<30	<30	-
Linear & Cyclic Methyl Siloxanes					
Hexamethylcyclotrisiloxane, D3(CVMS)	$\mu g/m^3$	170	<170	-	-
Octamethylcyclotetrasiloxane, D4(CVMS)	$\mu g/m^3$	170	<170	-	-
Decamethylcyclopentasiloxane, D5(CVMS)	$\mu g/m^3$	170	<170	-	-
Dodecamethylcyclohexasiloxane, D6(CVMS)	$\mu g/m^3$	170	<170	-	-
Hexamethyldisiloxane, MM(LVMS)	$\mu g/m^3$	170	<170	-	-
Octamethyltrisiloxane, MDM(LVMS)	$\mu g/m^3$	170	<170	-	-
Decamethyltetrasiloxane, MD2M(LVMS)	$\mu g/m^3$	170	<170	-	-
Dodecamethylpentasiloxane, MD3M(LVMS)	$\mu g/m^3$	170	<170	-	-
Hydrocarbons					
Benzene	$\mu g/m^3$	0.64	<0.64	<0.64	-
Toluene	$\mu g/m^3$	0.75	<0.75	<0.75	-
Ethylbenzene	$\mu g/m^3$	0.87	<0.87	<0.87	-
Xylenes (m & p)	$\mu g/m^3$	1.7	<1.7	<1.7	-
Xylene (o)	$\mu g/m^3$	0.87	<0.87	<0.87	-
Xylenes Total	$\mu g/m^3$	2	<2.0	<2.0	-
Styrene	$\mu g/m^3$	0.85	<0.85	<0.85	-
F1 (C_6-C_{10})	$\mu g/m^3$	15	53	33	-
F2 (C_{10}-C_{16})	$\mu g/m^3$	15	61	63	-
Alcohol					
Isopropanol	$\mu g/m^3$	2.5	<2.5	<2.5	-
High Level Fixed Gases					
Nitrogen	%	1	72.6	75.8	4
Oxygen	%	0.1	19.5	20.0	3
Carbon Dioxide	%	0.05	1.40	1.43	2
Carbon Monoxide	%	0.05	<0.050	<0.050	-
Methane	%	0.05	<0.050	<0.050	-
Hydrocarbon Gases (C_1-C_5)					
Methane	%	0.0001	0.00135	<0.00010	-
Ethane	%	0.0002	<0.00020	<0.00020	-
Ethene	%	0.0002	<0.00020	<0.00020	-
Propane	%	0.0002	<0.00020	<0.00020	-
Propene	%	0.0002	<0.00020	<0.00020	-
Butane	%	0.0002	<0.00020	<0.00020	-
Pentane	%	0.0002	<0.00020	<0.00020	-
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	$\mu g/m^3$	2.6	<2.6	<2.6	-
Volatile Organic Compounds (VOCs)					
1,1,1-Trichloroethane	$\mu g/m^3$	1.1	<1.1	<1.1	-
1,1,2,2-Tetrachloroethane	$\mu g/m^3$	1.4	<1.4	<1.4	-
1,1,2-Trichloroethane	$\mu g/m^3$	1.1	<1.1	<1.1	-
1,1-Dichloroethane	$\mu g/m^3$	0.81	<0.81	<0.81	-
1,1-Dichloroethene	$\mu g/m^3$	0.79	<0.79	<0.79	-
1,2,4-Trichlorobenzene	$\mu g/m^3$	1.5	<1.5	<1.5	-
1,2,4-Trimethylbenzene	$\mu g/m^3$	0.98	<0.98	<0.98	-
1,2-Dibromoethane	$\mu g/m^3$	1.5	<1.5	<1.5	-
1,2-Dichlorobenzene	$\mu g/m^3$	1.2	<1.2	<1.2	-
1,2-Dichloroethane	$\mu g/m^3$	0.81	<0.81	<0.81	-
1,2-Dichloroethene (cis)	$\mu g/m^3$	0.79	<0.79	<0.79	-
1,2-Dichloroethene (trans)	$\mu g/m^3$	0.79	<0.79	<0.79	-
1,2-Dichloropropane	$\mu g/m^3$	0.92	<0.92	<0.92	-
1,2-Dichlorotetrafluoroethane	$\mu g/m^3$	1.4	<1.4	<1.4	-
1,3,5-Trimethylbenzene	$\mu g/m^3$	0.98	<0.98	<0.98	-
1,3-Butadiene	$\mu g/m^3$	0.44	<0.44	<0.44	-
1,3-Dichlorobenzene	$\mu g/m^3$	1.2	<1.2	<1.2	-
1,3-Dichloropropene [cis]	$\mu g/m^3$	0.91	<0.91	<0.91	-
1,3-Dichloropropene [trans]	$\mu g/m^3$	0.91	<0.91	<0.91	-
1,4-Dichlorobenzene	$\mu g/m^3$	1.2	<1.2	<1.2	-
1,4-Dioxane	$\mu g/m^3$	0.72	<0.72	<0.72	-
1-Methyl-4 ethyl benzene	$\mu g/m^3$	0.98	<0.98	<0.98	-
2-Butanone (MEK)	$\mu g/m^3$	0.59	<0.59	<0.59	-
2-Hexanone (MBK)	$\mu g/m^3$	4.1	<4.1	<4.1	-
4-Methyl-2-pentanone (MIBK)	$\mu g/m^3$	0.82	<0.82	<0.82	-
Acetone	$\mu g/m^3$	1.2	2.3	2.7	-
Allyl chloride	$\mu g/m^3$	0.63	<0.63	<0.63	-
Benzyl chloride	$\mu g/m^3$	1	<1.0	<1.0	-
Bromodichloromethane	$\mu g/m^3$	1.3	<1.3	<1.3	-
Bromoform	$\mu g/m^3$	2.1	<2.1	<2.1	-
Bromomethane	$\mu g/m^3$	0.78	<0.78	<0.78	-
Carbon disulfide	$\mu g/m^3$	0.62	<0.62	<1.81	-
Carbon tetrachloride	$\mu g/m^3$	1.3	<1.3	<1.3	-
Chlorobenzene	$\mu g/m^3$	0.92	<0.92	<0.92	-
Chloroethane	$\mu g/m^3$	0.53	<0.53	<0.53	-
Chloroform	$\mu g/m^3$	0.98	1.70	1.52	-
Chloromethane	$\mu g/m^3$	0.41	<0.41	<0.41	-
Cyclohexane	$\mu g/m^3$	0.69	<0.69	<0.69	-
Dibromochloromethane	$\mu g/m^3$	1.7	<1.7	<1.7	-
Dichlorodifluoromethane	$\mu g/m^3$	0.99	1.86	1.88	-
Ethyl acetate	$\mu g/m^3$	0.72	<0.72	<0.72	-
Freon 113	$\mu g/m^3$	1.5	<1.5	<1.5	-

Notes:

-	Not analyzed or RPD not calculated.
<	Concentration is less than the laboratory detection limit indicated.
RDL	Laboratory Reportable Detection Limit.
RPD	RPD is Relative Percentage Difference calculated as RPD(%)=(|V1-V2|/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively. RPDs have only been calculated where a concentration is greater than 5 times the RDL.

Table 5: Soil Vapour Quality Assurance/Quality Control Analytical Results

		Field ID	VW-01	19DUP01	RPD (%)
		Sample Date	4-Dec-2019	4-Dec-2019	
		Lab Report Number	L2393610	L2393610	
		Laboratory ID	L2393610-1 / L2393610-4	L2393610-3	
Parameter	**Unit**	**RDL**			
Volatile Organic Compounds (VOCs)					
Heptane	µg/m^3	0.82	1.41	1.25	-
Hexachlorobutadiene	µg/m^3	2.1	<2.1	<2.1	-
Hexane	µg/m^3	0.7	2.75	2.5	-
Isooctane	µg/m^3	0.93	<0.93	<0.93	-
iso-Propylbenzene (cumene)	µg/m^3	0.98	<0.98	<0.98	-
Methyl t-Butyl Ether (MTBE)	µg/m^3	0.72	<0.72	<0.72	-
Methylene Chloride	µg/m^3	0.69	<0.69	<0.69	-
Propene	µg/m^3	0.34	<0.34	<0.34	-
Tetrachloroethene	µg/m^3	1.4	<1.4	<1.4	-
Tetrahydrofuran	µg/m^3	0.59	<0.59	<0.59	-
Trichloroethene	µg/m^3	1.1	<1.1	<1.1	-
Trichlorofluoromethane	µg/m^3	1.1	<1.1	<1.1	-
Vinyl acetate	µg/m^3	1.8	<1.8	<1.8	-
Vinyl bromide (bromoethene)	µg/m^3	0.87	<0.87	<0.87	-
Vinyl chloride	µg/m^3	0.51	<0.51	<0.51	-

Notes:

-	Not analyzed or RPD not calculated.
<	Concentration is less than the laboratory detection limit indicated.
RDL	Laboratory Reportable Detection Limit.
RPD	RPD is Relative Percentage Difference calculated as RPD(%)=(|V1-V2|/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively. RPDs have only been calculated where a concentration is greater than 5 times the RDL.

Table 6: Chemical, Physical, and Toxicological Properties

Parameter		TC	RsC	H'	D_{air}	D_{water}	BAF	MF		
		Tolerable Concentration	Risk-specific concentration	Unitless Henry's Law Constant	Pure component molecular diffusivity in air	Pure component molecular diffusivity in water	Bioattenuation Factor	Mass Fraction in Soil (Coarse and Fine)	Mass Fraction in Soil Vapour - Coarse Soil	Mass Fraction in Soil Vapour - Fine Soil
Units		mg/m^3	mg/m^3	unitless	cm^2/s	cm^2/s	unitless	unitless	unitless	unitless
Benzene		--	0.003	0.225	0.088	1.00E-05	10	--	--	--
Toluene		3.8	--	0.274	0.087	9.20E-06	10	--	--	--
Ethylbenzene		1	--	0.358	0.075	8.50E-06	10	--	--	--
Xylenes		0.18	--	0.252	0.078	9.90E-06	10	--	--	--
Naphthalene		0.003	--	0.017	0.059	7.50E-06	10	--	--	--
F1	Aliphatic C>6-C8	18.4	--	50	0.05	0.00001	10	0.55	0.854	0.842
	Aliphatic C>8-C10	1	--	80	0.05	0.00001	10	0.36	0.141	0.153
	Aromatic C>8-C10	0.2	--	0.48	0.05	0.00001	10	0.09	0.005	0.005
F2	Aliphatic C>10-C12	1	--	120	0.05	0.00001	10	0.36	0.767	0.766
	Aliphatic C>12-C16	1	--	520	0.05	0.00001	10	0.44	0.205	0.206
	Aromatic C>10-C12	0.2	--	0.14	0.05	0.00001	10	0.09	0.023	0.023
	Aromatic C>12-C16	0.2	--	0.053	0.05	0.00001	10	0.11	0.005	0.005
1,1,1-Trichloroethane		5	--	0.688	0.078	0.000009	10	--	--	--
1,1,2,2-Tetrachloroethane		--	0.000172	0.019	0.071	0.000008	10	--	--	--
1,1,2-Trichloroethane		0.0002	0.000625	0.038	0.078	0.000009	10	--	--	--
1,1-Dichloroethane		--	0.006250	0.240	0.074	0.000011	10	--	--	--
1,1-Dichloroethene		0.2	--	0.942	0.090	0.000010	10	--	--	--
1,2,4-Trichlorobenzene		0.007	--	0.112	0.030	0.000008	10	--	--	--
1,2,4-Trimethylbenzene		0.06	--	0.230	0.061	0.000008	10	--	--	--
1,2-Dibromoethane		0.0093	0.016700	0.027	0.022	0.000012	10	--	--	--
1,2-Dichlorobenzene		0.2	--	0.072	0.069	0.000008	10	--	--	--
1,2-Dichloroethane		0.007	0.000385	0.049	0.104	0.000010	10	--	--	--
1,2-Dichloropropane		0.004	0.002703	0.110	0.078	0.000009	10	--	--	--
1,3,5-Trimethylbenzene		0.06	--	0.359	0.060	0.000008	10	--	--	--
1,3-Butadiene		0.002	0.000333	3.009	0.249	0.000011	10	--	--	--
1,3-Dichlorobenzene		0.095	0.000909	0.128	0.069	0.000008	10	--	--	--
1,4-Dichlorobenzene		0.095	0.000909	0.098	0.069	0.000008	10	--	--	--
1,4-Dioxane		0.03	0.002000	0.000	0.229	0.000010	10	--	--	--
2-Hexanone		0.03	--	0.004	0.070	0.000008	10	--	--	--
Acetone		31	--	0.002	0.124	0.000011	10	--	--	--
Allyl chloride		0.001	--	0.450	0.094	0.000011	10	--	--	--
Benzyl chloride		0.001	--	0.017	0.075	0.000008	10	--	--	--
Bromodichloromethane		--	0.000270	0.098	0.030	0.000011	10	--	--	--
Bromoform		--	0.009091	0.024	0.015	0.000010	10	--	--	--
Bromomethane		0.005	--	0.255	0.073	0.000012	10	--	--	--
Carbon Disulfide		0.7	--	0.705	0.104	0.000010	10	--	--	--
Carbon Tetrachloride		0.1	0.001667	1.183	0.078	0.000009	10	--	--	--
Chlorobenzene		0.01	--	0.148	0.073	0.000009	10	--	--	--
Chloroethane		1	--	0.073	0.271	0.000012	10	--	--	--
Chloroform		0.098	0.000435	0.154	0.104	0.000010	10	--	--	--
Chloromethane		0.09	--	0.388	0.126	0.000007	10	--	--	--
cis-1,2-Dichloroethene		0.007	--	0.302	0.074	0.000011	10	--	--	--
cis-1,3-Dichloropropene		0.02	0.002500	0.053	0.087	0.000010	10	--	--	--
Cyclohexane		6	--	7.618	0.080	0.000009	10	--	--	--
Dibromochloromethane		0.07	--	0.040	0.020	0.000011	10	--	--	--
Dichlorodifluoromethane		0.1	--	16.475	0.067	0.000010	10	--	--	--
4-Ethyltoluene		0.40	--	0.205	0.065	0.000007	10	--	--	--
Ethyl acetate		0.07	--	0.006	0.067	0.000010	10	--	--	--
Freon 113		5	--	21.500	0.038	0.000009	10	--	--	--
Freon 114		17	--	115.000	0.082	0.000009	10	--	--	--
Heptane		0.4	--	83.709	0.065	0.000007	10	--	--	--
Hexachlorobutadiene		--	0.000455	0.421	0.027	0.000007	10	--	--	--
Isooctane		0.4	--	30.500	0.060	0.000007	10	--	--	--
Isopropyl alcohol		0.2	--	0.000331	0.103	0.000011	10	--	--	--
Isopropylbenzene		0.4	--	0.591	0.065	0.000007	10	--	--	--
Methyl ethyl ketone		5	--	0.001	0.081	0.000010	10	--	--	--
Methyl isobutyl ketone		0.003	--	0.006	0.075	0.000008	10	--	--	--
Methylene chloride		0.6	1	0.151	0.101	0.000012	10	--	--	--
MTBE		0.037	--	0.028	0.102	0.000011	10	--	--	--
n-Hexane		0.7	--	73.916	0.200	0.000008	10	--	--	--
Propylene		3	--	8.013	0.110	0.000011	10	--	--	--
Styrene		0.092	--	0.130	0.071	0.000008	10	--	--	--
Tetrachloroethylene		0.36	0.038462	1.077	0.072	0.000008	10	--	--	--
Tetrahydrofuran		2	--	0.003	0.099	0.000011	10	--	--	--
trans-1,2-Dichloroethene		--	--	0.277	0.071	0.000012	10	--	--	--
trans-1,3-Dichloropropene		0.02	0.002500	0.053	0.087	0.000010	10	--	--	--
Trichloroethylene		0.04	0.002439	0.477	0.079	0.000009	10	--	--	--
Trichlorofluoromethane		1.05	--	5.200	0.087	0.000010	10	--	--	--
Vinyl acetate		0.2	--	0.024	0.085	0.000009	10	--	--	--
Vinyl bromide		0.003	--	0.260	0.100	0.000012	10	--	--	--
Vinyl chloride		0.1	0.002273	3.236	0.106	0.000012	10	--	--	--
Hydrogen Sulfide		0.002	--	0.350	0.188	0.000022	10	--	--	--

Notes:

cm^2/s Square centimetres per second.
F1 Fraction 1 (C6-C10).
F2 Fraction 2 (C>10-C16).
mg/m^3 Milligrams per cubic metre.
PHC Petroleum hydrocarbon.
-- Not applicable.

References: Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours.

Table 7: Soil Properties for Evaluation of Vapour Transport

Parameter		Units	Coarse-Grained Soil	Fine-Grained Soil
θ_a	Vapour-filled porosity	unitless	0.31	0.303
ρ_b	Dry bulk density	g/cm^3	1.7	1.4
n	Total soil porosity	unitless	0.36	0.47
θ_w	Moisture-filled porosity	unitless	0.05	0.167
Q_{soil}	Soil gas flow rate	cm^3/s	167	16.7

Notes:

Values from CCME (2014).

cm	Centimetre.
cm^2	Square centimetre.
g/cm^3	Grams per cubic centimetre.
PHC	Petroleum hydrocarbon.

References: Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours.

Table 8: Building Properties for Evaluation of Vapour Transport

Parameter		Units	Residential Land Use
			Basement
L_B	Building length	cm	1,225
W_B	Building width	cm	1,225
A_B	Building area exposed to soil, including basement wall area	cm^2	2.7E+06
H_B	Building height	cm	360
L_{crack}	Thickness of the foundation	cm	11.25
A_{crack}	Area of cracks through which contaminant vapours enter the building	cm^2	994.5
ACH	Air exchanges per hour	h^{-1}	0.5

Notes:

Values taken from CCME (2014).

cm Centimetre.
cm^2 Square centimetre.
h^{-1} Per hour.

References: Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours.

Table 9: Calculated Generic Soil Vapour Criteria

Parameter	Residential Land Use			
	Basement and Slab-on-Grade			
	Units	Coarse-Grained	Units	Coarse-Grained
Benzene	mg/m^3	0.195	$\mu g/m^3$	195
Toluene		124		124,220
Ethylbenzene		34		34,330
Xylenes		6		6,330
PHC F1		867		867,380
PHC F2		53		52,500
Naphthalene		0.112		112
Isopropanol		6.22		6,219
1,1,1-Trichloroethane		1,694		1,693,510
1,1,2,2-Tetrachloroethane		0.01		11
1,1,2-Trichloroethane		0.01		7
1,1-Dichloroethane		0.43		430
1,1-Dichloroethene		6.47		6,470
1,2,4-Trichlorobenzene		0.36		365
1,2,4-Trimethylbenzene		2.23		2,235
1,2-Dibromoethane		0.59		590
1,2-Dichlorobenzene		7.07		7,072
1,2-Dichloroethane		0.02		24
1,2-Dichloroethene (cis)		0.24		242
1,2-Dichloroethene (trans)		NG		NG
1,2-Dichloropropane		0.14		135
1,3,5-Trimethylbenzene		2.23		2,235
1,3-Butadiene		0.02		17
1,3-Dichlorobenzene		0.06		64
1,3-Dichloropropene [cis]		0.16		163
1,3-Dichloropropene [trans]		0.15		149
1,4-Dichlorobenzene		0.06		64
1,4-Dioxane		0.11		105
1-Methyl-4 ethyl benzene		14.46		14,461
2-Butanone (MEK)		167		167,364
2-Hexanone (MBK)		1.05		1,053
4-Methyl-2-pentanone (MIBK)		0.1		103
Acetone		919		918,788
Allyl chloride		0.03		32
Benzyl chloride		0.03		34
Bromodichloromethane		0.03		28
Bromoform		1.49		1,494
Bromomethane		0.17		173
Carbon disulfide		21.71		21,713
Carbon tetrachloride		0.11		113
Chlorobenzene		0.35		347
Chloroethane		31		31,019
Chloroform		0.03		27
Chloromethane		2.66		2,657
Cyclohexane		202		201,510
Dibromochloromethane		4.75		4,750
Dichlorodifluoromethane		3.58		3,584
Ethyl acetate		2.51		2,509
Freon 113		231		230,627
Freon 114		566.00		566,335
Heptane		14.46		14,461
Hexachlorobutadiene		0.05		51
Hexane		18.84		18,839
Isooctane		14.92		14,917
iso-Propylbenzene (cumene)		14.46		14,461
Methyl t-Butyl Ether (MTBE)		1.15		1,153
Methylene Chloride		18.76		18,764
Propylene		92		91,723
Styrene		3.22		3,220
Tetrachloroethene		2.68		2,679
Tetrahydrofuran		62.83		62,828
Trichloroethene		0.15		153
Trichlorofluoromethane		34.32		34,325
Vinyl acetate		6.59		6,586
Vinyl bromide (bromoethene)		0.09		94
Vinyl chloride		0.14		140

Notes:

mg/m^3 Milligrams per cubic metre.
$\mu g/m^3$ Micrograms per cubic metre.

Table 10: Soil Vapour Risk Evaluation

Parameter	Unit	Soil Vapour Screening Criteria [a]	Soil Vapour Results (µg/m^3)			Comparisons of Soil Vapour Measurements to Soil Vapour Criteria					
						Estimated Cancer Risk [b]			Estimated Hazard Quotients [c]		
			VW-01	19DUP01	VW-02	VW-01	19DUP01	VW-02	VW-01	19DUP01	VW-02
Benzene	µg/m^3	195	<0.64	<0.64	9.47	ND	ND	4.9E-07	--	--	--
Toluene	µg/m^3	124,220	<0.75	<0.75	2.04	-	-	-	ND	ND	1.64E-05
Xylenes, Total	µg/m^3	6,330	<2.0	<2.0	4.0	-	-	-	ND	ND	6.32E-04
F1 (C_6-C_{10})	µg/m^3	867,383	53	33	300	-	-	-	6.11E-05	3.80E-05	3.46E-04
F2 (C_{10}-C_{16})	µg/m^3	52,495	61	63	421	-	-	-	1.16E-03	1.20E-03	8.02E-03
Aliphatics (C_6-C_8)	µg/m^3	740,737	22	17	43	-	-	-	2.97E-05	2.30E-05	5.81E-05
Aliphatics (>C_8-C_{10})	µg/m^3	40,257	33	24	253	-	-	-	8.20E-04	5.96E-04	6.28E-03
Aliphatics (>C_{10}-C_{12})	µg/m^3	40,257	27	25	292	-	-	-	6.71E-04	6.21E-04	7.25E-03
Acetone	µg/m^3	918,788	2.3	2.7	18.5	-	-	-	2.50E-06	2.94E-06	2.01E-05
Chloroform	µg/m^3	3,040 / 27[e]	1.70	1.52	<0.98	6.3E-07	5.6E-07	ND	5.59E-04	5.00E-04	ND
Chloromethane	µg/m^3	2,657	<0.41	<0.41	1.78	-	-	-	ND	ND	6.70E-04
Dichlorodifluoromethane	µg/m^3	3,584	1.86	1.88	1.86	-	-	-	5.19E-04	5.25E-04	5.19E-04
Heptane	µg/m^3	14,461	1.41	1.25	<0.82	-	-	-	9.75E-05	8.64E-05	ND
Hexane	µg/m^3	18,839	2.75	2.5	0.98	-	-	-	1.46E-04	1.33E-04	5.20E-05
Tetrahydrofuran	µg/m^3	62,828	<0.59	<0.59	1.53	-	-	-	ND	ND	2.44E-05
Cumulative Risk and Hazard Index [d]						6.3E-07	5.6E-07	4.9E-07	0.004	0.004	0.024
Target Risk and Hazard Levels						**1.0 x 10^{-5}**			**1.00**		

Notes:

< – not detected. Listed value is the corresponding detection limit.

- = screening criteria not calculated as appropriate toxicity data not available.

Bold = identifies estimated risks and hazards that exceed the target risk level of 1 x 10^{-5} or target hazard level of 1.

[a] Listed soil vapour screening criteria derived in accordance with CCME, 2014.

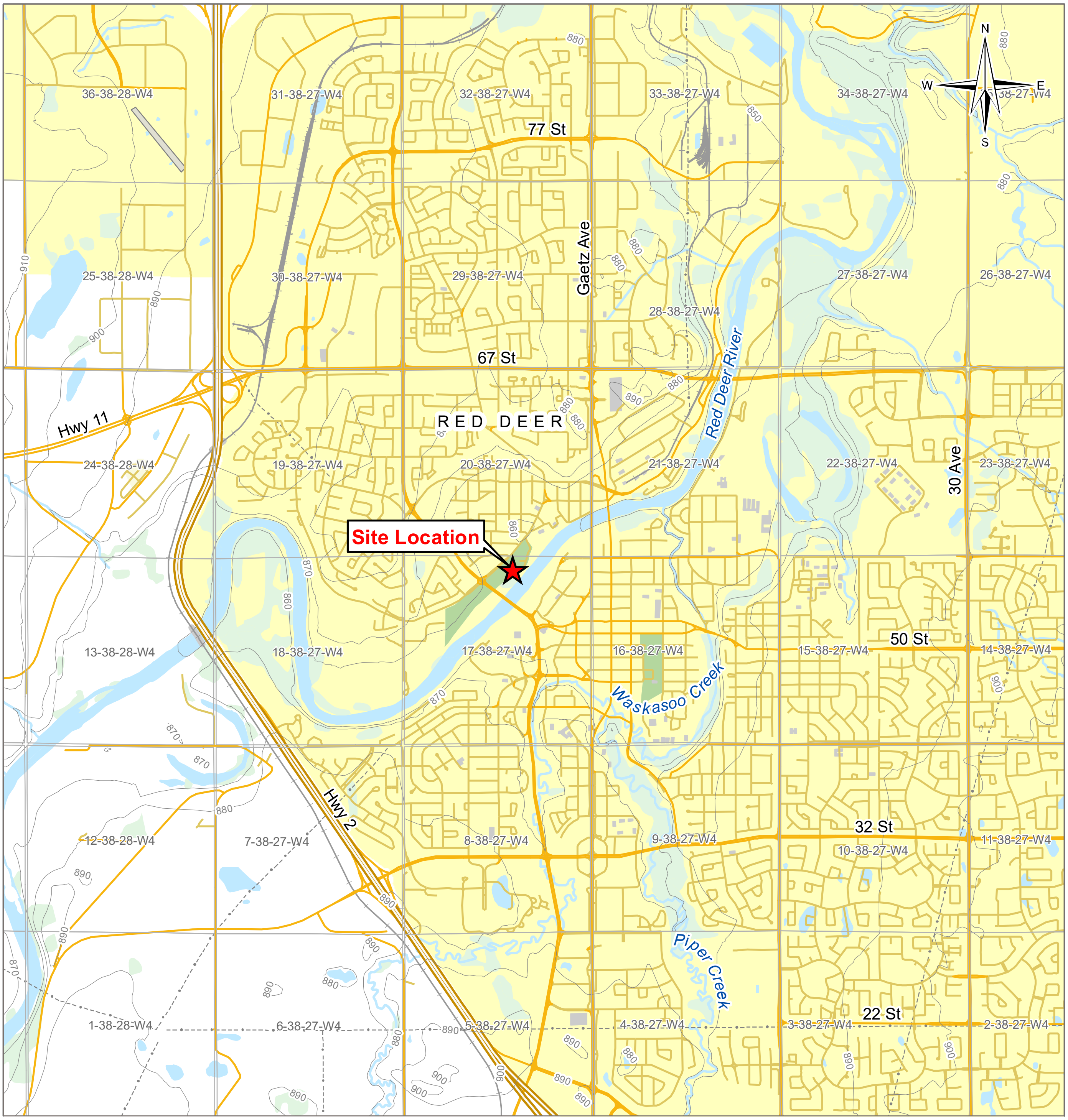
[b] Estimated cancer risk = (soil vapour concentration/cancer soil vapour screening level) x 10^{-5}.

[c] Estimated hazard quotient = (soil vapour concentration/non-cancer soil vapour screening level).

[d] Cumulative risk and hazard index represent the sum of chemical-specific cancer risks and hazard quotients.

[e] Soil vapour screening criteria shows both the threshold criteria and non-threshold criteria. Target risk and hazard levels are calculated with the appropriate criteria.

FIGURES



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LEGEND

- ★ Site Location
- Highway
- Main Road
- Local Road
- Resource/Recreational Road
- Railway
- Power Line
- Runway
- Building
- Park
- Residential Area
- Contour (10 m)
- Watercourse
- Waterbody
- Wooded Area
- Urban Area

NOTES
Base data source: CanVec 1:50,000.

STATUS
ISSUED FOR USE

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT GREAT WEST ADVENTURE PARK

Site Location Plan

PROJECTION	DATUM	CLIENT
3TM 114	NAD83	THE CITY OF Red Deer

Scale: 1:50,000
1 0.5 0 1
Kilometres

FILE NO.
SWOP04071-01_Figure1_SiteLocation.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

DATE	PROJECT NO.
June 30, 2020	SWM.SWOP04071-01.001

Figure 1

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-01\Maps\Task001\SWOP04071-01_Figure2_LandUse.mxd modified 6/30/2020 by megan.verburg

LEGEND

- Monitoring Well
- Vapour Well
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Site Boundary
- Lot Boundary

Utilities

- Electrical
- Sanitary
- Storm
- Water

NOTES

Base data source: Imagery provided by ESRI; Red Deer County (2018)
Roads from City of Red Deer Open Data, 2018
Utilities provided by City of Red Deer.
Locations have not been field verified, and should not be used for construction or other intrusive field activities.

STATUS
ISSUED FOR USE

Scale: 1:3,500

80 40 0 80

Metres

PROJECTION
3TM 114

DATUM
NAD83

FILE NO.
SWOP04071-01_Figure2_LandUse.mxd

CLIENT
The City of Red Deer

TETRA TECH

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT GREAT WEST ADVENTURE PARK

Site Plan and Surrounding Land Use

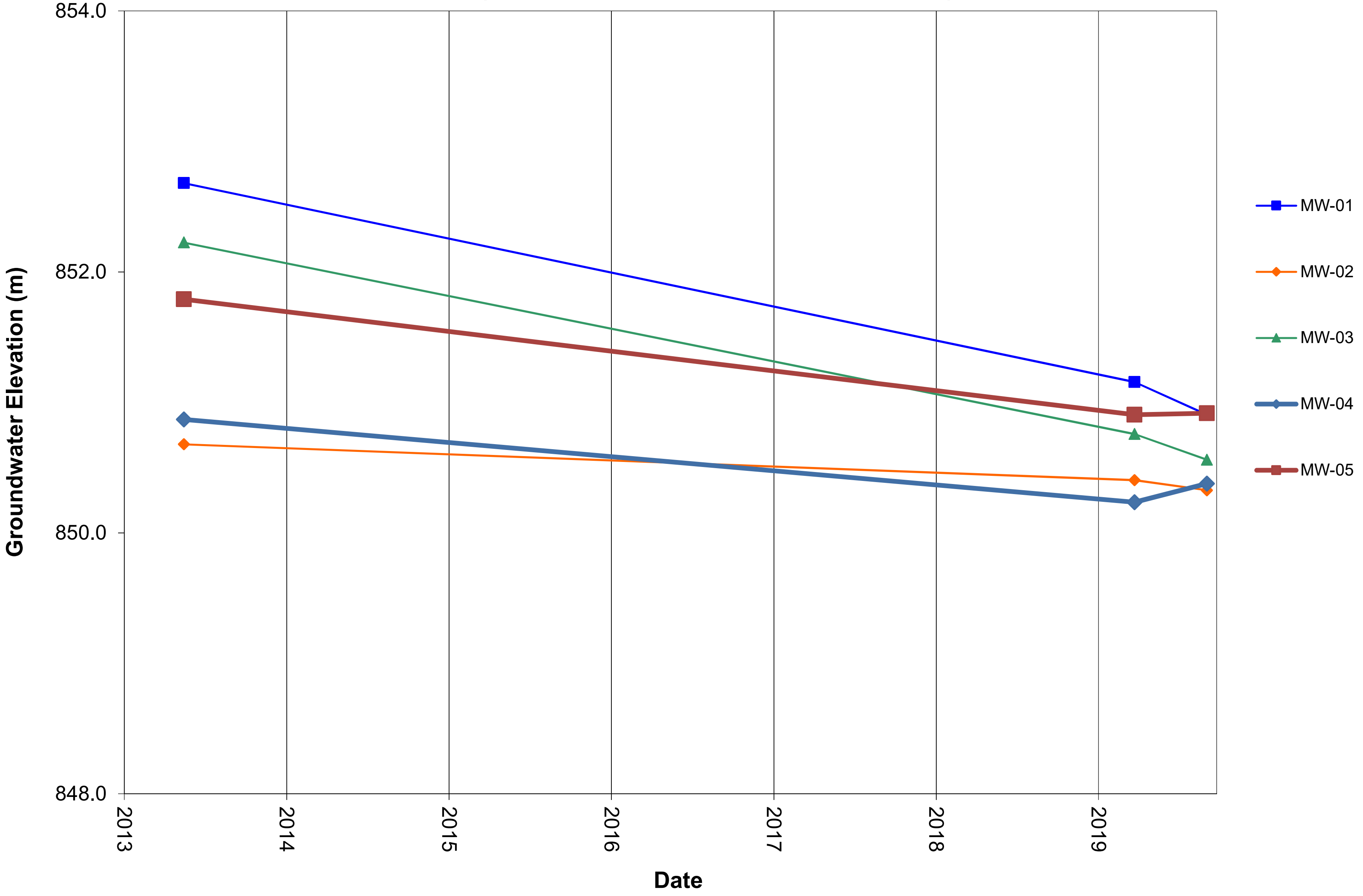
OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

DATE
June 30, 2020

PROJECT NO.
SWM.SWOP04071-01.001

Figure 2

FIGURE 3
HISTORICAL GROUNDWATER ELEVATIONS (GROUNDWATER MONITORING WELLS)



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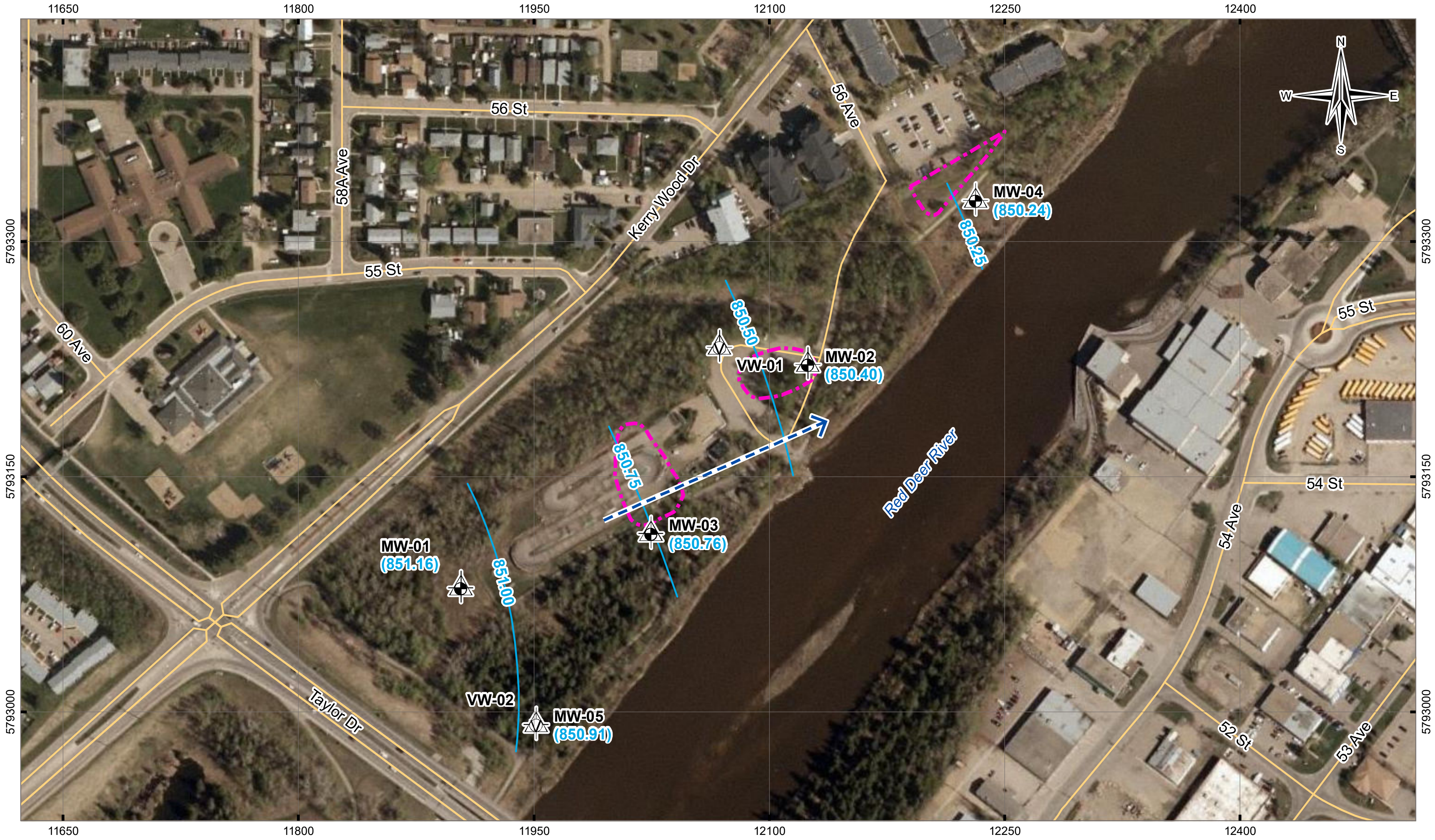

LEGEND

Monitoring Well

Vapour Well

Inferred Direction of Groundwater Flow

Interpreted Groundwater Elevation Contour

(85X.XX) Groundwater Elevation (masl)

Historic Waste Disposal (Provided by Tiamat, 2014)

Road

NOTES
Base data source: Imagery provided by ESRI; Red Deer County (2018)
Roads from City of Red Deer Open Data, 2018
masl - metres above sea level

STATUS
ISSUED FOR USE

Scale: 1:3,500

80 40 0 80

Metres

PROJECTION
3TM 114

DATUM
NAD83

FILE NO.
SWOP04071-01_Figure4_GW_June2019.mxd

CLIENT
THE CITY OF Red Deer

TETRA TECH

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT GREAT WEST ADVENTURE PARK

Groundwater Elevation Contours June 2019

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

DATE
June 30, 2020

PROJECT NO.
SWM.SWOP04071-01.001

Figure 4

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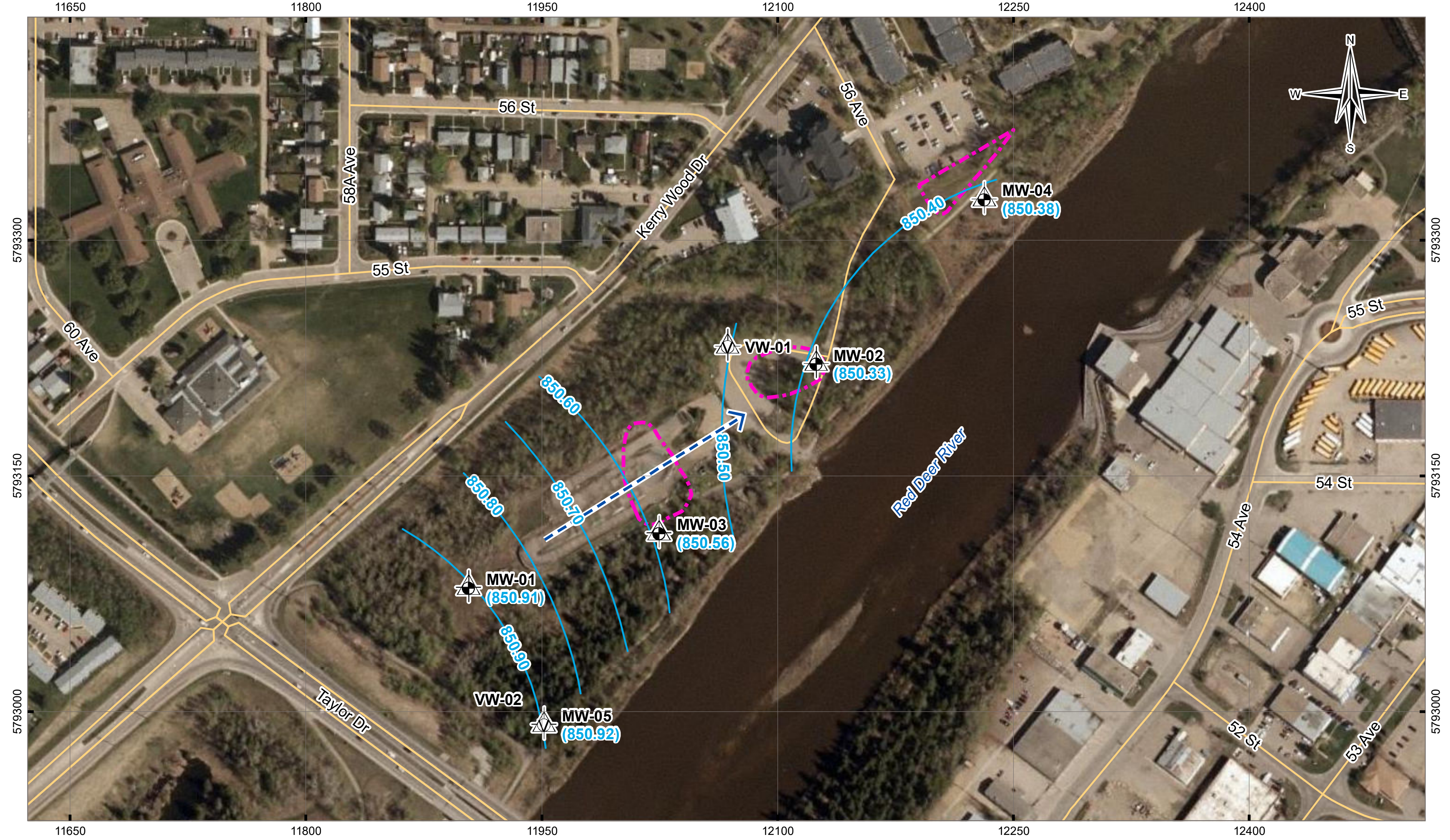

LEGEND

Monitoring Well

Vapour Well

Inferred Direction of Groundwater Flow

Interpreted Groundwater Elevation Contour

(85X.XX) Groundwater Elevation (masl)

Historic Waste Disposal (Provided by Tiamat, 2014)

Road

NOTES
Base data source: Imagery provided by ESRI; Red Deer County (2018)
Roads from City of Red Deer Open Data, 2018
masl - metres above sea level

STATUS
ISSUED FOR USE

Scale: 1:3,500

80 40 0 80

Metres

PROJECTION	DATUM
3TM 114	NAD83

FILE NO.
SWOP04071-01_Figure5_GW_Dec2019.mxd

CLIENT
The City of Red Deer

TETRA TECH

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT GREAT WEST ADVENTURE PARK

Groundwater Elevation Contours December 2019

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

DATE
June 30, 2020

PROJECT NO.
SWM.SWOP04071-01.001

Figure 5

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

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While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

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The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

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In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

CROSS-SECTIONS (TIAMAT 2014A)

0 20 50 100m

Scale 1:2000

PHASE II TEST LOCATIONS

MW-##	GROUNDWATER MONITORING WELL (5)
TH-##	TESTHOLE (16)
VW-##	SOIL VAPOUR MONITORING WELL (2)

REFER TO TABLE 1 FOR TESTHOLE INFORMATION

LEGEND

▪▪▪▪	HISTORIC WASTE DISPOSAL
──	LOT BOUNDARY
↑__↑	CROSS SECTION LOCATION
──	ELECTRICAL
──	SANITARY
──	STORM
──	WATER

NOTE:
LOCATION OF BURIED UTILITIES ARE APPROXIMATE, ACTUAL LOCATIONS OF THE SHALLOW UTILITIES AND ANY OTHER UTILITIES SHOULD BE VERIFIED PRIOR TO ANY GROUND DISTURBANCE ACTIVITY.

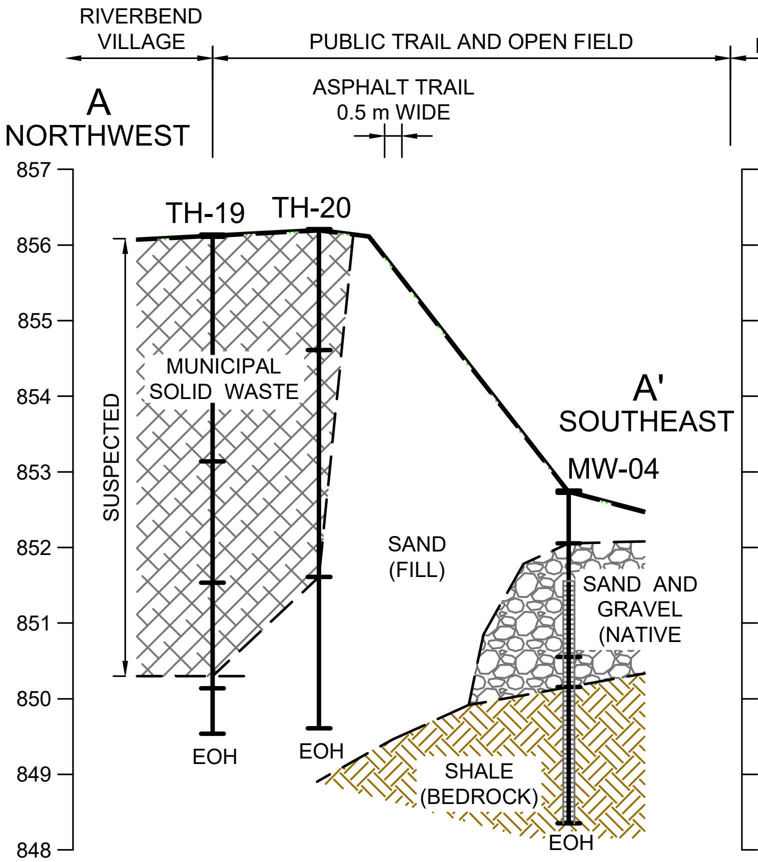
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
GREAT WEST PTN NW AND NE 17-38-27 W4M

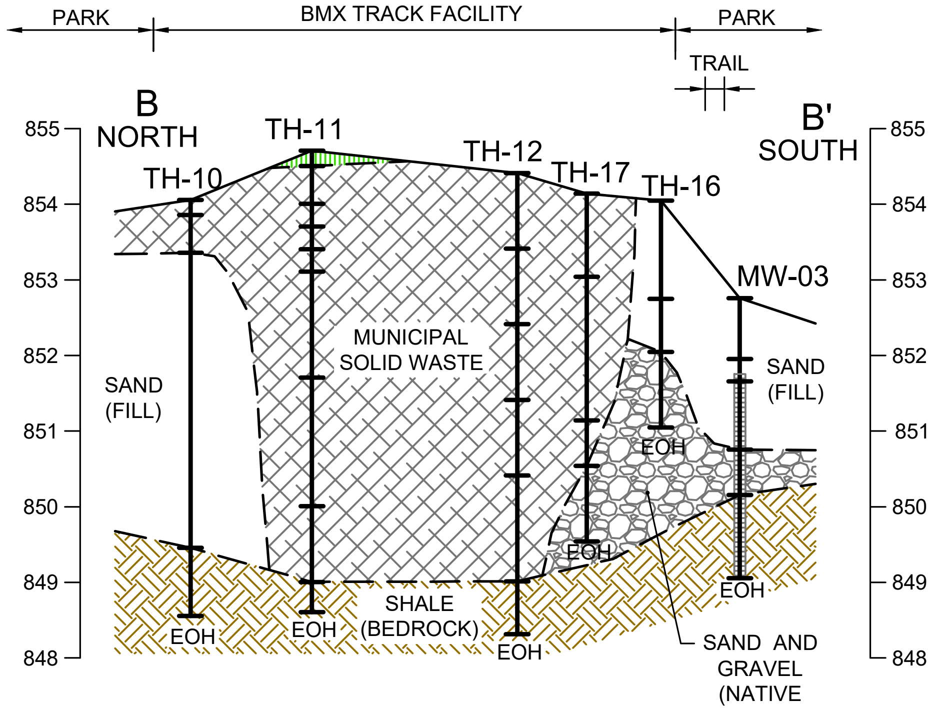
TITLE: PHASE II ESA TEST LOCATIONS AND
INTERPRETED EXTENT OF WASTE

Tiamat Environmental Consultants Ltd.

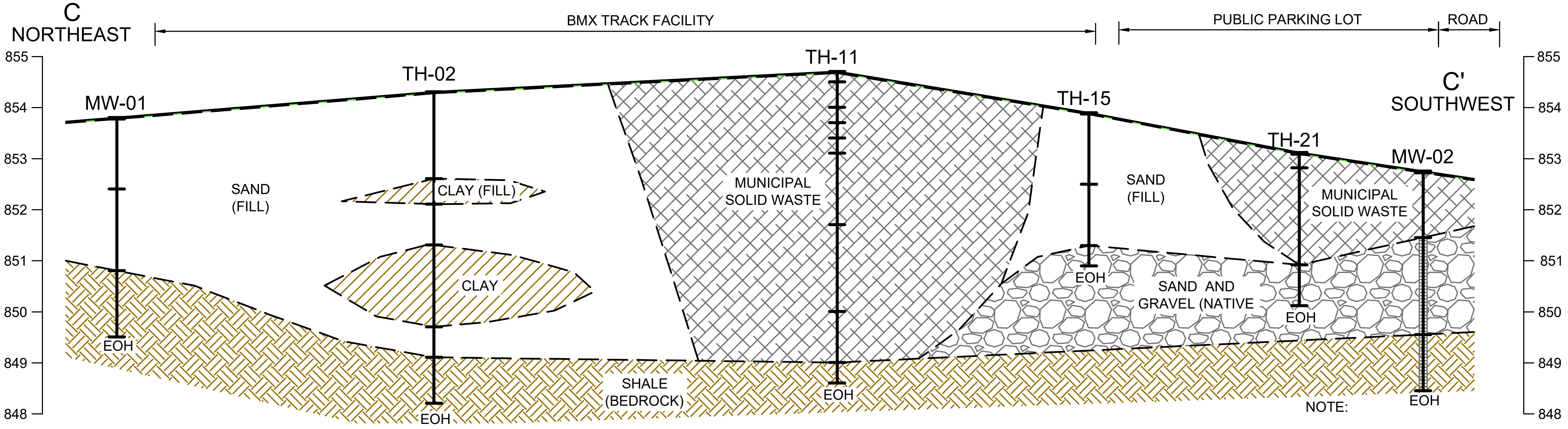
SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 2000	April 10/14	12–435	FIGURE 2
DRAWN BY:	CHECKED BY:	CAD FILE NO.:	
LCH	LTM	Phase II ESA v1.04.dwg	



TRAVERSE ADJACENT TO RIVERBEND VILLAGE



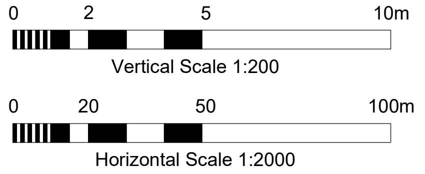
TRAVERSE OF BMX TRACK FACILITY



LONGITUDINAL OF BMX TRACK FACILITY

NOTE:

THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.



CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
GREAT WEST ADVENTURE PARK SITE

TITLE: CROSS SECTIONS A - A', B -B' AND C - C'

Tiamat Environmental Consultants Ltd.

SCALE: AS SHOWN	DATE: MAR. 14/14	PROJECT NO.: 12-435	FIGURE NO.: FIGURE 3
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: SECTIONS V1.00	

APPENDIX C

WATER WELL DATA

Reconnaissance Report

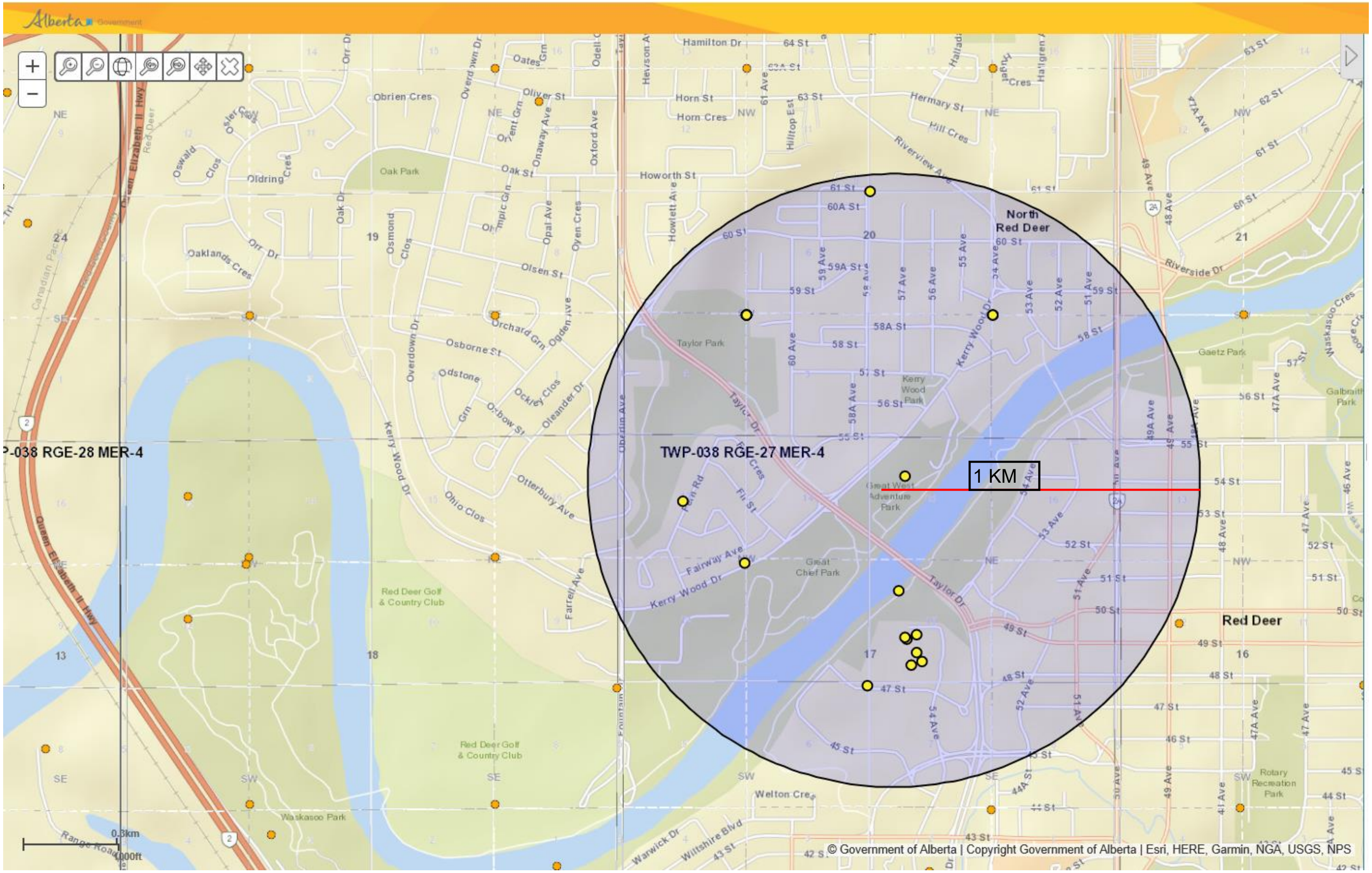
View in Metric

Export to Excel

Groundwater Wells

Please click the water Well ID to generate the Water Well Drilling Report.

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (ft)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (ft)	TEST RATE (igpm)	SC_DIA (in)
96216	NW	17	38	27	4	FORRESTER DRILLING	1977-05-03	135.00	New Well	Domestic		9		MURRAY, JOHN	15.00	20.00	7.00
96217	13	17	38	27	4	OTHER	1960-10-07	190.00	New Well	Unknown		3	2	FRIESEN, BEN	66.00	4.00	4.00
96218		17	38	27	4	MCDONNEL & SCHMIDT	1960-06-01	130.00	New Well	Industrial		8	2	PINEWOOD INDUSTRIES	79.00	10.00	4.50
96268	SE	20	38	27	4	UNKNOWN DRILLER		150.00	Chemistry	Domestic	1			SIMS AUCTION MART			0.00
96269	SE	20	38	27	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic				ST JOSEPH'S CONVENT			0.00
96270	SW	20	38	27	4	COMFORT DRLG	1972-11-18	170.00	New Well	Domestic		8		SCHMIDT, PETER	80.00	7.00	4.50
96271	SW	20	38	27	4	UNKNOWN DRILLER		90.00	Chemistry	Domestic	1			CURZON, W.B.	60.00		0.00
96272	SW	20	38	27	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic				LEES, W.			0.00
96273	SW	20	38	27	4	FORRESTER DRILLING	1963-10-09	75.00	New Well	Domestic		5		BOURNE, DAVID	20.00	30.00	7.00
96276		20	38	27	4	FORRESTER DRILLING	1972-02-16	100.00	New Well	Domestic		5	1	RED DEER, CITY OF	56.00	15.00	5.50
1590215	15	17	38	27	4	PARSONS WATER WELLS LTD (o/a AMA Drilling)	1986-07-12	25.00	New Well	Other		3		CITY OF RED DEER	13.00	100.00	32.00
9826058	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			
9826059	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			
9826060	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			
9826061	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			
9826062	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			
9826063	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			
9826064	10	17	38	27	4	ALTAIR WATER AND DRILLING SERVICES INC.			Existing Well-Decommissioned	Unknown				CITY OF RED DEER			



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APPENDIX D

LABORATORY ANALYTICAL REPORTS

TETRA TECH CANADA INC.
ATTN: Darby Madalena
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3

Date Received: 06-DEC-19
Report Date: 27-DEC-19 16:13 (MT)
Version: FINAL

Client Phone: 403-203-3355

Certificate of Analysis

Lab Work Order #: L2393423

Project P.O. #: SWOP04071-01.001
Job Reference: SWOP04071-01.001
C of C Numbers: GREAT WEST
Legal Site Desc:

Dhaliwal

Inayat Dhaliwal
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-1 MW-01							
Sampled By: RYAN MILLER on 05-DEC-19 @ 10:45							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	67.9		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		10-DEC-19	R4938070
F1-BTEX	<0.10		0.10	mg/L		10-DEC-19	R4938070
Surrogate: 3,4-Dichlorotoluene	97.3		70-130	%		10-DEC-19	R4938070
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	0.231		0.050	mg/L		16-DEC-19	R4943991
Dissolved Organic Carbon	9.9		1.0	mg/L		13-DEC-19	R4943327
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	3.1	DLM	1.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	1.27	DLHC	0.10	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	267	DLHC	2.5	mg/L		07-DEC-19	R4942649
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					09-DEC-19	R4938487
Aluminum (Al)-Dissolved	0.0112	DLDS	0.0050	mg/L		09-DEC-19	R4937828
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Arsenic (As)-Dissolved	0.00208	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Barium (Ba)-Dissolved	0.224	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Boron (B)-Dissolved	0.057	DLDS	0.050	mg/L		09-DEC-19	R4937828
Cadmium (Cd)-Dissolved	0.000049	DLDS	0.000025	mg/L		09-DEC-19	R4937828
Calcium (Ca)-Dissolved	173	DLDS	0.25	mg/L		09-DEC-19	R4937828
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Copper (Cu)-Dissolved	<0.0010	DLDS	0.0010	mg/L		09-DEC-19	R4937828
Iron (Fe)-Dissolved	7.59	DLDS	0.050	mg/L		09-DEC-19	R4937828
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		09-DEC-19	R4937828
Magnesium (Mg)-Dissolved	43.4	DLDS	0.025	mg/L		09-DEC-19	R4937828
Manganese (Mn)-Dissolved	1.96	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Nickel (Ni)-Dissolved	0.0082	DLDS	0.0025	mg/L		09-DEC-19	R4937828
Potassium (K)-Dissolved	4.04	DLDS	0.25	mg/L		09-DEC-19	R4937828
Selenium (Se)-Dissolved	<0.00025	DLDS	0.00025	mg/L		09-DEC-19	R4937828
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		09-DEC-19	R4937828
Sodium (Na)-Dissolved	114	DLDS	0.25	mg/L		09-DEC-19	R4937828
Uranium (U)-Dissolved	0.00449	DLDS	0.000050	mg/L		09-DEC-19	R4937828
Zinc (Zn)-Dissolved	<0.0050	DLDS	0.0050	mg/L		09-DEC-19	R4937828

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-1 MW-01							
Sampled By: RYAN MILLER on 05-DEC-19 @ 10:45							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Ion Balance Calculation							
Ion Balance	99.2			%		16-DEC-19	
TDS (Calculated)	923			mg/L		16-DEC-19	
Hardness (as CaCO3)	611			mg/L		16-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		13-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		07-DEC-19	R4942649
Sulfate in Water by IC							
Sulfate (SO4)	65.1	DLHC	1.5	mg/L		07-DEC-19	R4942649
pH, Conductivity and Total Alkalinity							
pH	7.62		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1590		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	521		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	427		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
2,2-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
2-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
4-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
p-Isopropyltoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Benzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromochloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromodichloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromoform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromomethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Carbon tetrachloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-1 MW-01							
Sampled By: RYAN MILLER on 05-DEC-19 @ 10:45							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,2-Dichloroethene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromochloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromomethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylbenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylene dibromide	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Hexachlorobutadiene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Isopropylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
m+p-Xylenes	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Methylene chloride	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Propylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
o-Xylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
sec-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Styrene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
tert-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Tetrachloroethylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Toluene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichlorofluoromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Vinyl chloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Surrogate: 1,4-Difluorobenzene	98.9		70-130	%	10-DEC-19	10-DEC-19	R4937909
Surrogate: 4-Bromofluorobenzene	78.3		70-130	%	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-2 MW-02							
Sampled By: RYAN MILLER on 05-DEC-19 @ 11:50							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	60.5		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		10-DEC-19	R4938070
F1-BTEX	<0.10		0.10	mg/L		10-DEC-19	R4938070
Surrogate: 3,4-Dichlorotoluene	99.9		70-130	%		10-DEC-19	R4938070
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	0.338		0.050	mg/L		16-DEC-19	R4943991
Dissolved Organic Carbon	7.8		1.0	mg/L		13-DEC-19	R4943327
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	40.9	DLHC	5.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	12.5	DLHC	0.50	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	233	DLHC	2.5	mg/L		07-DEC-19	R4942649
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					09-DEC-19	R4938487
Aluminum (Al)-Dissolved	0.0157	DLDS	0.0050	mg/L		09-DEC-19	R4937828
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Arsenic (As)-Dissolved	0.00679	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Barium (Ba)-Dissolved	0.257	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Boron (B)-Dissolved	0.067	DLDS	0.050	mg/L		09-DEC-19	R4937828
Cadmium (Cd)-Dissolved	0.00377	DLDS	0.000025	mg/L		09-DEC-19	R4937828
Calcium (Ca)-Dissolved	177	DLDS	0.25	mg/L		09-DEC-19	R4937828
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Copper (Cu)-Dissolved	<0.0010	DLDS	0.0010	mg/L		09-DEC-19	R4937828
Iron (Fe)-Dissolved	6.80	DLDS	0.050	mg/L		09-DEC-19	R4937828
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		09-DEC-19	R4937828
Magnesium (Mg)-Dissolved	47.7	DLDS	0.025	mg/L		09-DEC-19	R4937828
Manganese (Mn)-Dissolved	1.56	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Nickel (Ni)-Dissolved	0.0064	DLDS	0.0025	mg/L		09-DEC-19	R4937828
Potassium (K)-Dissolved	4.85	DLDS	0.25	mg/L		09-DEC-19	R4937828
Selenium (Se)-Dissolved	<0.00025	DLDS	0.00025	mg/L		09-DEC-19	R4937828
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		09-DEC-19	R4937828
Sodium (Na)-Dissolved	112	DLDS	0.25	mg/L		09-DEC-19	R4937828
Uranium (U)-Dissolved	0.00243	DLDS	0.000050	mg/L		09-DEC-19	R4937828
Zinc (Zn)-Dissolved	0.0161	DLDS	0.0050	mg/L		09-DEC-19	R4937828

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-2 MW-02							
Sampled By: RYAN MILLER on 05-DEC-19 @ 11:50							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Ion Balance Calculation							
Ion Balance	94.1			%		16-DEC-19	
TDS (Calculated)	965			mg/L		16-DEC-19	
Hardness (as CaCO3)	638			mg/L		16-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		13-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		07-DEC-19	R4942649
Sulfate in Water by IC							
Sulfate (SO4)	54.6	DLHC	1.5	mg/L		07-DEC-19	R4942649
pH, Conductivity and Total Alkalinity							
pH	7.72		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1590		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	683		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	560		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
2,2-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
2-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
4-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
p-Isopropyltoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Benzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromochloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromodichloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromoform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromomethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Carbon tetrachloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-2 MW-02							
Sampled By: RYAN MILLER on 05-DEC-19 @ 11:50							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,2-Dichloroethene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromochloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromomethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylbenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylene dibromide	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Hexachlorobutadiene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Isopropylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
m+p-Xylenes	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Methylene chloride	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Propylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
o-Xylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
sec-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Styrene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
tert-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Tetrachloroethylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Toluene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichlorofluoromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Vinyl chloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Surrogate: 1,4-Difluorobenzene	99.1		70-130	%	10-DEC-19	10-DEC-19	R4937909
Surrogate: 4-Bromofluorobenzene	80.3		70-130	%	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-3 MW-03							
Sampled By: RYAN MILLER on 05-DEC-19 @ 10:20							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	85.9		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		10-DEC-19	R4938070
F1-BTEX	<0.10		0.10	mg/L		10-DEC-19	R4938070
Surrogate: 3,4-Dichlorotoluene	97.5		70-130	%		10-DEC-19	R4938070
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	0.174		0.050	mg/L		16-DEC-19	R4943991
Dissolved Organic Carbon	6.9		1.0	mg/L		13-DEC-19	R4943327
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	5.1	DLHC	2.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	4.26	DLHC	0.25	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	234	DLHC	2.5	mg/L		07-DEC-19	R4942649
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					09-DEC-19	R4938487
Aluminum (Al)-Dissolved	<0.0050	DLDS	0.0050	mg/L		09-DEC-19	R4937828
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Arsenic (As)-Dissolved	0.00415	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Barium (Ba)-Dissolved	0.239	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Boron (B)-Dissolved	0.157	DLDS	0.050	mg/L		09-DEC-19	R4937828
Cadmium (Cd)-Dissolved	0.000035	DLDS	0.000025	mg/L		09-DEC-19	R4937828
Calcium (Ca)-Dissolved	178	DLDS	0.25	mg/L		09-DEC-19	R4937828
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Copper (Cu)-Dissolved	<0.0010	DLDS	0.0010	mg/L		09-DEC-19	R4937828
Iron (Fe)-Dissolved	4.52	DLDS	0.050	mg/L		09-DEC-19	R4937828
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		09-DEC-19	R4937828
Magnesium (Mg)-Dissolved	46.3	DLDS	0.025	mg/L		09-DEC-19	R4937828
Manganese (Mn)-Dissolved	0.822	DLDS	0.00050	mg/L		09-DEC-19	R4937828
Nickel (Ni)-Dissolved	0.0042	DLDS	0.0025	mg/L		09-DEC-19	R4937828
Potassium (K)-Dissolved	4.34	DLDS	0.25	mg/L		09-DEC-19	R4937828
Selenium (Se)-Dissolved	<0.00025	DLDS	0.00025	mg/L		09-DEC-19	R4937828
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		09-DEC-19	R4937828
Sodium (Na)-Dissolved	114	DLDS	0.25	mg/L		09-DEC-19	R4937828
Uranium (U)-Dissolved	0.00205	DLDS	0.000050	mg/L		09-DEC-19	R4937828
Zinc (Zn)-Dissolved	<0.0050	DLDS	0.0050	mg/L		09-DEC-19	R4937828

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-3 MW-03							
Sampled By: RYAN MILLER on 05-DEC-19 @ 10:20							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Ion Balance Calculation							
Ion Balance	97.1			%		16-DEC-19	
TDS (Calculated)	951			mg/L		16-DEC-19	
Hardness (as CaCO3)	635			mg/L		16-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		13-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		07-DEC-19	R4942649
Sulfate in Water by IC							
Sulfate (SO4)	62.8	DLHC	1.5	mg/L		07-DEC-19	R4942649
pH, Conductivity and Total Alkalinity							
pH	7.71		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1560		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	634		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	520		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
2,2-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
2-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
4-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
p-Isopropyltoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Benzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromochloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromodichloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromoform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromomethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Carbon tetrachloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-3 MW-03							
Sampled By: RYAN MILLER on 05-DEC-19 @ 10:20							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,2-Dichloroethene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromochloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromomethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylbenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylene dibromide	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Hexachlorobutadiene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Isopropylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
m+p-Xylenes	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Methylene chloride	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Propylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
o-Xylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
sec-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Styrene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
tert-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Tetrachloroethylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Toluene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichlorofluoromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Vinyl chloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Surrogate: 1,4-Difluorobenzene	99.2		70-130	%	10-DEC-19	10-DEC-19	R4937909
Surrogate: 4-Bromofluorobenzene	79.1		70-130	%	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-4 MW-04							
Sampled By: RYAN MILLER on 05-DEC-19 @ 12:20							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	64.1		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		10-DEC-19	R4938070
F1-BTEX	<0.10		0.10	mg/L		10-DEC-19	R4938070
Surrogate: 3,4-Dichlorotoluene	99.7		70-130	%		10-DEC-19	R4938070
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	<0.050		0.050	mg/L		16-DEC-19	R4943991
Dissolved Organic Carbon	4.0		1.0	mg/L		13-DEC-19	R4943327
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	2.3	DLM	1.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	1.33	DLHC	0.10	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	162	DLHC	2.5	mg/L		07-DEC-19	R4942649
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					09-DEC-19	R4938487
Aluminum (Al)-Dissolved	0.0024		0.0010	mg/L		09-DEC-19	R4937828
Antimony (Sb)-Dissolved	0.00011		0.00010	mg/L		09-DEC-19	R4937828
Arsenic (As)-Dissolved	0.00019		0.00010	mg/L		09-DEC-19	R4937828
Barium (Ba)-Dissolved	0.122		0.00010	mg/L		09-DEC-19	R4937828
Boron (B)-Dissolved	0.091		0.010	mg/L		09-DEC-19	R4937828
Cadmium (Cd)-Dissolved	0.000120		0.0000050	mg/L		09-DEC-19	R4937828
Calcium (Ca)-Dissolved	166		0.050	mg/L		09-DEC-19	R4937828
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		09-DEC-19	R4937828
Copper (Cu)-Dissolved	0.00277		0.00020	mg/L		09-DEC-19	R4937828
Iron (Fe)-Dissolved	<0.010		0.010	mg/L		09-DEC-19	R4937828
Lead (Pb)-Dissolved	0.000066		0.000050	mg/L		09-DEC-19	R4937828
Magnesium (Mg)-Dissolved	40.4		0.0050	mg/L		09-DEC-19	R4937828
Manganese (Mn)-Dissolved	0.00576		0.00010	mg/L		09-DEC-19	R4937828
Nickel (Ni)-Dissolved	0.00195		0.00050	mg/L		09-DEC-19	R4937828
Potassium (K)-Dissolved	4.17		0.050	mg/L		09-DEC-19	R4937828
Selenium (Se)-Dissolved	0.00357		0.000050	mg/L		09-DEC-19	R4937828
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		09-DEC-19	R4937828
Sodium (Na)-Dissolved	96.9		0.050	mg/L		09-DEC-19	R4937828
Uranium (U)-Dissolved	0.00351		0.000010	mg/L		09-DEC-19	R4937828
Zinc (Zn)-Dissolved	0.0017		0.0010	mg/L		09-DEC-19	R4937828

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-4 MW-04							
Sampled By: RYAN MILLER on 05-DEC-19 @ 12:20							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Ion Balance Calculation							
Ion Balance	105			%		16-DEC-19	
TDS (Calculated)	823			mg/L		16-DEC-19	
Hardness (as CaCO3)	581			mg/L		16-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	0.24	DLHC	0.10	mg/L		07-DEC-19	R4942649
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.24		0.11	mg/L		13-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		07-DEC-19	R4942649
Sulfate in Water by IC							
Sulfate (SO4)	87.5	DLHC	1.5	mg/L		07-DEC-19	R4942649
pH, Conductivity and Total Alkalinity							
pH	7.68		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1290		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	538		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	441		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
2,2-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
2-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
4-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
p-Isopropyltoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Benzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromochloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromodichloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromoform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromomethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Carbon tetrachloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-4 MW-04							
Sampled By: RYAN MILLER on 05-DEC-19 @ 12:20							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,2-Dichloroethene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromochloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromomethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylbenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylene dibromide	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Hexachlorobutadiene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Isopropylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
m+p-Xylenes	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Methylene chloride	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Propylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
o-Xylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
sec-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Styrene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
tert-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Tetrachloroethylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Toluene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichlorofluoromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Vinyl chloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Surrogate: 1,4-Difluorobenzene	98.7		70-130	%	10-DEC-19	10-DEC-19	R4937909
Surrogate: 4-Bromofluorobenzene	78.9		70-130	%	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-5 MW-05							
Sampled By: RYAN MILLER on 05-DEC-19 @ 11:25							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	69.9		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		10-DEC-19	R4938070
F1-BTEX	<0.10		0.10	mg/L		10-DEC-19	R4938070
Surrogate: 3,4-Dichlorotoluene	103.5		70-130	%		10-DEC-19	R4938070
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	0.082		0.050	mg/L		16-DEC-19	R4943991
Dissolved Organic Carbon	5.3		1.0	mg/L		13-DEC-19	R4943327
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	11.3	DLHC	2.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	6.69	DLHC	0.50	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	141	DLHC	2.5	mg/L		07-DEC-19	R4942649
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					09-DEC-19	R4938487
Aluminum (Al)-Dissolved	0.248		0.0010	mg/L		09-DEC-19	R4937828
Antimony (Sb)-Dissolved	0.00021		0.00010	mg/L		09-DEC-19	R4937828
Arsenic (As)-Dissolved	0.00084		0.00010	mg/L		09-DEC-19	R4937828
Barium (Ba)-Dissolved	0.151		0.00010	mg/L		09-DEC-19	R4937828
Boron (B)-Dissolved	0.052		0.010	mg/L		09-DEC-19	R4937828
Cadmium (Cd)-Dissolved	0.00219		0.0000050	mg/L		09-DEC-19	R4937828
Calcium (Ca)-Dissolved	144		0.050	mg/L		09-DEC-19	R4937828
Chromium (Cr)-Dissolved	0.00067		0.00010	mg/L		09-DEC-19	R4937828
Copper (Cu)-Dissolved	0.00823		0.00020	mg/L		09-DEC-19	R4937828
Iron (Fe)-Dissolved	0.450		0.010	mg/L		09-DEC-19	R4937828
Lead (Pb)-Dissolved	0.000738		0.000050	mg/L		09-DEC-19	R4937828
Magnesium (Mg)-Dissolved	37.0		0.0050	mg/L		09-DEC-19	R4937828
Manganese (Mn)-Dissolved	0.0975		0.00010	mg/L		09-DEC-19	R4937828
Nickel (Ni)-Dissolved	0.00327		0.00050	mg/L		09-DEC-19	R4937828
Potassium (K)-Dissolved	4.27		0.050	mg/L		09-DEC-19	R4937828
Selenium (Se)-Dissolved	0.00273		0.000050	mg/L		09-DEC-19	R4937828
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		09-DEC-19	R4937828
Sodium (Na)-Dissolved	101		0.050	mg/L		09-DEC-19	R4937828
Uranium (U)-Dissolved	0.00436		0.000010	mg/L		09-DEC-19	R4937828
Zinc (Zn)-Dissolved	0.0070		0.0010	mg/L		09-DEC-19	R4937828

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-5 MW-05							
Sampled By: RYAN MILLER on 05-DEC-19 @ 11:25							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Ion Balance Calculation							
Ion Balance	100			%		16-DEC-19	
TDS (Calculated)	765			mg/L		16-DEC-19	
Hardness (as CaCO3)	512			mg/L		16-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		07-DEC-19	R4942649
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		13-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		07-DEC-19	R4942649
Sulfate in Water by IC							
Sulfate (SO4)	42.7	DLHC	1.5	mg/L		07-DEC-19	R4942649
pH, Conductivity and Total Alkalinity							
pH	7.76		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1220		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	600		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	492		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,1-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,2-Dichloropropane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
1,3-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
2,2-Dichloropropane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
2-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
4-Chlorotoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
p-Isopropyltoluene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Benzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromobenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromochloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromodichloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromoform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Bromomethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Carbon tetrachloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393423-5 MW-05							
Sampled By: RYAN MILLER on 05-DEC-19 @ 11:25							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloroform	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Chloromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,2-Dichloroethene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromochloromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dibromomethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylbenzene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Ethylene dibromide	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Hexachlorobutadiene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Isopropylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
m+p-Xylenes	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Methylene chloride	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
n-Propylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
o-Xylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
sec-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Styrene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
tert-Butylbenzene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Tetrachloroethylene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Toluene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichloroethene	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Trichlorofluoromethane	<0.0010		0.0010	mg/L	10-DEC-19	10-DEC-19	R4937909
Vinyl chloride	<0.00050		0.00050	mg/L	10-DEC-19	10-DEC-19	R4937909
Surrogate: 1,4-Difluorobenzene	98.7		70-130	%	10-DEC-19	10-DEC-19	R4937909
Surrogate: 4-Bromofluorobenzene	80.3		70-130	%	10-DEC-19	10-DEC-19	R4937909

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

<table>
<tr><th>ALS Test Code</th><th>Matrix</th><th>Test Description</th><th>Method Reference**</th></tr>
<tr><td>AOX-MISA-KL</td><td>Water</td><td>Adsorbable Organic Halides</td><td>EPA 1650</td></tr>
<tr><td>BTXS-HS-MS-CL</td><td>Water</td><td>BTEX and Styrene</td><td>EPA 8260C/5021A</td></tr>
<tr><td colspan="4">The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. BTEX Target compound concentrations are measured using mass spectrometry detection.</td></tr>
<tr><td>C-DIS-ORG-CL</td><td>Water</td><td>Dissolved Organic Carbon</td><td>APHA 5310 B-Instrumental</td></tr>
<tr><td colspan="4">Filtered (0.45 um) sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO2 which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.</td></tr>
<tr><td>CL-IC-N-CL</td><td>Water</td><td>Chloride in Water by IC</td><td>EPA 300.1 (mod)</td></tr>
<tr><td colspan="4">Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</td></tr>
<tr><td>F-IC-N-CL</td><td>Water</td><td>Fluoride in Water by IC</td><td>EPA 300.1 (mod)</td></tr>
<tr><td colspan="4">Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</td></tr>
<tr><td>F1-HS-FID-CL</td><td>Water</td><td>F1 (C6-C10)</td><td>EPA 5021A / CWS PHC Tier 1</td></tr>
<tr><td colspan="4">This analysis is based on the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2001." For F1 (C6-C10) analysis, the water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a GC-FID for analysis.</td></tr>
<tr><td>F2-4-ME-FID-CL</td><td>Water</td><td>CCME F2-4 Hydrocarbons</td><td>EPA 3511/ CCME PHC CWS GC-FID</td></tr>
<tr><td colspan="4">Water samples are spiked with 2-BBTF surrogate, and extracted by reciprocal action shaker for 30 minutes using a single micro-extraction with hexane. Instrumental analysis is by GC-FID, as per the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil, Tier 1 Method, CCME, December 2001.</td></tr>
<tr><td>HG-D-CVAA-CL</td><td>Water</td><td>Dissolved Mercury in Water by CVAAS</td><td>APHA 3030B/EPA 1631E (mod)</td></tr>
<tr><td colspan="4">Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.</td></tr>
<tr><td>IONBALANCE-CL</td><td>Water</td><td>Ion Balance Calculation</td><td>APHA 1030E</td></tr>
<tr><td>MET-D-CCMS-CL</td><td>Water</td><td>Dissolved Metals in Water by CRC ICPMS</td><td>APHA 3030B/6020A (mod)</td></tr>
<tr><td colspan="4">Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</td></tr>
<tr><td>N2N3-CALC-CL</td><td>Water</td><td>Nitrate+Nitrite</td><td>CALCULATION</td></tr>
<tr><td>NH3-F-CL</td><td>Water</td><td>Ammonia by Fluorescence</td><td>J. ENVIRON. MONIT., 2005, 7, 37-42, RSC</td></tr>
<tr><td colspan="4">This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</td></tr>
<tr><td>NO2-IC-N-CL</td><td>Water</td><td>Nitrite in Water by IC</td><td>EPA 300.1 (mod)</td></tr>
<tr><td colspan="4">Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</td></tr>
<tr><td>NO3-IC-N-CL</td><td>Water</td><td>Nitrate in Water by IC</td><td>EPA 300.1 (mod)</td></tr>
<tr><td colspan="4">Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</td></tr>
<tr><td>P-T-COL-CL</td><td>Water</td><td>Total P in Water by Colour</td><td>APHA 4500-P PHOSPHORUS</td></tr>
<tr><td colspan="4">This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.</td></tr>
<tr><td>PH/EC/ALK-CL</td><td>Water</td><td>pH, Conductivity and Total Alkalinity</td><td>APHA 4500H,2510,2320</td></tr>
<tr><td colspan="4">All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)</td></tr>
</table>

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode.
Alkalinity measurement is based on the sample's capacity to neutralize acid
Conductivity measurement is based on the sample's capacity to convey an electric current

SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TKN-F-CL	Water	Total Kjeldahl Nitrogen by Fluorescence	APHA 4500-NORG (TKN)

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

VFA-WP	Water	Volatile fatty/carboxylic acids	ASTM D2908-91

In the field, water and soil samples are collected in certified clean glass jars. In the laboratory, water samples are filtered and transferred to an autosampler vial for analysis. Soil samples are extracted with water and an aliquot of water is filtered. All extracts have internal standard added prior to injection. Analysis is performed by GC/MS in the selected ion monitoring (SIM) mode.

VOC-HS-MS-CL	Water	VOCs in Water	EPA 8260C/5021A

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. VOC Target compound concentrations are measured using mass spectrometry detection.

XYLENES-CALC-CL	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
KL	ALS ENVIRONMENTAL - KELSO, WASHINGTON, USA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GREAT WEST

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

ALS Routine Water Chemistry Report

L2393423

Lab ID	Sample ID			

L2393423-1 MW-01
Sample Date: 05-DEC-19
Matrix: WATER

	Result	UNITS	MEQ/L	MEQ %
Ion Balance	99.2	%		
Routine Anions				
Bicarbonate	521	mg/L	8.54	25
Carbonate	<5.0	mg/L	0	0
Hydroxide	<5.0	mg/L	0	0
Chloride	267	mg/L	7.53	22
Sulfate	65.1	mg/L	1.36	4
Nitrate+Nitrite-N		mg/L	0	0
Anion Sum			17.43	50
Routine Cations				
Calcium	173	mg/L	8.63	25
Magnesium	43.4	mg/L	3.57	10
Sodium	114	mg/L	4.96	14
Potassium	4.04	mg/L	0.10	0
Ammonium	0.231	mg/L	0.02	0
Cation Sum			17.28	50

L2393423-2 MW-02
Sample Date: 05-DEC-19
Matrix: WATER

	Result	UNITS	MEQ/L	MEQ %
Ion Balance	94.1	%		
Routine Anions				
Bicarbonate	683	mg/L	11.19	31
Carbonate	<5.0	mg/L	0	0
Hydroxide	<5.0	mg/L	0	0
Chloride	233	mg/L	6.57	18
Sulfate	54.6	mg/L	1.14	3
Nitrate+Nitrite-N		mg/L	0	0
Anion Sum			18.90	52
Routine Cations				
Calcium	177	mg/L	8.83	24
Magnesium	47.7	mg/L	3.93	11
Sodium	112	mg/L	4.87	13
Potassium	4.85	mg/L	0.12	0
Ammonium	0.338	mg/L	0.02	0
Cation Sum			17.78	48

L2393423-3 MW-03
Sample Date: 05-DEC-19
Matrix: WATER

	Result	UNITS	MEQ/L	MEQ %
Ion Balance	97.1	%		
Routine Anions				
Bicarbonate	634	mg/L	10.39	29
Carbonate	<5.0	mg/L	0	0
Hydroxide	<5.0	mg/L	0	0
Chloride	234	mg/L	6.60	18
Sulfate	62.8	mg/L	1.31	4
Nitrate+Nitrite-N		mg/L	0	0
Anion Sum			18.30	51
Routine Cations				
Calcium	178	mg/L	8.88	25
Magnesium	46.3	mg/L	3.81	11
Sodium	114	mg/L	4.96	14
Potassium	4.34	mg/L	0.11	0
Ammonium	0.174	mg/L	0.01	0
Cation Sum			17.78	49

L2393423-4 MW-04
Sample Date: 05-DEC-19
Matrix: WATER

	Result	UNITS	MEQ/L	MEQ %
Ion Balance	105	%		
Routine Anions				
Bicarbonate	538	mg/L	8.82	28
Carbonate	<5.0	mg/L	0	0
Hydroxide	<5.0	mg/L	0	0
Chloride	162	mg/L	4.57	15
Sulfate	87.5	mg/L	1.82	6
Nitrate+Nitrite-N		mg/L	0.02	0
Anion Sum			15.23	49
Routine Cations				
Calcium	166	mg/L	8.28	27
Magnesium	40.4	mg/L	3.33	11
Sodium	96.9	mg/L	4.21	14
Potassium	4.17	mg/L	0.11	0
Ammonium	<0.050	mg/L	0	0
Cation Sum			15.93	51

ALS Routine Water Chemistry Report

L2393423

Lab ID	Sample ID				Lab ID	Sample ID

L2393423-5 MW-05
Sample Date: 05-DEC-19
Matrix: WATER

	Result	UNITS	MEQ/L	MEQ %
Ion Balance	100	%		
Routine Anions				
Bicarbonate	600	mg/L	9.83	33
Carbonate	<5.0	mg/L	0	0
Hydroxide	<5.0	mg/L	0	0
Chloride	141	mg/L	3.98	14
Sulfate	42.7	mg/L	0.89	3
Nitrate+Nitrite-N		mg/L	0	0
Anion Sum			14.70	50
Routine Cations				
Calcium	144	mg/L	7.19	24
Magnesium	37.0	mg/L	3.05	10
Sodium	101	mg/L	4.39	15
Potassium	4.27	mg/L	0.11	0
Ammonium	0.082	mg/L	0.01	0
Cation Sum			14.74	50

ALS LABORATORY GROUP SOIL SALINITY CONVERSION

L2393423

Lab ID	Sample ID					Lab ID	Sample ID				

"Calculations are as per:
Methods of Analysis for Soils, Plants and Waters
Homer D. Chapman and Parker F. Pratt
University of California, Riverside, Cl.
August, 1961."

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-CL	**Water**							
Batch R4943327								
WG3242690-7 DUP		**L2390727-1**						
Dissolved Organic Carbon		12.7	11.3		mg/L	12	20	13-DEC-19
WG3242690-2 LCS								
Dissolved Organic Carbon			106.1		%		80-120	13-DEC-19
WG3242690-6 LCS								
Dissolved Organic Carbon			114.9		%		80-120	13-DEC-19
WG3242690-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	13-DEC-19
WG3242690-5 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	13-DEC-19
WG3242690-8 MS		**L2390727-1**						
Dissolved Organic Carbon			95.2		%		70-130	13-DEC-19
CL-IC-N-CL	**Water**							
Batch R4942649								
WG3241458-7 DUP		**L2393392-1**						
Chloride (Cl)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	07-DEC-19
WG3241458-6 LCS								
Chloride (Cl)			103.3		%		90-110	07-DEC-19
WG3241458-5 MB								
Chloride (Cl)			<0.50		mg/L		0.5	07-DEC-19
WG3241458-8 MS		**L2393392-1**						
Chloride (Cl)			108.4		%		75-125	07-DEC-19
F-IC-N-CL	**Water**							
Batch R4942649								
WG3241458-7 DUP		**L2393392-1**						
Fluoride (F)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	07-DEC-19
WG3241458-6 LCS								
Fluoride (F)			105.9		%		90-110	07-DEC-19
WG3241458-5 MB								
Fluoride (F)			<0.020		mg/L		0.02	07-DEC-19
WG3241458-8 MS		**L2393392-1**						
Fluoride (F)			99.97		%		75-125	07-DEC-19
F1-HS-FID-CL	**Water**							
Batch R4938070								
WG3238489-3 DUP		**L2393363-1**						
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	09-DEC-19
WG3238489-2 LCS								

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-FID-CL	**Water**							
Batch R4938070								
WG3238489-2 LCS								
F1(C6-C10)			72.1		%		70-130	10-DEC-19
WG3238489-1 MB								
F1(C6-C10)			<0.10		mg/L		0.1	09-DEC-19
Surrogate: 3,4-Dichlorotoluene			119.7		%		70-130	09-DEC-19
F2-4-ME-FID-CL	**Water**							
Batch R4944846								
WG3243467-1 MB								
F2: (C10-C16)			<0.10		mg/L		0.1	17-DEC-19
Surrogate: 2-Bromobenzotrifluoride			70.9		%		60-140	17-DEC-19
HG-D-CVAA-CL	**Water**							
Batch R4943011								
WG3242289-3 DUP		**L2393429-4**						
Mercury (Hg)-Dissolved		<0.0000050	<0.0000050	RPD-NA	mg/L	N/A	20	13-DEC-19
WG3242289-2 LCS								
Mercury (Hg)-Dissolved			112.0		%		80-120	13-DEC-19
WG3242289-1 MB								
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	13-DEC-19
WG3242289-4 MS		**L2393429-4**						
Mercury (Hg)-Dissolved			106.0		%		70-130	13-DEC-19
MET-D-CCMS-CL	**Water**							
Batch R4937828								
WG3238594-7 DUP		**L2393428-4**						
Aluminum (Al)-Dissolved		0.0040	0.0040		mg/L	0.9	20	13-DEC-19
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	13-DEC-19
Arsenic (As)-Dissolved		0.00046	0.00042		mg/L	9.4	20	13-DEC-19
Barium (Ba)-Dissolved		0.272	0.288		mg/L	5.6	20	13-DEC-19
Boron (B)-Dissolved		0.070	0.088	J	mg/L	0.018	0.02	13-DEC-19
Cadmium (Cd)-Dissolved		0.0000707	0.0000799		mg/L	12	20	13-DEC-19
Calcium (Ca)-Dissolved		157	168		mg/L	6.4	20	13-DEC-19
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	13-DEC-19
Copper (Cu)-Dissolved		0.00055	0.00061		mg/L	9.8	20	13-DEC-19
Iron (Fe)-Dissolved		0.106	0.118		mg/L	11	20	13-DEC-19
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	13-DEC-19
Magnesium (Mg)-Dissolved		64.7	72.3		mg/L	11	20	13-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R4937828								
WG3238594-7 DUP		**L2393428-4**						
Manganese (Mn)-Dissolved		1.03	1.12		mg/L	8.4	20	13-DEC-19
Nickel (Ni)-Dissolved		0.00519	0.00553		mg/L	6.3	20	13-DEC-19
Potassium (K)-Dissolved		10.1	9.80		mg/L	3.5	20	13-DEC-19
Selenium (Se)-Dissolved		0.000088	0.000068	J	mg/L	0.000020	0.0001	13-DEC-19
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	13-DEC-19
Sodium (Na)-Dissolved		57.5	67.8		mg/L	16	20	13-DEC-19
Uranium (U)-Dissolved		0.00551	0.00604		mg/L	9.2	20	13-DEC-19
Zinc (Zn)-Dissolved		0.0015	0.0015		mg/L	2.8	20	13-DEC-19
WG3238594-6 LCS								
Aluminum (Al)-Dissolved			98.2		%		80-120	09-DEC-19
Antimony (Sb)-Dissolved			92.9		%		80-120	09-DEC-19
Arsenic (As)-Dissolved			94.2		%		80-120	09-DEC-19
Barium (Ba)-Dissolved			90.9		%		80-120	09-DEC-19
Boron (B)-Dissolved			93.0		%		80-120	09-DEC-19
Cadmium (Cd)-Dissolved			92.2		%		80-120	09-DEC-19
Calcium (Ca)-Dissolved			106.7		%		80-120	09-DEC-19
Chromium (Cr)-Dissolved			93.7		%		80-120	09-DEC-19
Copper (Cu)-Dissolved			93.4		%		80-120	09-DEC-19
Iron (Fe)-Dissolved			97.2		%		80-120	09-DEC-19
Lead (Pb)-Dissolved			93.4		%		80-120	09-DEC-19
Magnesium (Mg)-Dissolved			91.2		%		80-120	09-DEC-19
Manganese (Mn)-Dissolved			95.8		%		80-120	09-DEC-19
Nickel (Ni)-Dissolved			92.9		%		80-120	09-DEC-19
Potassium (K)-Dissolved			94.9		%		80-120	09-DEC-19
Selenium (Se)-Dissolved			111.2		%		80-120	09-DEC-19
Silver (Ag)-Dissolved			103.0		%		80-120	09-DEC-19
Sodium (Na)-Dissolved			86.0		%		80-120	09-DEC-19
Uranium (U)-Dissolved			103.0		%		80-120	09-DEC-19
Zinc (Zn)-Dissolved			93.6		%		80-120	09-DEC-19
WG3238594-5 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	09-DEC-19
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	09-DEC-19
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	09-DEC-19
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	09-DEC-19

Quality Control Report

Workorder: L2393423 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R4937828								
WG3238594-5 MB								
Boron (B)-Dissolved			<0.010		mg/L		0.01	09-DEC-19
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	09-DEC-19
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	09-DEC-19
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	09-DEC-19
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	09-DEC-19
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	09-DEC-19
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	09-DEC-19
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	09-DEC-19
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	09-DEC-19
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	09-DEC-19
Potassium (K)-Dissolved			<0.050		mg/L		0.05	09-DEC-19
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	09-DEC-19
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	09-DEC-19
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	09-DEC-19
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	09-DEC-19
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	09-DEC-19
WG3238594-8 MS		**L2393428-4**						
Aluminum (Al)-Dissolved			120.8		%		70-130	14-DEC-19
Antimony (Sb)-Dissolved			103.8		%		70-130	14-DEC-19
Arsenic (As)-Dissolved			120.6		%		70-130	14-DEC-19
Barium (Ba)-Dissolved			N/A	MS-B	%		-	14-DEC-19
Boron (B)-Dissolved			111.5		%		70-130	14-DEC-19
Cadmium (Cd)-Dissolved			121.0		%		70-130	14-DEC-19
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	14-DEC-19
Chromium (Cr)-Dissolved			117.2		%		70-130	14-DEC-19
Copper (Cu)-Dissolved			117.4		%		70-130	14-DEC-19
Iron (Fe)-Dissolved			103.6		%		70-130	14-DEC-19
Lead (Pb)-Dissolved			108.0		%		70-130	14-DEC-19
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	14-DEC-19
Manganese (Mn)-Dissolved			N/A	MS-B	%		-	14-DEC-19
Nickel (Ni)-Dissolved			119.6		%		70-130	14-DEC-19
Potassium (K)-Dissolved			127.0		%		70-130	14-DEC-19
Selenium (Se)-Dissolved			110.4		%		70-130	14-DEC-19
Silver (Ag)-Dissolved			92.2		%		70-130	14-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R4937828								
WG3238594-8 MS		**L2393428-4**						
Sodium (Na)-Dissolved			N/A	MS-B	%		-	14-DEC-19
Uranium (U)-Dissolved			110.8		%		70-130	14-DEC-19
Zinc (Zn)-Dissolved			117.1		%		70-130	14-DEC-19
NH3-F-CL	**Water**							
Batch R4943991								
WG3242302-14 LCS								
Ammonia, Total (as N)			94.7		%		85-115	16-DEC-19
WG3242302-13 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	16-DEC-19
NO2-IC-N-CL	**Water**							
Batch R4942649								
WG3241458-6 LCS								
Nitrite (as N)			106.1		%		90-110	07-DEC-19
WG3241458-5 MB								
Nitrite (as N)			<0.010		mg/L		0.01	07-DEC-19
NO3-IC-N-CL	**Water**							
Batch R4942649								
WG3241458-6 LCS								
Nitrate (as N)			104.0		%		90-110	07-DEC-19
WG3241458-5 MB								
Nitrate (as N)			<0.020		mg/L		0.02	07-DEC-19
P-T-COL-CL	**Water**							
Batch R4943276								
WG3242072-10 LCS								
Phosphorus (P)-Total			92.6		%		80-120	13-DEC-19
WG3242072-6 LCS								
Phosphorus (P)-Total			91.3		%		80-120	13-DEC-19
WG3242072-5 MB								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	13-DEC-19
WG3242072-9 MB								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	13-DEC-19
PH/EC/ALK-CL	**Water**							
Batch R4943994								
WG3243425-11 LCS								
Conductivity (EC)			99.3		%		90-110	14-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-CL	**Water**							
Batch R4943994								
WG3243425-11 LCS								
Alkalinity, Total (as CaCO3)			104.4		%		85-115	14-DEC-19
WG3243425-8 LCS								
Conductivity (EC)			98.6		%		90-110	14-DEC-19
Alkalinity, Total (as CaCO3)			104.1		%		85-115	14-DEC-19
WG3243425-10 MB								
Conductivity (EC)			<2.0		uS/cm		2	14-DEC-19
Bicarbonate (HCO3)			<5.0		mg/L		5	14-DEC-19
Carbonate (CO3)			<5.0		mg/L		5	14-DEC-19
Hydroxide (OH)			<5.0		mg/L		5	14-DEC-19
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	14-DEC-19
WG3243425-7 MB								
Conductivity (EC)			<2.0		uS/cm		2	14-DEC-19
Bicarbonate (HCO3)			<5.0		mg/L		5	14-DEC-19
Carbonate (CO3)			<5.0		mg/L		5	14-DEC-19
Hydroxide (OH)			<5.0		mg/L		5	14-DEC-19
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	14-DEC-19
SO4-IC-N-CL	**Water**							
Batch R4942649								
WG3241458-7 DUP		**L2393392-1**						
Sulfate (SO4)		<0.30	0.40	RPD-NA	mg/L	N/A	20	07-DEC-19
WG3241458-6 LCS								
Sulfate (SO4)			100.3		%		90-110	07-DEC-19
WG3241458-5 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	07-DEC-19
WG3241458-8 MS		**L2393392-1**						
Sulfate (SO4)			105.6		%		75-125	07-DEC-19
TKN-F-CL	**Water**							
Batch R4943090								
WG3242367-15 DUP		**L2393430-1**						
Total Kjeldahl Nitrogen		0.69	0.64		mg/L	8.0	20	12-DEC-19
WG3242367-17 DUP		**L2393876-2**						
Total Kjeldahl Nitrogen		18	17		mg/L	0.5	20	12-DEC-19
WG3242367-18 DUP		**L2393879-1**						
Total Kjeldahl Nitrogen		74	71		mg/L	4.4	20	12-DEC-19
WG3242367-3 DUP		**L2394735-1**						
Total Kjeldahl Nitrogen		3.93	3.82		mg/L			12-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-F-CL	**Water**							
Batch R4943090								
WG3242367-3 DUP		**L2394735-1**						
Total Kjeldahl Nitrogen		3.93	3.82		mg/L	2.8	20	12-DEC-19
WG3242367-10 LCS								
Total Kjeldahl Nitrogen			102.0		%		75-125	12-DEC-19
WG3242367-14 LCS								
Total Kjeldahl Nitrogen			102.0		%		75-125	12-DEC-19
WG3242367-2 LCS								
Total Kjeldahl Nitrogen			98.4		%		75-125	12-DEC-19
WG3242367-6 LCS								
Total Kjeldahl Nitrogen			100.2		%		75-125	12-DEC-19
WG3242367-1 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-13 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-5 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-9 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-16 MS		**L2393430-1**						
Total Kjeldahl Nitrogen			99.9		%		70-130	12-DEC-19
WG3242367-4 MS		**L2394735-1**						
Total Kjeldahl Nitrogen			107.0		%		70-130	12-DEC-19
VFA-WP	**Water**							
Batch R4943956								
WG3243150-3 DUP		**L2393425-3**						
Formic Acid		<50	<50	RPD-NA	mg/L	N/A	30	14-DEC-19
Acetic Acid		<10	<10	RPD-NA	mg/L	N/A	30	14-DEC-19
Propionic Acid		<5.0	<5.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Butyric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Isobutyric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Valeric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Isovaleric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Caproic (Hexanoic) Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
WG3243154-3 DUP		**L2393428-2**						
Formic Acid		<50	<50	RPD-NA	mg/L	N/A	30	14-DEC-19
Acetic Acid		<10	<10	RPD-NA	mg/L	N/A	30	14-DEC-19
Propionic Acid		<5.0	<5.0	RPD-NA	mg/L	N/A	30	14-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VFA-WP	**Water**							
Batch R4943956								
WG3243154-3 DUP		**L2393428-2**						
Butyric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Isobutyric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Valeric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Isovaleric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Caproic (Hexanoic) Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
WG3243150-2 LCS								
Formic Acid			126.9		%		70-130	16-DEC-19
Acetic Acid			79.8		%		70-130	16-DEC-19
Propionic Acid			82.0		%		70-130	16-DEC-19
Butyric Acid			72.2		%		70-130	16-DEC-19
Isobutyric Acid			78.9		%		70-130	16-DEC-19
Valeric Acid			73.7		%		70-130	16-DEC-19
Isovaleric Acid			70.0		%		70-130	16-DEC-19
Caproic (Hexanoic) Acid			82.3		%		70-130	16-DEC-19
WG3243154-2 LCS								
Formic Acid			124.7		%		70-130	16-DEC-19
Acetic Acid			73.5		%		70-130	16-DEC-19
Propionic Acid			87.7		%		70-130	16-DEC-19
Butyric Acid			70.6		%		70-130	16-DEC-19
Isobutyric Acid			76.8		%		70-130	16-DEC-19
Valeric Acid			75.6		%		70-130	16-DEC-19
Isovaleric Acid			71.7		%		70-130	16-DEC-19
Caproic (Hexanoic) Acid			85.2		%		70-130	16-DEC-19
WG3243150-1 MB								
Formic Acid			<30		mg/L		30	13-DEC-19
Acetic Acid			<10		mg/L		10	13-DEC-19
Propionic Acid			<5.0		mg/L		5	13-DEC-19
Butyric Acid			<1.0		mg/L		1	13-DEC-19
Isobutyric Acid			<1.0		mg/L		1	13-DEC-19
Valeric Acid			<1.0		mg/L		1	13-DEC-19
Isovaleric Acid			<1.0		mg/L		1	13-DEC-19
Caproic (Hexanoic) Acid			<1.0		mg/L		1	13-DEC-19
WG3243154-1 MB								
Formic Acid			<30		mg/L		30	13-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VFA-WP	**Water**							
Batch R4943956								
WG3243154-1 MB								
Acetic Acid			<10		mg/L		10	13-DEC-19
Propionic Acid			<5.0		mg/L		5	13-DEC-19
Butyric Acid			<1.0		mg/L		1	13-DEC-19
Isobutyric Acid			<1.0		mg/L		1	13-DEC-19
Valeric Acid			<1.0		mg/L		1	13-DEC-19
Isovaleric Acid			<1.0		mg/L		1	13-DEC-19
Caproic (Hexanoic) Acid			<1.0		mg/L		1	13-DEC-19
WG3243150-4 MS		**L2393410-5**						
Formic Acid			89.8		%		70-130	13-DEC-19
Acetic Acid			82.9		%		70-130	13-DEC-19
Propionic Acid			79.8		%		70-130	13-DEC-19
Butyric Acid			79.4		%		70-130	13-DEC-19
Isobutyric Acid			80.4		%		70-130	13-DEC-19
Valeric Acid			85.5		%		70-130	13-DEC-19
Isovaleric Acid			75.3		%		70-130	13-DEC-19
Caproic (Hexanoic) Acid			97.3		%		70-130	13-DEC-19
WG3243154-4 MS		**L2393423-2**						
Formic Acid			92.1		%		70-130	13-DEC-19
Acetic Acid			78.9		%		70-130	13-DEC-19
Propionic Acid			74.4		%		70-130	13-DEC-19
Butyric Acid			72.4		%		70-130	13-DEC-19
Isobutyric Acid			80.5		%		70-130	13-DEC-19
Valeric Acid			72.6		%		70-130	13-DEC-19
Isovaleric Acid			70.3		%		70-130	13-DEC-19
Caproic (Hexanoic) Acid			91.8		%		70-130	13-DEC-19
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-5 DUP		**L2393231-1**						
1,1,1,2-Tetrachloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,1,1-Trichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,1,2,2-Tetrachloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,1,2-Trichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,1-Dichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,1-Dichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-5 DUP		**L2393231-1**						
1,1-Dichloropropene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2,3-Trichlorobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2,3-Trichloropropane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2,4-Trichlorobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2,4-Trimethylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2-Dibromo-3-chloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2-Dichloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,2-Dichloropropane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,3,5-Trimethylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,3-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
1,3-Dichloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
1,4-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
2,2-Dichloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
2-Chlorotoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
4-Chlorotoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
p-Isopropyltoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	10-DEC-19
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Bromobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Bromochloromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Bromodichloromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Bromoform		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Bromomethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Carbon tetrachloride		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Chlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Chloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Chloroform		0.00166	0.00171		mg/L	3.0	30	10-DEC-19
Chloromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
cis-1,2-Dichloroethene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
cis-1,3-Dichloropropene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Dibromochloromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Dibromomethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Dichlorodifluoromethane		<0.00050	<0.00050		mg/L			10-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-5 DUP		**L2393231-1**						
Dichlorodifluoromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Ethylene dibromide		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Hexachlorobutadiene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Isopropylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
m+p-Xylenes		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Methylene chloride		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
n-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
n-Propylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
sec-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Styrene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
tert-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Tetrachloroethylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
trans-1,2-Dichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
trans-1,3-Dichloropropene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Trichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
Trichlorofluoromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	10-DEC-19
Vinyl chloride		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	10-DEC-19
WG3238459-2 LCS								
1,1,1,2-Tetrachloroethane			104.2		%		70-130	09-DEC-19
1,1,1-Trichloroethane			96.0		%		70-130	09-DEC-19
1,1,2,2-Tetrachloroethane			94.1		%		70-130	09-DEC-19
1,1,2-Trichloroethane			93.3		%		70-130	09-DEC-19
1,1-Dichloroethane			100.0		%		70-130	09-DEC-19
1,1-Dichloroethene			99.8		%		70-130	09-DEC-19
1,1-Dichloropropene			87.0		%		70-130	09-DEC-19
1,2,3-Trichlorobenzene			95.0		%		70-130	09-DEC-19
1,2,3-Trichloropropane			98.2		%		70-130	09-DEC-19
1,2,4-Trichlorobenzene			96.7		%		70-130	09-DEC-19
1,2,4-Trimethylbenzene			100.5		%		70-130	09-DEC-19
1,2-Dibromo-3-chloropropane			88.1		%		70-130	09-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-2 LCS								
1,2-Dichlorobenzene			101.3		%		70-130	09-DEC-19
1,2-Dichloroethane			93.1		%		70-130	09-DEC-19
1,2-Dichloropropane			95.9		%		70-130	09-DEC-19
1,3,5-Trimethylbenzene			101.4		%		70-130	09-DEC-19
1,3-Dichlorobenzene			100.6		%		70-130	09-DEC-19
1,3-Dichloropropane			92.3		%		70-130	09-DEC-19
1,4-Dichlorobenzene			106.6		%		70-130	09-DEC-19
2,2-Dichloropropane			94.4		%		70-130	09-DEC-19
2-Chlorotoluene			98.4		%		70-130	09-DEC-19
4-Chlorotoluene			94.9		%		70-130	09-DEC-19
p-Isopropyltoluene			96.2		%		50-150	09-DEC-19
Benzene			96.6		%		70-130	09-DEC-19
Bromobenzene			101.9		%		70-130	09-DEC-19
Bromochloromethane			92.5		%		70-130	09-DEC-19
Bromodichloromethane			98.0		%		70-130	09-DEC-19
Bromoform			96.4		%		70-130	09-DEC-19
Bromomethane			111.8		%		60-140	09-DEC-19
Carbon tetrachloride			94.1		%		70-130	09-DEC-19
Chlorobenzene			103.2		%		70-130	09-DEC-19
Chloroethane			126.5		%		60-140	09-DEC-19
Chloroform			96.6		%		70-130	09-DEC-19
Chloromethane			120.3		%		60-140	09-DEC-19
cis-1,2-Dichloroethene			92.9		%		70-130	09-DEC-19
cis-1,3-Dichloropropene			85.8		%		70-130	09-DEC-19
Dibromochloromethane			97.9		%		70-130	09-DEC-19
Dibromomethane			94.2		%		70-130	09-DEC-19
Dichlorodifluoromethane			122.0		%		60-140	09-DEC-19
Ethylbenzene			97.2		%		70-130	09-DEC-19
Ethylene dibromide			88.4		%		70-130	09-DEC-19
Hexachlorobutadiene			102.7		%		70-130	09-DEC-19
Isopropylbenzene			98.0		%		70-130	09-DEC-19
m+p-Xylenes			104.8		%		70-130	09-DEC-19
Methylene chloride			92.5		%		60-140	09-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-2 LCS								
n-Butylbenzene			98.5		%		70-130	09-DEC-19
n-Propylbenzene			92.2		%		70-130	09-DEC-19
o-Xylene			92.6		%		70-130	09-DEC-19
sec-Butylbenzene			103.6		%		70-130	09-DEC-19
Styrene			87.5		%		70-130	09-DEC-19
tert-Butylbenzene			98.5		%		70-130	09-DEC-19
Tetrachloroethylene			102.0		%		70-130	09-DEC-19
Toluene			89.9		%		70-130	09-DEC-19
trans-1,2-Dichloroethene			98.2		%		70-130	09-DEC-19
trans-1,3-Dichloropropene			91.6		%		70-130	09-DEC-19
Trichloroethene			98.1		%		70-130	09-DEC-19
Trichlorofluoromethane			122.0		%		60-140	09-DEC-19
Vinyl chloride			117.5		%		60-140	09-DEC-19
WG3238459-1 MB								
1,1,1,2-Tetrachloroethane			<0.0010		mg/L		0.001	09-DEC-19
1,1,1-Trichloroethane			<0.00050		mg/L		0.0005	09-DEC-19
1,1,2,2-Tetrachloroethane			<0.00050		mg/L		0.0005	09-DEC-19
1,1,2-Trichloroethane			<0.00050		mg/L		0.0005	09-DEC-19
1,1-Dichloroethane			<0.00050		mg/L		0.0005	09-DEC-19
1,1-Dichloroethene			<0.00050		mg/L		0.0005	09-DEC-19
1,1-Dichloropropene			<0.0010		mg/L		0.001	09-DEC-19
1,2,3-Trichlorobenzene			<0.0010		mg/L		0.001	09-DEC-19
1,2,3-Trichloropropane			<0.00050		mg/L		0.0005	09-DEC-19
1,2,4-Trichlorobenzene			<0.0010		mg/L		0.001	09-DEC-19
1,2,4-Trimethylbenzene			<0.0010		mg/L		0.001	09-DEC-19
1,2-Dibromo-3-chloropropane			<0.0010		mg/L		0.001	09-DEC-19
1,2-Dichlorobenzene			<0.00050		mg/L		0.0005	09-DEC-19
1,2-Dichloroethane			<0.0010		mg/L		0.001	09-DEC-19
1,2-Dichloropropane			<0.00050		mg/L		0.0005	09-DEC-19
1,3,5-Trimethylbenzene			<0.0010		mg/L		0.001	09-DEC-19
1,3-Dichlorobenzene			<0.00050		mg/L		0.0005	09-DEC-19
1,3-Dichloropropane			<0.0010		mg/L		0.001	09-DEC-19
1,4-Dichlorobenzene			<0.00050		mg/L		0.0005	09-DEC-19
2,2-Dichloropropane			<0.0010		mg/L		0.001	09-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-1 MB								
2-Chlorotoluene			<0.0010		mg/L		0.001	09-DEC-19
4-Chlorotoluene			<0.0010		mg/L		0.001	09-DEC-19
p-Isopropyltoluene			<0.0010		mg/L		0.001	09-DEC-19
Benzene			<0.00050		mg/L		0.0005	09-DEC-19
Bromobenzene			<0.0010		mg/L		0.001	09-DEC-19
Bromochloromethane			<0.0010		mg/L		0.001	09-DEC-19
Bromodichloromethane			<0.00050		mg/L		0.0005	09-DEC-19
Bromoform			<0.00050		mg/L		0.0005	09-DEC-19
Bromomethane			<0.0010		mg/L		0.001	09-DEC-19
Carbon tetrachloride			<0.00050		mg/L		0.0005	09-DEC-19
Chlorobenzene			<0.00050		mg/L		0.0005	09-DEC-19
Chloroethane			<0.0010		mg/L		0.001	09-DEC-19
Chloroform			<0.00050		mg/L		0.0005	09-DEC-19
Chloromethane			<0.0010		mg/L		0.001	09-DEC-19
cis-1,2-Dichloroethene			<0.0010		mg/L		0.001	09-DEC-19
cis-1,3-Dichloropropene			<0.00050		mg/L		0.0005	09-DEC-19
Dibromochloromethane			<0.00050		mg/L		0.0005	09-DEC-19
Dibromomethane			<0.00050		mg/L		0.0005	09-DEC-19
Dichlorodifluoromethane			<0.00050		mg/L		0.0005	09-DEC-19
Ethylbenzene			<0.00050		mg/L		0.0005	09-DEC-19
Ethylene dibromide			<0.00050		mg/L		0.0005	09-DEC-19
Hexachlorobutadiene			<0.0010		mg/L		0.001	09-DEC-19
Isopropylbenzene			<0.0010		mg/L		0.001	09-DEC-19
m+p-Xylenes			<0.00050		mg/L		0.0005	09-DEC-19
Methylene chloride			<0.0010		mg/L		0.001	09-DEC-19
n-Butylbenzene			<0.0010		mg/L		0.001	09-DEC-19
n-Propylbenzene			<0.0010		mg/L		0.001	09-DEC-19
o-Xylene			<0.00050		mg/L		0.0005	09-DEC-19
sec-Butylbenzene			<0.0010		mg/L		0.001	09-DEC-19
Styrene			<0.00050		mg/L		0.0005	09-DEC-19
tert-Butylbenzene			<0.0010		mg/L		0.001	09-DEC-19
Tetrachloroethylene			<0.00050		mg/L		0.0005	09-DEC-19
Toluene			<0.00050		mg/L		0.0005	09-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4937909								
WG3238459-1 MB								
trans-1,2-Dichloroethene			<0.00050		mg/L		0.0005	09-DEC-19
trans-1,3-Dichloropropene			<0.0010		mg/L		0.001	09-DEC-19
Trichloroethene			<0.00050		mg/L		0.0005	09-DEC-19
Trichlorofluoromethane			<0.0010		mg/L		0.001	09-DEC-19
Vinyl chloride			<0.00050		mg/L		0.0005	09-DEC-19
Surrogate: 1,4-Difluorobenzene			100.6		%		70-130	09-DEC-19
Surrogate: 4-Bromofluorobenzene			80.9		%		70-130	09-DEC-19
WG3238459-6 MS		**L2393231-2**						
1,1,1,2-Tetrachloroethane			99.0		%		50-140	09-DEC-19
1,1,1-Trichloroethane			99.0		%		50-140	09-DEC-19
1,1,2,2-Tetrachloroethane			87.1		%		50-140	09-DEC-19
1,1,2-Trichloroethane			88.5		%		50-140	09-DEC-19
1,1-Dichloroethane			101.6		%		50-140	09-DEC-19
1,1-Dichloroethene			102.3		%		50-140	09-DEC-19
1,1-Dichloropropene			94.7		%		50-140	09-DEC-19
1,2,3-Trichlorobenzene			109.6		%		50-140	09-DEC-19
1,2,3-Trichloropropane			89.8		%		70-130	09-DEC-19
1,2,4-Trichlorobenzene			106.1		%		50-140	09-DEC-19
1,2,4-Trimethylbenzene			102.6		%		50-140	09-DEC-19
1,2-Dibromo-3-chloropropane			92.5		%		50-140	09-DEC-19
1,2-Dichlorobenzene			100.5		%		50-140	09-DEC-19
1,2-Dichloroethane			89.2		%		50-140	09-DEC-19
1,2-Dichloropropane			96.1		%		50-140	09-DEC-19
1,3,5-Trimethylbenzene			103.0		%		50-140	09-DEC-19
1,3-Dichlorobenzene			98.8		%		50-140	09-DEC-19
1,3-Dichloropropane			88.8		%		50-140	09-DEC-19
1,4-Dichlorobenzene			104.7		%		50-140	09-DEC-19
2,2-Dichloropropane			98.2		%		50-140	09-DEC-19
2-Chlorotoluene			99.5		%		50-140	09-DEC-19
4-Chlorotoluene			95.2		%		50-140	09-DEC-19
p-Isopropyltoluene			101.3		%		50-140	09-DEC-19
Benzene			98.9		%		50-140	09-DEC-19
Bromobenzene			98.7		%		50-140	09-DEC-19
Bromochloromethane			90.1		%		50-140	09-DEC-19

ALS Environmental

Quality Control Report

Workorder: L2393423 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch	**R4937909**							
WG3238459-6 MS		**L2393231-2**						
Bromodichloromethane			95.6		%		50-140	09-DEC-19
Bromoform			89.3		%		50-140	09-DEC-19
Bromomethane			113.0		%		50-140	09-DEC-19
Carbon tetrachloride			96.1		%		50-140	09-DEC-19
Chlorobenzene			100.3		%		50-140	09-DEC-19
Chloroethane			127.7		%		50-140	09-DEC-19
Chloroform			96.5		%		50-140	09-DEC-19
Chloromethane			120.4		%		50-140	09-DEC-19
cis-1,2-Dichloroethene			95.9		%		50-140	09-DEC-19
cis-1,3-Dichloropropene			89.3		%		50-140	09-DEC-19
Dibromochloromethane			95.2		%		50-140	09-DEC-19
Dibromomethane			89.7		%		50-140	09-DEC-19
Dichlorodifluoromethane			122.6		%		50-140	09-DEC-19
Ethylbenzene			101.7		%		50-140	09-DEC-19
Ethylene dibromide			84.8		%		50-140	09-DEC-19
Hexachlorobutadiene			104.6		%		50-140	09-DEC-19
Isopropylbenzene			100.7		%		50-140	09-DEC-19
m+p-Xylenes			102.3		%		50-140	09-DEC-19
Methylene chloride			91.4		%		50-140	09-DEC-19
n-Butylbenzene			100.9		%		50-140	09-DEC-19
n-Propylbenzene			98.8		%		50-140	09-DEC-19
o-Xylene			97.8		%		50-140	09-DEC-19
sec-Butylbenzene			103.9		%		50-140	09-DEC-19
Styrene			92.3		%		50-140	09-DEC-19
tert-Butylbenzene			101.5		%		50-140	09-DEC-19
Tetrachloroethylene			102.1		%		50-140	09-DEC-19
Toluene			95.8		%		50-140	09-DEC-19
trans-1,2-Dichloroethene			99.0		%		50-140	09-DEC-19
trans-1,3-Dichloropropene			92.1		%		50-140	09-DEC-19
Trichloroethene			101.5		%		50-140	09-DEC-19
Trichlorofluoromethane			110.9		%		50-140	09-DEC-19
Vinyl chloride			122.7		%		50-140	09-DEC-19

Legend:

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

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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

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

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

December 26, 2019 Service Request No:K1911630

Inayat Dhaliwal
ALS Environmental - Canada
2559 29 Street NE
Calgary, AB T1Y 7B5

Laboratory Results for: L2393423

Dear Inayat,

Enclosed are the results of the sample(s) submitted to our laboratory December 12, 2019
For your reference, these analyses have been assigned our service request number **K1911630.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3293. You may also contact me via email at Elizabeth.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Elizabeth Harris
Project Manager

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

RIGHT SOLUTIONS | RIGHT PARTNER

Client: ALS Environmental - Canada
Service Request: K1911630
Project: L2393423
Date Received: 12/12/2019
Sample Matrix: Water

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Five water samples were received for analysis at ALS Environmental on 12/12/2019. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

General Chemistry:

No significant anomalies were noted with this analysis.

Approved by ______________________ Date 12/26/2019

Sample Receipt Information

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: ALS Environmental - Canada **Service Request:**K1911630

Project: L2393423

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K1911630-001	L2393423-1	12/5/2019	
K1911630-002	L2393423-2	12/5/2019	
K1911630-003	L2393423-3	12/5/2019	
K1911630-004	L2393423-4	12/5/2019	
K1911630-005	L2393423-5	12/5/2019	

K1911630

L2393423

CALGARY

Subcontract Request Form

Subcontract To:

ALS ENVIRONMENTAL - KELSO, WASHINGTON, USA
1317 S. 13TH AVE
KELSO,WA 98626

NOTES: Please reference on final report and invoice: PO# L2393423
ALS requires QC data to be provided with your final results.

Please see enclosed 5 **sample(s) in** 5 **Container(s)**

SAMPLE NUMBER	ANALYTICAL REQUIRED	DATE SAMPLED DUE DATE	Priority Flag
L2393423-1 MW-01		**12/ 5/ 2019**	
	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/30/2019	
L2393423-2 MW-02		**12/ 5/ 2019**	
	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/30/2019	
L2393423-3 MW-03		**12/ 5/ 2019**	
	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/30/2019	
L2393423-4 MW-04		**12/ 5/ 2019**	
	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/30/2019	
L2393423-5 MW-05		**12/ 5/ 2019**	
	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/30/2019	

Subcontract Info Contact: John Forbes (403) 291-9897

Analysis and reporting info contact: Inayat Dhaliwal
2559 29 STREET NE
CALGARY,AB T1Y 7B5
Phone: (403) 291-9897 Email: inayat.dhaliwal@alsglobal.com

Please email confirmation of receipt to: **inayat.dhaliwal@alsglobal.com**

Shipped By: ______ Date Shipped: ______

Received By: ______ Date Received: 12/12/19 1000

Verified By: ______ Date Verified: ______

Temperature: ______

Sample Integrity Issues: ______

Monday, December 09, 2019 9:57 AM

ALS

PC ĒH

Cooler Receipt and Preservation Form

Client ALS CANADA Service Request *K19* 11630

Received: 12/12/19 Opened: 12/12/19 By: CG Unloaded: 12/12/19 By: CG

1. Samples were received via? *USPS* [✓ *Fed Ex*] *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) [✓ *Cooler*] *Box* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA Y [✓ N] If yes, how many and where? ______

   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID [✓ NA]	Tracking Number NA	Filed
0.1	0.4	—	—	+0.3	403		7772 0068 8607	

4. Packing material: *Inserts* *Baggies* [✓ *Bubble Wrap*] [✓ *Gel Packs*] *Wet Ice* *Dry Ice* *Sleeves* ______
5. Were custody papers properly filled out (ink, signed, etc.)? NA [✓ Y] N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA [✓ Y] N

   If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA [✓ Y] N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA [✓ Y] N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA [✓ Y] N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y [✓ N]
11. Were VOA vials received without headspace? *Indicate in the table below.* [✓ NA] Y N
12. Was C12/Res negative? [✓ NA] Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time
L2393423 - 1	1-250ml, A				X	HNO_3	0.5mL	REI-48-U	CG	1315
-2					X				CG	1315
-3					X				CG	1315
-5					X				CG	1315

Notes, Discrepancies, & Resolutions: L2393423-1, L2393423-2: pH didnot adjust to <2.

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

ALS Group USA, Corp.
dba ALS Environmental

Analyst Summary report

Client: ALS Environmental - Canada
Service Request: K1911630
Project: L2393423/

Sample Name: L2393423-1
Lab Code: K1911630-001
Sample Matrix: Water
Date Collected: 12/5/19
Date Received: 12/12/19

Analysis Method	**Extracted/Digested By**	**Analyzed By**
1650C		ESCHLOSS

Sample Name: L2393423-2
Lab Code: K1911630-002
Sample Matrix: Water
Date Collected: 12/5/19
Date Received: 12/12/19

Analysis Method	**Extracted/Digested By**	**Analyzed By**
1650C		ESCHLOSS

Sample Name: L2393423-3
Lab Code: K1911630-003
Sample Matrix: Water
Date Collected: 12/5/19
Date Received: 12/12/19

Analysis Method	**Extracted/Digested By**	**Analyzed By**
1650C		ESCHLOSS

Sample Name: L2393423-4
Lab Code: K1911630-004
Sample Matrix: Water
Date Collected: 12/5/19
Date Received: 12/12/19

Analysis Method	**Extracted/Digested By**	**Analyzed By**
1650C		ESCHLOSS

Sample Name: L2393423-5
Lab Code: K1911630-005
Sample Matrix: Water
Date Collected: 12/5/19
Date Received: 12/12/19

Analysis Method	**Extracted/Digested By**	**Analyzed By**
1650C		ESCHLOSS

Sample Results

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423	**Date Collected:**	12/05/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393423-1	**Basis:**	NA
Lab Code:	K1911630-001		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.025	2.5	12/18/19 10:50	

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423	**Date Collected:**	12/05/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393423-2	**Basis:**	NA
Lab Code:	K1911630-002		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.025	2.5	12/18/19 10:50	

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423	**Date Collected:**	12/05/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393423-3	**Basis:**	NA
Lab Code:	K1911630-003		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.025	2.5	12/18/19 10:50	

ALS Group USA, Corp.

dba ALS Environmental

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423	**Date Collected:**	12/05/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393423-4	**Basis:**	NA
Lab Code:	K1911630-004		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.025	2.5	12/18/19 10:50	

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423	**Date Collected:**	12/05/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393423-5	**Basis:**	NA
Lab Code:	K1911630-005		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.025	2.5	12/18/19 10:50	

QC Summary Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

General Chemistry

ALS Environmental—Kelso Laboratory
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Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	K1911630-MB		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.010	1	12/18/19 10:50	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911630
Project:	L2393423/	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	12/18/2019
		Analysis Lot:	663758

Calibration and Method Blank Summary
Halides, Adsorbable Organic (AOX)
1650C

	Halide Check Standard (ug)	**Instrument Calibration Standard** (ug)	**PAR Standard** (ug/L)
True Value	3.64	10.0	0.100
Run A	3.72	10.3	0.105
Percent Recovery A	102	103	105
Run B	3.66	9.96	
Percent Recovery B	101	100	

Client:	ALS Environmental - Canada		**Service Request:**	K1911630
Project:	L2393423		**Date Collected:**	N/A
Sample Matrix:	Water		**Date Received:**	N/A
			Date Analyzed:	12/18/19
			Date Extracted:	NA

Duplicate Matrix Spike Summary
Halides, Adsorbable Organic (AOX)

Sample Name:	Batch QC		**Units:**	mg/L
Lab Code:	K1911720-001		**Basis:**	NA
Analysis Method:	1650C			
Prep Method:	None			

		Matrix Spike K1911720-001MS			**Duplicate Matrix Spike** K1911720-001DMS					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Halides, Adsorbable Organic (AOX)	2.35	12.3	10.0	100	12.4	10.0	100	90-110	<1	20

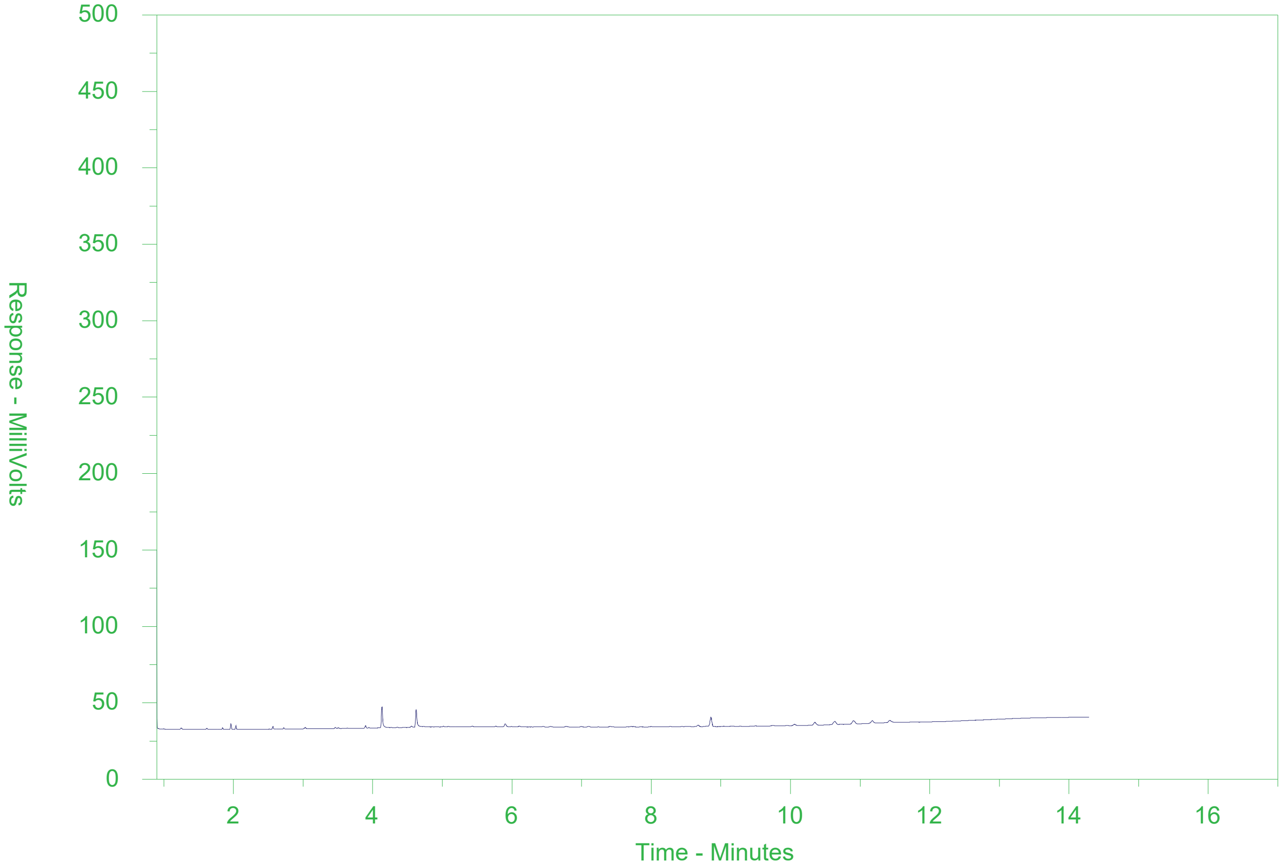
Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393423-1
Client Sample ID: MW-01



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

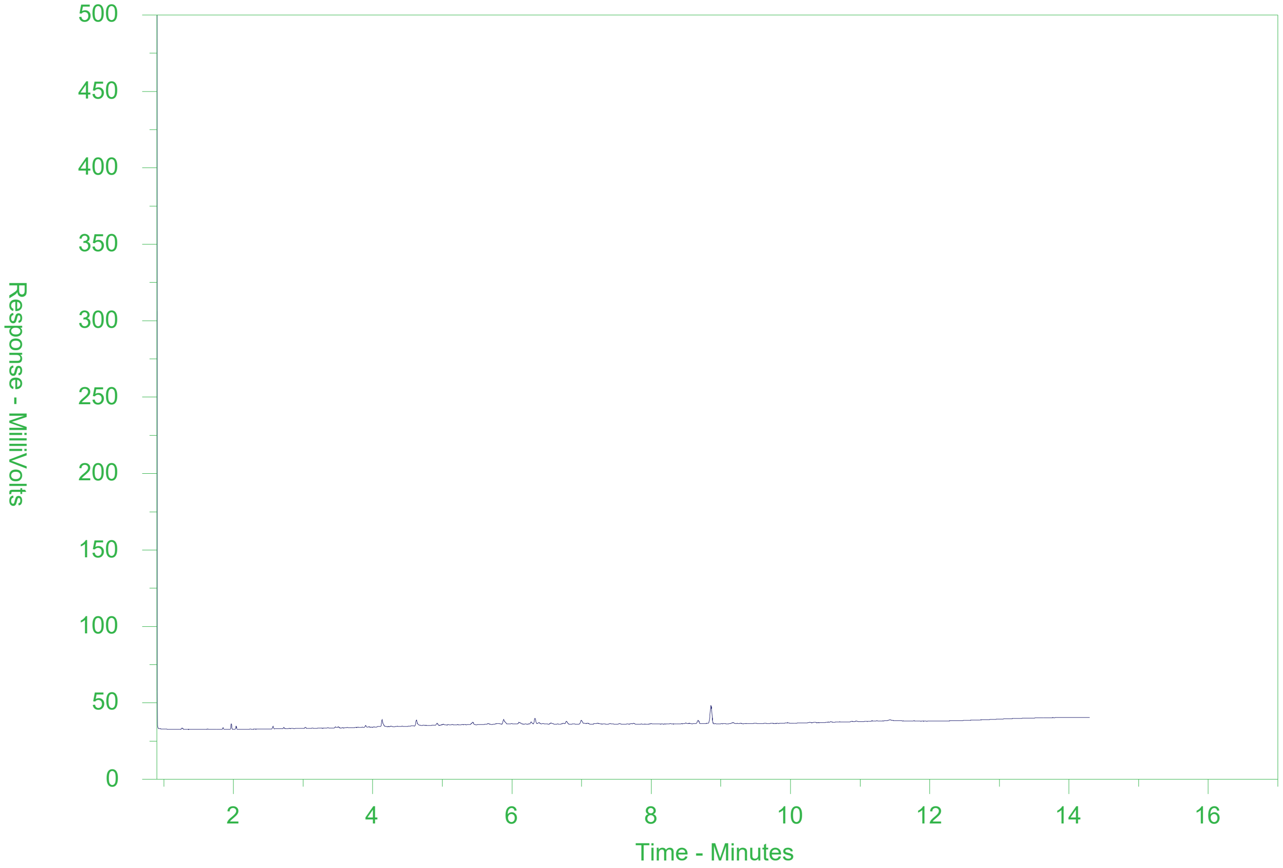
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

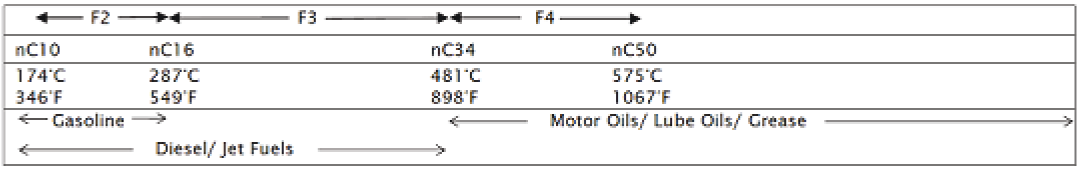
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393423-2
Client Sample ID: MW-02





The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

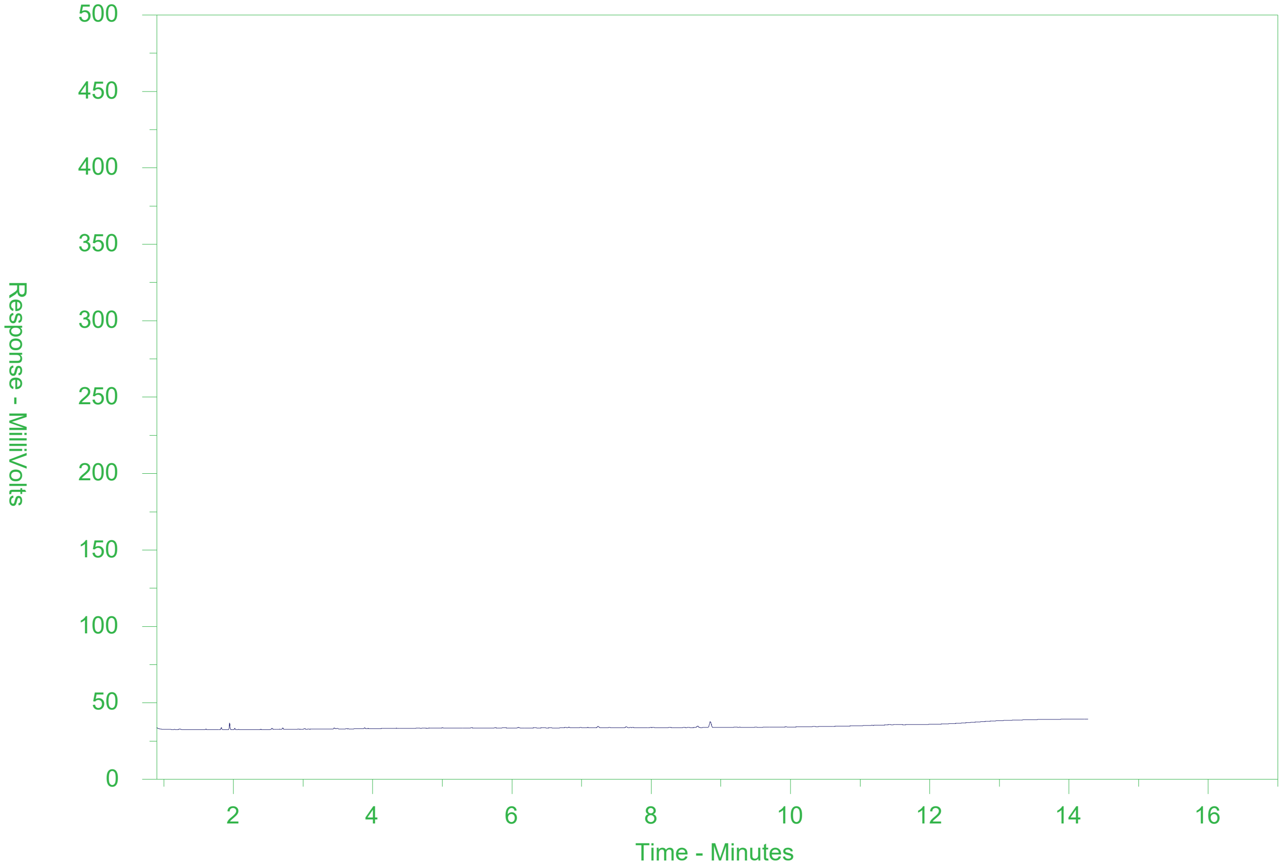
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393423-3R
Client Sample ID: MW-03



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

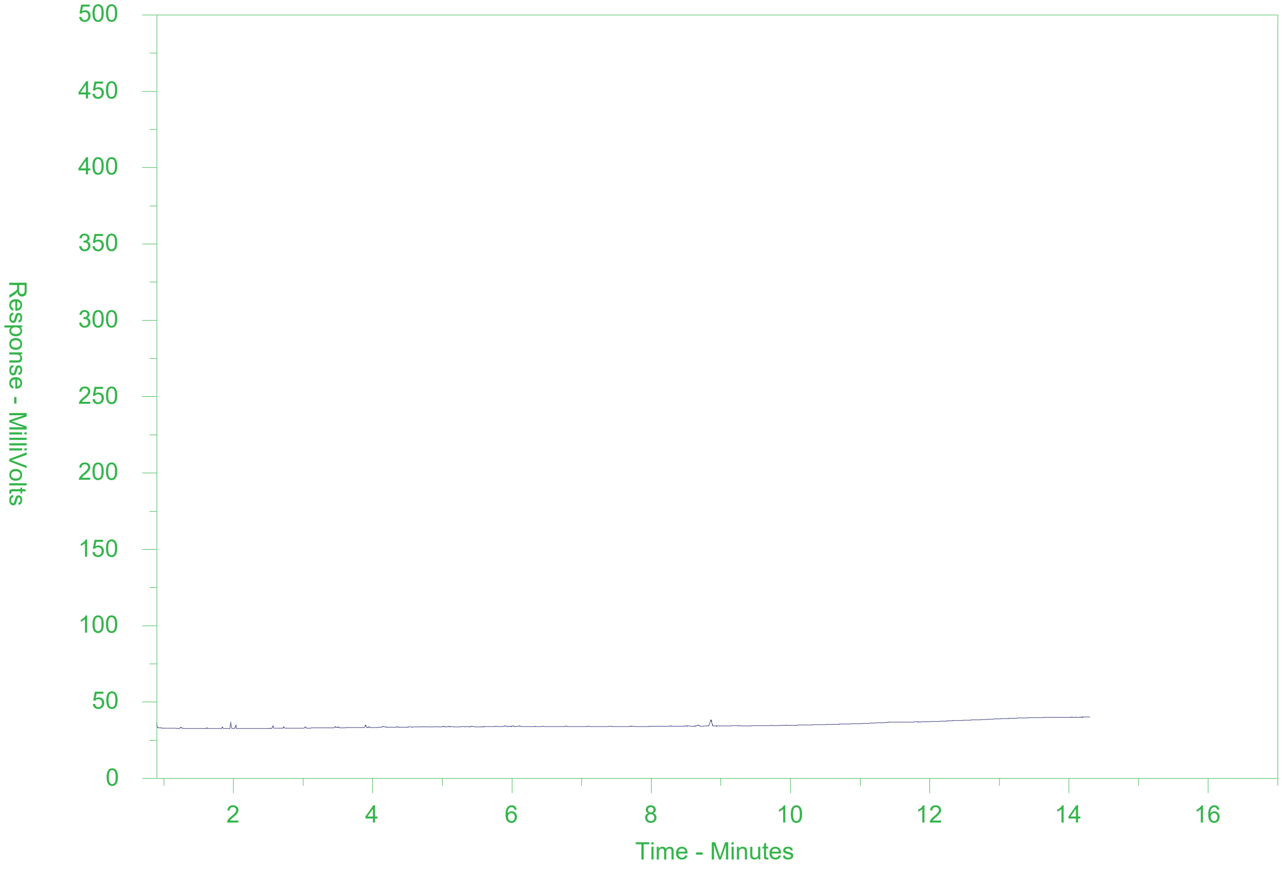
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393423-4
Client Sample ID: MW-04



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

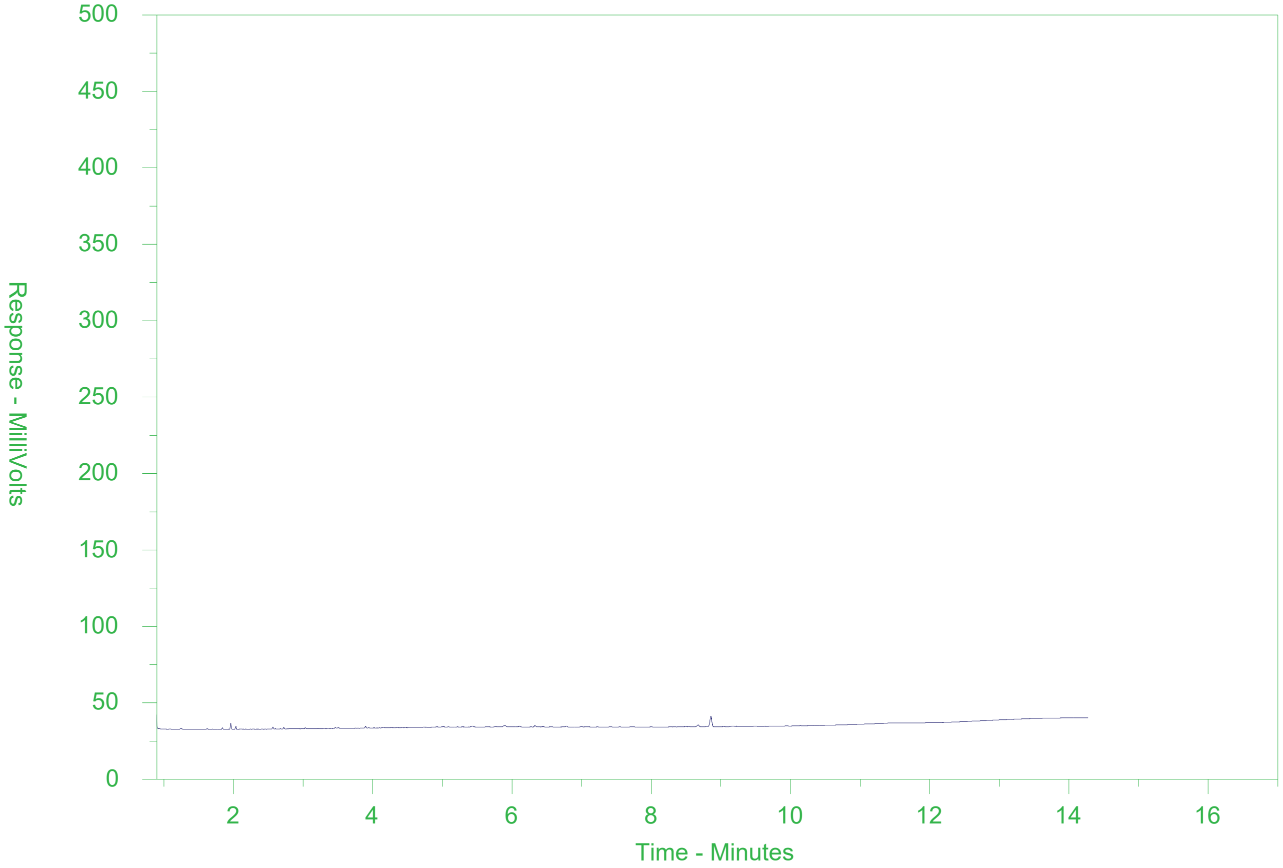
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID:	L2393423-5
Client Sample ID:	MW-05



← F2 →	← F3 →		← F4 →
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F

← Gasoline → ← Motor Oils/ Lube Oils/ Grease →

← Diesel/ Jet Fuels →

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

L2393423-COFC

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #ORD Great West Adventure

Page 1 of 1

Report to:	**Report Format / Distribution**	**Service Requested:**
Company: Tetra Tech Canada Inc.	☐ Standard ☐ Other	☑ Regular Service (Default)
Contact: Darby Madalena	☑ PDF ☑ Excel ☐ Fax	☐ Rush Service (2-3 Days)
Address: 110, 140 Quarry Park Blvd SE, Calgary, AB T2C 3G3	Email 1: darby.madalena@tetratech.com	☐ Priority Service (1 Day or ASAP)
	Email 2:	☐ Emergency Service (<1 Day / Wkend) - Contact ALS
Phone: 403-723-6867 Fax: 403-203-3301	ALS Digital Crosstab results	**Analysis Request**
Invoice To: ☑ Same as Report	Indicate Bottles: Filtered / Preserved (F/P) →	
Company: SAME AS REPORT	**Client / Project Information:**	
Contact:	Job #: SWOP04071-01.001	
Address:	PO/AFE: SWOP04071-01.001	
Sample	Legal Site Description:	
Phone: Fax:	Quote #: Q71650	
Lab Work Order # (lab use only) [redacted]	**ALS Contact:** Wendy Sears	**Sampler** (Initials): Ryan Miller

Sample #	**Sample Identification** (This description will appear on the report)	**Date** dd-mmm-yy	**Time** hh:mm	**Sample Type** (Select from drop-down list)	BTX,F1,F2-CL	VOC-8260-CL	TKN-F-CL	ROU-MET_D-ABT1-CL	C-DIS-ORG-CL	NH3-F-CL	P-T-COL-CL	AOX-MISA-KL	VFA-WP		Hazardous?	Highly Contaminated?	Number of Containers
[redacted]	MW-01	05-dec-19	1045	Water	X	X	X	X	X	X	X	X	X				12
[redacted]	MW-02	↓	1150	Water	X	X	X	X	X	X	X	X	X				12
[redacted]	MW-03		1030	Water	X	X	X	X	X	X	X	X	X				12
[redacted]	MW-04		1220	Water	X	X	X	X	X	X	X	X	X				12
[redacted]	MW-05		1235	Water	X	X	X	X	X	X	X	X	X				12
[redacted]																	
[redacted]																	
[redacted]																	
[redacted]																	
[redacted]																	

Guidelines / Regulations	**Special Instructions / Hazardous Details**
	Metals + Hg + DOC F/P

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 adjacent worksheet.

Relinquished By:		Date & Time:	Dec 6/19	Received By:		Date & Time:	[illegible]
Relinquished By:		Date & Time:	1600	Received By:		Date & Time:	

Sample Condition (lab use only)	
Temperature	Samples Received In Good Condition? Y / N (if no provided details)
3	

TETRA TECH CANADA INC.
ATTN: Darby Madalena
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3

Date Received: 06-DEC-19
Report Date: 24-DEC-19 15:24 (MT)
Version: FINAL

Client Phone: 403-203-3355

Certificate of Analysis

Lab Work Order #: L2393610

Project P.O. #: SWM.SWOP04071-01.001
Job Reference: SWM.SWOP04071-01.001 (GREAT WEST ADVENTURE PARK)
C of C Numbers:
Legal Site Desc:

Dhaliwal

Inayat Dhaliwal
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-1 VW-01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 13:42							
Matrix: SG							
Total F1 and F2+ Sub Fractionation							
Aliphatic/Aromatic PHC Sub-Fractionation							
Aliphatic C6-C8	22		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>8-C10	33		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>10-C12	27		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>12-C16	<30		30	ug/m3		24-DEC-19	R4953507
Aromatic C>8-C10	<15		15	ug/m3		24-DEC-19	R4953507
Aromatic C>10-C12	<15		15	ug/m3		24-DEC-19	R4953507
Aromatic C>12-C16	<30		30	ug/m3		24-DEC-19	R4953507
Total F1and F2 fractions (not corrected)							
F1 (C6-C10)	53		15	ug/m3		24-DEC-19	R4953507
F2 (C10-C16)	61		15	ug/m3		24-DEC-19	R4953507
Surrogate: 4-Bromofluorobenzene	99.8		50-150	%		24-DEC-19	R4953507
High Level Fixed Gases by TCD							
Nitrogen	72.6		1.0	%		13-DEC-19	R4944389
Oxygen	19.5		0.10	%		13-DEC-19	R4944389
Carbon Dioxide	1.40		0.050	%		13-DEC-19	R4944389
Carbon Monoxide	<0.050		0.050	%		13-DEC-19	R4944389
Methane	<0.050		0.050	%		13-DEC-19	R4944389
BTEX and Naphthalene							
Naphthalene	<2.6		2.6	ug/m3		24-DEC-19	R4953168
Naphthalene	<0.50		0.50	ppb(V)		24-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	94.2		50-150	%		24-DEC-19	R4953168
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		24-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1-Dichloroethane	<0.81		0.81	ug/m3		24-DEC-19	R4953168
1,1-Dichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
1,1-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2,4-Trichlorobenzene	<1.5		1.5	ug/m3		24-DEC-19	R4953168
1,2,4-Trichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dibromoethane	<1.5		1.5	ug/m3		24-DEC-19	R4953168
1,2-Dibromoethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,2-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichloroethane	<0.81		0.81	ug/m3		24-DEC-19	R4953168
1,2-Dichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichloropropane	<0.92		0.92	ug/m3		24-DEC-19	R4953168
1,2-Dichloropropane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3-Butadiene	<0.44		0.44	ug/m3		24-DEC-19	R4953168
1,3-Butadiene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,3-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-1 VW-01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 13:42							
Matrix: SG							
Canister EPA TO-15							
1,4-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,4-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,4-Dioxane	<0.72		0.72	ug/m3		24-DEC-19	R4953168
1,4-Dioxane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
2-Hexanone	<4.1		4.1	ug/m3		24-DEC-19	R4953168
2-Hexanone	<1.0		1.0	ppb(V)		24-DEC-19	R4953168
4-Ethyltoluene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
4-Ethyltoluene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Acetone	2.3	AI	1.2	ug/m3		24-DEC-19	R4953168
Acetone	0.99	AI	0.50	ppb(V)		24-DEC-19	R4953168
Allyl chloride	<0.63		0.63	ug/m3		24-DEC-19	R4953168
Allyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Benzene	<0.64		0.64	ug/m3		24-DEC-19	R4953168
Benzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Benzyl chloride	<1.0		1.0	ug/m3		24-DEC-19	R4953168
Benzyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromodichloromethane	<1.3		1.3	ug/m3		24-DEC-19	R4953168
Bromodichloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromoform	<2.1		2.1	ug/m3		24-DEC-19	R4953168
Bromoform	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromomethane	<0.78		0.78	ug/m3		24-DEC-19	R4953168
Bromomethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Carbon Disulfide	<0.62		0.62	ug/m3		24-DEC-19	R4953168
Carbon Disulfide	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Carbon Tetrachloride	<1.3		1.3	ug/m3		24-DEC-19	R4953168
Carbon Tetrachloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chlorobenzene	<0.92		0.92	ug/m3		24-DEC-19	R4953168
Chlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloroethane	<0.53		0.53	ug/m3		24-DEC-19	R4953168
Chloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloroform	1.70		0.98	ug/m3		24-DEC-19	R4953168
Chloroform	0.35		0.20	ppb(V)		24-DEC-19	R4953168
Chloromethane	<0.41		0.41	ug/m3		24-DEC-19	R4953168
Chloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		24-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Cyclohexane	<0.69		0.69	ug/m3		24-DEC-19	R4953168
Cyclohexane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Dibromochloromethane	<1.7		1.7	ug/m3		24-DEC-19	R4953168
Dibromochloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Dichlorodifluoromethane	1.86		0.99	ug/m3		24-DEC-19	R4953168
Dichlorodifluoromethane	0.38		0.20	ppb(V)		24-DEC-19	R4953168
Ethyl acetate	<0.72		0.72	ug/m3		24-DEC-19	R4953168
Ethyl acetate	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Ethylbenzene	<0.87		0.87	ug/m3		24-DEC-19	R4953168
Ethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Freon 113	<1.5		1.5	ug/m3		24-DEC-19	R4953168
Freon 113	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Freon 114	<1.4		1.4	ug/m3		24-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-1 VW-01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 13:42							
Matrix: SG							
Canister EPA TO-15							
Freon 114	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Hexachlorobutadiene	<2.1		2.1	ug/m3		24-DEC-19	R4953168
Hexachlorobutadiene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Isooctane	<0.93		0.93	ug/m3		24-DEC-19	R4953168
Isooctane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Isopropyl alcohol	<2.5		2.5	ug/m3		24-DEC-19	R4953168
Isopropyl alcohol	<1.0		1.0	ppb(V)		24-DEC-19	R4953168
Isopropylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
Isopropylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
m&p-Xylene	<1.7		1.7	ug/m3		24-DEC-19	R4953168
m&p-Xylene	<0.40		0.40	ppb(V)		24-DEC-19	R4953168
Methyl ethyl ketone	<0.59		0.59	ug/m3		24-DEC-19	R4953168
Methyl ethyl ketone	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Methyl isobutyl ketone	<0.82		0.82	ug/m3		24-DEC-19	R4953168
Methyl isobutyl ketone	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Methylene chloride	<0.69		0.69	ug/m3		24-DEC-19	R4953168
Methylene chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
MTBE	<0.72		0.72	ug/m3		24-DEC-19	R4953168
MTBE	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
n-Heptane	1.41		0.82	ug/m3		24-DEC-19	R4953168
n-Heptane	0.34		0.20	ppb(V)		24-DEC-19	R4953168
n-Hexane	2.75		0.70	ug/m3		24-DEC-19	R4953168
n-Hexane	0.78		0.20	ppb(V)		24-DEC-19	R4953168
o-Xylene	<0.87		0.87	ug/m3		24-DEC-19	R4953168
o-Xylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Propylene	<0.34		0.34	ug/m3		24-DEC-19	R4953168
Propylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Styrene	<0.85		0.85	ug/m3		24-DEC-19	R4953168
Styrene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Tetrachloroethylene	<1.4		1.4	ug/m3		24-DEC-19	R4953168
Tetrachloroethylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Tetrahydrofuran	<0.59		0.59	ug/m3		24-DEC-19	R4953168
Tetrahydrofuran	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Toluene	<0.75		0.75	ug/m3		24-DEC-19	R4953168
Toluene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		24-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Trichloroethylene	<1.1		1.1	ug/m3		24-DEC-19	R4953168
Trichloroethylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Trichlorofluoromethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
Trichlorofluoromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Vinyl acetate	<1.8		1.8	ug/m3		24-DEC-19	R4953168
Vinyl acetate	<0.50		0.50	ppb(V)		24-DEC-19	R4953168
Vinyl bromide	<0.87		0.87	ug/m3		24-DEC-19	R4953168
Vinyl bromide	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Vinyl chloride	<0.51		0.51	ug/m3		24-DEC-19	R4953168
Vinyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	94.2		50-150	%		24-DEC-19	R4953168
Sum of Xylene Isomer Concentrations							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-1 VW-01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 13:42							
Matrix: SG							
Sum of Xylene Isomer Concentrations							
Xylenes (Total)	<0.45		0.45	ppb(V)		24-DEC-19	
Xylenes (Total)	<2.0		2.0	ug/m3		24-DEC-19	
Select list of 7 C1-C5 hydrocarbon gases							
Methane	0.00135		0.00010	%		10-DEC-19	R4944650
Ethane	<0.00020		0.00020	%		10-DEC-19	R4944650
Ethene	<0.00020		0.00020	%		10-DEC-19	R4944650
Propane	<0.00020		0.00020	%		10-DEC-19	R4944650
Propene	<0.00020		0.00020	%		10-DEC-19	R4944650
Butane	<0.00020		0.00020	%		10-DEC-19	R4944650
Pentane	<0.00020		0.00020	%		10-DEC-19	R4944650
Canister Information							
Pressure on Receipt	-4.9		-30	in Hg	17-DEC-19	17-DEC-19	R4944737
Canister ID	01400-0323				17-DEC-19	17-DEC-19	R4944737
Regulator ID	G39				17-DEC-19	17-DEC-19	R4944737
Batch Proof ID	191119.102				17-DEC-19	17-DEC-19	R4944737

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-2 VW-02							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 14:19							
Matrix: SG							
Total F1 and F2+ Sub Fractionation							
Aliphatic/Aromatic PHC Sub-Fractionation							
Aliphatic C6-C8	43		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>8-C10	253		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>10-C12	292		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>12-C16	<30		30	ug/m3		24-DEC-19	R4953507
Aromatic C>8-C10	<15		15	ug/m3		24-DEC-19	R4953507
Aromatic C>10-C12	<15		15	ug/m3		24-DEC-19	R4953507
Aromatic C>12-C16	<30		30	ug/m3		24-DEC-19	R4953507
Total F1and F2 fractions (not corrected)							
F1 (C6-C10)	300		15	ug/m3		24-DEC-19	R4953507
F2 (C10-C16)	421		15	ug/m3		24-DEC-19	R4953507
Surrogate: 4-Bromofluorobenzene	98.4		50-150	%		24-DEC-19	R4953507
High Level Fixed Gases by TCD							
Nitrogen	74.1		1.0	%		13-DEC-19	R4944389
Oxygen	20.5		0.10	%		13-DEC-19	R4944389
Carbon Dioxide	0.064		0.050	%		13-DEC-19	R4944389
Carbon Monoxide	<0.050		0.050	%		13-DEC-19	R4944389
Methane	<0.050		0.050	%		13-DEC-19	R4944389
BTEX and Naphthalene							
Naphthalene	<2.6		2.6	ug/m3		24-DEC-19	R4953168
Naphthalene	<0.50		0.50	ppb(V)		24-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	99.5		50-150	%		24-DEC-19	R4953168
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		24-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1-Dichloroethane	<0.81		0.81	ug/m3		24-DEC-19	R4953168
1,1-Dichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
1,1-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2,4-Trichlorobenzene	<1.5		1.5	ug/m3		24-DEC-19	R4953168
1,2,4-Trichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dibromoethane	<1.5		1.5	ug/m3		24-DEC-19	R4953168
1,2-Dibromoethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,2-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichloroethane	<0.81		0.81	ug/m3		24-DEC-19	R4953168
1,2-Dichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichloropropane	<0.92		0.92	ug/m3		24-DEC-19	R4953168
1,2-Dichloropropane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3-Butadiene	<0.44		0.44	ug/m3		24-DEC-19	R4953168
1,3-Butadiene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,3-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-2 VW-02							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 14:19							
Matrix: SG							
Canister EPA TO-15							
1,4-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,4-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,4-Dioxane	<0.72		0.72	ug/m3		24-DEC-19	R4953168
1,4-Dioxane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
2-Hexanone	<4.1		4.1	ug/m3		24-DEC-19	R4953168
2-Hexanone	<1.0		1.0	ppb(V)		24-DEC-19	R4953168
4-Ethyltoluene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
4-Ethyltoluene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Acetone	18.5	DLA	5.9	ug/m3		24-DEC-19	R4953168
Acetone	7.8	DLA	2.5	ppb(V)		24-DEC-19	R4953168
Allyl chloride	<0.63		0.63	ug/m3		24-DEC-19	R4953168
Allyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Benzene	9.47		0.64	ug/m3		24-DEC-19	R4953168
Benzene	2.96		0.20	ppb(V)		24-DEC-19	R4953168
Benzyl chloride	<1.0		1.0	ug/m3		24-DEC-19	R4953168
Benzyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromodichloromethane	<1.3		1.3	ug/m3		24-DEC-19	R4953168
Bromodichloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromoform	<2.1		2.1	ug/m3		24-DEC-19	R4953168
Bromoform	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromomethane	<0.78		0.78	ug/m3		24-DEC-19	R4953168
Bromomethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Carbon Disulfide	<0.62		0.62	ug/m3		24-DEC-19	R4953168
Carbon Disulfide	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Carbon Tetrachloride	<1.3		1.3	ug/m3		24-DEC-19	R4953168
Carbon Tetrachloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chlorobenzene	<0.92		0.92	ug/m3		24-DEC-19	R4953168
Chlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloroethane	<0.53		0.53	ug/m3		24-DEC-19	R4953168
Chloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloroform	<0.98		0.98	ug/m3		24-DEC-19	R4953168
Chloroform	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloromethane	1.78		0.41	ug/m3		24-DEC-19	R4953168
Chloromethane	0.86		0.20	ppb(V)		24-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		24-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Cyclohexane	<0.69		0.69	ug/m3		24-DEC-19	R4953168
Cyclohexane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Dibromochloromethane	<1.7		1.7	ug/m3		24-DEC-19	R4953168
Dibromochloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Dichlorodifluoromethane	1.86		0.99	ug/m3		24-DEC-19	R4953168
Dichlorodifluoromethane	0.38		0.20	ppb(V)		24-DEC-19	R4953168
Ethyl acetate	<0.72		0.72	ug/m3		24-DEC-19	R4953168
Ethyl acetate	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Ethylbenzene	<0.87		0.87	ug/m3		24-DEC-19	R4953168
Ethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Freon 113	<1.5		1.5	ug/m3		24-DEC-19	R4953168
Freon 113	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Freon 114	<1.4		1.4	ug/m3		24-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-2 VW-02							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 14:19							
Matrix: SG							
Canister EPA TO-15							
Freon 114	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Hexachlorobutadiene	<2.1		2.1	ug/m3		24-DEC-19	R4953168
Hexachlorobutadiene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Isooctane	<0.93		0.93	ug/m3		24-DEC-19	R4953168
Isooctane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Isopropyl alcohol	<2.5		2.5	ug/m3		24-DEC-19	R4953168
Isopropyl alcohol	<1.0		1.0	ppb(V)		24-DEC-19	R4953168
Isopropylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
Isopropylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
m&p-Xylene	3.0		1.7	ug/m3		24-DEC-19	R4953168
m&p-Xylene	0.69		0.40	ppb(V)		24-DEC-19	R4953168
Methyl ethyl ketone	1.43		0.59	ug/m3		24-DEC-19	R4953168
Methyl ethyl ketone	0.48		0.20	ppb(V)		24-DEC-19	R4953168
Methyl isobutyl ketone	<0.82		0.82	ug/m3		24-DEC-19	R4953168
Methyl isobutyl ketone	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Methylene chloride	<0.69		0.69	ug/m3		24-DEC-19	R4953168
Methylene chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
MTBE	<0.72		0.72	ug/m3		24-DEC-19	R4953168
MTBE	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
n-Heptane	<0.82		0.82	ug/m3		24-DEC-19	R4953168
n-Heptane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
n-Hexane	0.98		0.70	ug/m3		24-DEC-19	R4953168
n-Hexane	0.28		0.20	ppb(V)		24-DEC-19	R4953168
o-Xylene	1.05		0.87	ug/m3		24-DEC-19	R4953168
o-Xylene	0.24		0.20	ppb(V)		24-DEC-19	R4953168
Propylene	<0.34		0.34	ug/m3		24-DEC-19	R4953168
Propylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Styrene	<0.85		0.85	ug/m3		24-DEC-19	R4953168
Styrene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Tetrachloroethylene	<1.4		1.4	ug/m3		24-DEC-19	R4953168
Tetrachloroethylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Tetrahydrofuran	1.53		0.59	ug/m3		24-DEC-19	R4953168
Tetrahydrofuran	0.52		0.20	ppb(V)		24-DEC-19	R4953168
Toluene	2.04		0.75	ug/m3		24-DEC-19	R4953168
Toluene	0.54		0.20	ppb(V)		24-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		24-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Trichloroethylene	<1.1		1.1	ug/m3		24-DEC-19	R4953168
Trichloroethylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Trichlorofluoromethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
Trichlorofluoromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Vinyl acetate	<1.8		1.8	ug/m3		24-DEC-19	R4953168
Vinyl acetate	<0.50		0.50	ppb(V)		24-DEC-19	R4953168
Vinyl bromide	<0.87		0.87	ug/m3		24-DEC-19	R4953168
Vinyl bromide	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Vinyl chloride	<0.51		0.51	ug/m3		24-DEC-19	R4953168
Vinyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	99.5		50-150	%		24-DEC-19	R4953168
Sum of Xylene Isomer Concentrations							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-2 VW-02							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 14:19							
Matrix: SG							
Sum of Xylene Isomer Concentrations							
Xylenes (Total)	0.93		0.45	ppb(V)		24-DEC-19	
Xylenes (Total)	4.0		2.0	ug/m3		24-DEC-19	
Select list of 7 C1-C5 hydrocarbon gases							
Methane	0.00040		0.00010	%		10-DEC-19	R4944650
Ethane	<0.00020		0.00020	%		10-DEC-19	R4944650
Ethene	<0.00020		0.00020	%		10-DEC-19	R4944650
Propane	<0.00020		0.00020	%		10-DEC-19	R4944650
Propene	<0.00020		0.00020	%		10-DEC-19	R4944650
Butane	<0.00020		0.00020	%		10-DEC-19	R4944650
Pentane	<0.00020		0.00020	%		10-DEC-19	R4944650
Canister Information							
Pressure on Receipt	-8.2		-30	in Hg	17-DEC-19	17-DEC-19	R4944737
Canister ID	01400-0108				17-DEC-19	17-DEC-19	R4944737
Regulator ID	G280				17-DEC-19	17-DEC-19	R4944737
Batch Proof ID	191119.106				17-DEC-19	17-DEC-19	R4944737

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-3 19DUP01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 12:00							
Matrix: SG							
Total F1 and F2+ Sub Fractionation							
Aliphatic/Aromatic PHC Sub-Fractionation							
Aliphatic C6-C8	17		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>8-C10	24		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>10-C12	25		15	ug/m3		24-DEC-19	R4953507
Aliphatic C>12-C16	<30		30	ug/m3		24-DEC-19	R4953507
Aromatic C>8-C10	<15		15	ug/m3		24-DEC-19	R4953507
Aromatic C>10-C12	<15		15	ug/m3		24-DEC-19	R4953507
Aromatic C>12-C16	<30		30	ug/m3		24-DEC-19	R4953507
Total F1and F2 fractions (not corrected)							
F1 (C6-C10)	33		15	ug/m3		24-DEC-19	R4953507
F2 (C10-C16)	63		15	ug/m3		24-DEC-19	R4953507
Surrogate: 4-Bromofluorobenzene	96.1		50-150	%		24-DEC-19	R4953507
High Level Fixed Gases by TCD							
Nitrogen	75.8		1.0	%		13-DEC-19	R4944389
Oxygen	20.0		0.10	%		13-DEC-19	R4944389
Carbon Dioxide	1.43		0.050	%		13-DEC-19	R4944389
Carbon Monoxide	<0.050		0.050	%		13-DEC-19	R4944389
Methane	<0.050		0.050	%		13-DEC-19	R4944389
BTEX and Naphthalene							
Naphthalene	<2.6		2.6	ug/m3		24-DEC-19	R4953168
Naphthalene	<0.50		0.50	ppb(V)		24-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	96.6		50-150	%		24-DEC-19	R4953168
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		24-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1-Dichloroethane	<0.81		0.81	ug/m3		24-DEC-19	R4953168
1,1-Dichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,1-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
1,1-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2,4-Trichlorobenzene	<1.5		1.5	ug/m3		24-DEC-19	R4953168
1,2,4-Trichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dibromoethane	<1.5		1.5	ug/m3		24-DEC-19	R4953168
1,2-Dibromoethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,2-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichloroethane	<0.81		0.81	ug/m3		24-DEC-19	R4953168
1,2-Dichloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,2-Dichloropropane	<0.92		0.92	ug/m3		24-DEC-19	R4953168
1,2-Dichloropropane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3-Butadiene	<0.44		0.44	ug/m3		24-DEC-19	R4953168
1,3-Butadiene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,3-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,3-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-3 19DUP01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 12:00							
Matrix: SG							
Canister EPA TO-15							
1,4-Dichlorobenzene	<1.2		1.2	ug/m3		24-DEC-19	R4953168
1,4-Dichlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
1,4-Dioxane	<0.72		0.72	ug/m3		24-DEC-19	R4953168
1,4-Dioxane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
2-Hexanone	<4.1		4.1	ug/m3		24-DEC-19	R4953168
2-Hexanone	<1.0		1.0	ppb(V)		24-DEC-19	R4953168
4-Ethyltoluene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
4-Ethyltoluene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Acetone	2.7	AI	1.2	ug/m3		24-DEC-19	R4953168
Acetone	1.13	AI	0.50	ppb(V)		24-DEC-19	R4953168
Allyl chloride	<0.63		0.63	ug/m3		24-DEC-19	R4953168
Allyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Benzene	<0.64		0.64	ug/m3		24-DEC-19	R4953168
Benzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Benzyl chloride	<1.0		1.0	ug/m3		24-DEC-19	R4953168
Benzyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromodichloromethane	<1.3		1.3	ug/m3		24-DEC-19	R4953168
Bromodichloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromoform	<2.1		2.1	ug/m3		24-DEC-19	R4953168
Bromoform	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Bromomethane	<0.78		0.78	ug/m3		24-DEC-19	R4953168
Bromomethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Carbon Disulfide	<1.81	RRR	1.8	ug/m3		24-DEC-19	R4953168
Carbon Disulfide	<0.60	RRR	0.60	ppb(V)		24-DEC-19	R4953168
Carbon Tetrachloride	<1.3		1.3	ug/m3		24-DEC-19	R4953168
Carbon Tetrachloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chlorobenzene	<0.92		0.92	ug/m3		24-DEC-19	R4953168
Chlorobenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloroethane	<0.53		0.53	ug/m3		24-DEC-19	R4953168
Chloroethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Chloroform	1.52		0.98	ug/m3		24-DEC-19	R4953168
Chloroform	0.31		0.20	ppb(V)		24-DEC-19	R4953168
Chloromethane	<0.41		0.41	ug/m3		24-DEC-19	R4953168
Chloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		24-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Cyclohexane	<0.69		0.69	ug/m3		24-DEC-19	R4953168
Cyclohexane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Dibromochloromethane	<1.7		1.7	ug/m3		24-DEC-19	R4953168
Dibromochloromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Dichlorodifluoromethane	1.88		0.99	ug/m3		24-DEC-19	R4953168
Dichlorodifluoromethane	0.38		0.20	ppb(V)		24-DEC-19	R4953168
Ethyl acetate	<0.72		0.72	ug/m3		24-DEC-19	R4953168
Ethyl acetate	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Ethylbenzene	<0.87		0.87	ug/m3		24-DEC-19	R4953168
Ethylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Freon 113	<1.5		1.5	ug/m3		24-DEC-19	R4953168
Freon 113	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Freon 114	<1.4		1.4	ug/m3		24-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-3 19DUP01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 12:00							
Matrix: SG							
Canister EPA TO-15							
Freon 114	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Hexachlorobutadiene	<2.1		2.1	ug/m3		24-DEC-19	R4953168
Hexachlorobutadiene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Isooctane	<0.93		0.93	ug/m3		24-DEC-19	R4953168
Isooctane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Isopropyl alcohol	<2.5		2.5	ug/m3		24-DEC-19	R4953168
Isopropyl alcohol	<1.0		1.0	ppb(V)		24-DEC-19	R4953168
Isopropylbenzene	<0.98		0.98	ug/m3		24-DEC-19	R4953168
Isopropylbenzene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
m&p-Xylene	<1.7		1.7	ug/m3		24-DEC-19	R4953168
m&p-Xylene	<0.40		0.40	ppb(V)		24-DEC-19	R4953168
Methyl ethyl ketone	<0.59		0.59	ug/m3		24-DEC-19	R4953168
Methyl ethyl ketone	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Methyl isobutyl ketone	<0.82		0.82	ug/m3		24-DEC-19	R4953168
Methyl isobutyl ketone	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Methylene chloride	<0.69		0.69	ug/m3		24-DEC-19	R4953168
Methylene chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
MTBE	<0.72		0.72	ug/m3		24-DEC-19	R4953168
MTBE	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
n-Heptane	1.25		0.82	ug/m3		24-DEC-19	R4953168
n-Heptane	0.30		0.20	ppb(V)		24-DEC-19	R4953168
n-Hexane	2.50		0.70	ug/m3		24-DEC-19	R4953168
n-Hexane	0.71		0.20	ppb(V)		24-DEC-19	R4953168
o-Xylene	<0.87		0.87	ug/m3		24-DEC-19	R4953168
o-Xylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Propylene	<0.34		0.34	ug/m3		24-DEC-19	R4953168
Propylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Styrene	<0.85		0.85	ug/m3		24-DEC-19	R4953168
Styrene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Tetrachloroethylene	<1.4		1.4	ug/m3		24-DEC-19	R4953168
Tetrachloroethylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Tetrahydrofuran	<0.59		0.59	ug/m3		24-DEC-19	R4953168
Tetrahydrofuran	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Toluene	<0.75		0.75	ug/m3		24-DEC-19	R4953168
Toluene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		24-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		24-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Trichloroethylene	<1.1		1.1	ug/m3		24-DEC-19	R4953168
Trichloroethylene	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Trichlorofluoromethane	<1.1		1.1	ug/m3		24-DEC-19	R4953168
Trichlorofluoromethane	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Vinyl acetate	<1.8		1.8	ug/m3		24-DEC-19	R4953168
Vinyl acetate	<0.50		0.50	ppb(V)		24-DEC-19	R4953168
Vinyl bromide	<0.87		0.87	ug/m3		24-DEC-19	R4953168
Vinyl bromide	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Vinyl chloride	<0.51		0.51	ug/m3		24-DEC-19	R4953168
Vinyl chloride	<0.20		0.20	ppb(V)		24-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	96.6		50-150	%		24-DEC-19	R4953168
Note: RRR: LOR raised due to background in canister proof.							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-3 19DUP01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 12:00							
Matrix: SG							
Sum of Xylene Isomer Concentrations							
Xylenes (Total)	<0.45		0.45	ppb(V)		24-DEC-19	
Xylenes (Total)	<2.0		2.0	ug/m3		24-DEC-19	
Select list of 7 C1-C5 hydrocarbon gases							
Methane	<0.00010		0.00010	%		10-DEC-19	R4944650
Ethane	<0.00020		0.00020	%		10-DEC-19	R4944650
Ethene	<0.00020		0.00020	%		10-DEC-19	R4944650
Propane	<0.00020		0.00020	%		10-DEC-19	R4944650
Propene	<0.00020		0.00020	%		10-DEC-19	R4944650
Butane	<0.00020		0.00020	%		10-DEC-19	R4944650
Pentane	<0.00020		0.00020	%		10-DEC-19	R4944650
Canister Information							
Pressure on Receipt	-4.9		-30	in Hg	17-DEC-19	17-DEC-19	R4944737
Canister ID	01400-0135				17-DEC-19	17-DEC-19	R4944737
Regulator ID	G39				17-DEC-19	17-DEC-19	R4944737
Batch Proof ID	191119.120				17-DEC-19	17-DEC-19	R4944737

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-4 VW-01							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 16:50							
Matrix: SG							
Miscellaneous Parameters							
Air volume	.06			L		19-DEC-19	R4939247
Linear & Cyclic Methyl Siloxanes							
D3(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D3(CVMS)	<10		10	ng		18-DEC-19	R4945277
D4(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D4(CVMS)	<10		10	ng		18-DEC-19	R4945277
D5(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D5(CVMS)	<10		10	ng		18-DEC-19	R4945277
D6(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D6(CVMS)	<10		10	ng		18-DEC-19	R4945277
MM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MDM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MDM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD2M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD2M(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD3M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD3M(LVMS)	<10		10	ng		18-DEC-19	R4945277
Surrogate: 4-Bromofluorobenzene	98.2		50-150	%		18-DEC-19	R4945277
Tube Information							
Tube ID	G0150323SVI					13-DEC-19	R4942791
Batch Proof ID	19-Nov-19					13-DEC-19	R4942791
Tube Usage Number	N/A					13-DEC-19	R4942791
Tube Manufacturer Date	N/A					13-DEC-19	R4942791

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393610-5 VW-02							
Sampled By: MEGAN ROUSE on 04-DEC-19 @ 15:20							
Matrix: SG							
Miscellaneous Parameters							
Air volume	.06			L		19-DEC-19	R4939247
Linear & Cyclic Methyl Siloxanes							
D3(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D3(CVMS)	<10		10	ng		18-DEC-19	R4945277
D4(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D4(CVMS)	<10		10	ng		18-DEC-19	R4945277
D5(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D5(CVMS)	<10		10	ng		18-DEC-19	R4945277
D6(CVMS)	330		170	ug/m3		18-DEC-19	R4945277
D6(CVMS)	20		10	ng		18-DEC-19	R4945277
MM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MDM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MDM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD2M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD2M(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD3M(LVMS)	370		170	ug/m3		18-DEC-19	R4945277
MD3M(LVMS)	22		10	ng		18-DEC-19	R4945277
Surrogate: 4-Bromofluorobenzene	100.5		50-150	%		18-DEC-19	R4945277
Tube Information							
Tube ID	G0150384SVI					13-DEC-19	R4942791
Batch Proof ID	19-Nov-19					13-DEC-19	R4942791
Tube Usage Number	N/A					13-DEC-19	R4942791
Tube Manufacturer Date	N/A					13-DEC-19	R4942791

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
AI	Analytical interferences may be present. Result may be biased high.
DLA	Detection Limit adjusted for required dilution
RRR	Refer to Report Remarks for issues regarding this analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-WT	Misc.	Air volume (L)	DATA ENTRY
ALIPH/AROM-GCMS-WT	Canister	Aliphatic/Aromatic PHC Sub-Fractionation	EPA TO-15, Atlantic RBCA

This analysis is performed using procedures adapted from EPA TO-15 & Atlantic RBCA. A volume of air is removed from a canister & injected into a GCMS with preconcentrator for analysis. The concentrations of the hydrocarbon aliphatic & aromatic sub-fractions are calculated using gas standards. The canister samples will be retained for 7 calendar days after final report.

BTEX+NAPH-GCMS-WT	Canister	BTEX and Naphthalene	EPA TO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

C1-C5-FID-WT	Canister	Select list of 7 C1-C5 hydrocarbon gases	EPA Method 3C & ASTM D1946

This analysis is performed using procedures adapted from ASTM D1946/EPA Method 3C. Air samples are collected into cleaned evaculated canisters. A volume of air is removed from the canister & injected into a GC-FID for analysis. Hydrocarbon gas concentrations are calculated against a gas standard. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require longer canister storage time, please contact your account manager.

CAN-DATA-WT	Canister	Canister Information	EPA TO-15

Batch Proof ID, Canister ID, Pressure on Receipt, Regulator ID.

F1-F2-GCMS-WT	Canister	Total F1and F2 fractions (not corrected)	EPATO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

FIXED GASES-TCD-WT	Canister	High Level Fixed Gases by TCD	EPA Method 3C & ASTM D1946

This analysis is performed using procedures adapted from EPA Method 3C & ASTM D1946. Air samples are collected into cleaned evacuated canisters. A volume of air is removed from the canister and injected by means of a gas-sampling/backflush valve onto a series of packed GC columns and measured using a thermal conductivity detector (TCD).

Oxygen is not separated from Argon.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

SILOXANES-GCMS-WT	Tube	Linear & Cyclic Methyl Siloxanes	EPA TO-17

This analysis is performed using procedures adapted from EPA Method TO-17, ISO Method 16017 & NIOSH Method 2549. Air samples actively collected on PE VI TD tubes are thermally stripped & the analytes are re-collected on trapping material of a focusing trap in the thermal desorber. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

This analysis was performed under AIHA-IHLAP Scope of Accreditation, GC/MS Field of Testing which is compliant with AIHA-LAP, LLC Accreditation Policy Modules & ISO/IEC 17025:2005 Standard.

TD tube samples will be retained for 7 calendar days after final report. If you require a longer TD tube storage time, please contact your account manager.

TO15-GCMS-WT	Canister	Canister EPA TO-15	EPA TO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.			
XYLENES-SUM-CALC-WT	Canister	Sum of Xylene Isomer Concentrations	CALCULATION

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

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

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Routine Water Chemistry Report

L2393610

Lab ID	Sample ID				Lab ID	Sample ID			

ALS LABORATORY GROUP SOIL SALINITY CONVERSION

L2393610

Lab ID	Sample ID					Lab ID	Sample ID				

"Calculations are as per:
Methods of Analysis for Soils, Plants and Waters
Homer D. Chapman and Parker F. Pratt
University of California, Riverside, Cl.
August, 1961."

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALIPH/AROM-GCMS-WT	**Canister**							
Batch R4953507								
WG3249117-4 DUP		**L2393610-1**						
Aliphatic C6-C8		22	20		ug/m3	9.3	50	24-DEC-19
Aliphatic C>8-C10		33	19	J	ug/m3	14	30	24-DEC-19
Aliphatic C>10-C12		27	30		ug/m3	11	50	24-DEC-19
Aliphatic C>12-C16		<30	<30	RPD-NA	ug/m3	N/A	50	24-DEC-19
Aromatic C>8-C10		<15	<15	RPD-NA	ug/m3	N/A	50	24-DEC-19
Aromatic C>10-C12		<15	<15	RPD-NA	ug/m3	N/A	50	24-DEC-19
Aromatic C>12-C16		<30	<30	RPD-NA	ug/m3	N/A	50	24-DEC-19
WG3249117-2 LCS								
Aliphatic C6-C8			119.6		%		50-150	24-DEC-19
Aliphatic C>8-C10			102.6		%		50-150	24-DEC-19
Aliphatic C>10-C12			119.0		%		50-150	24-DEC-19
Aliphatic C>12-C16			134.7		%		50-150	24-DEC-19
Aromatic C>8-C10			106.5		%		50-150	24-DEC-19
Aromatic C>10-C12			103.2		%		50-150	24-DEC-19
Aromatic C>12-C16			87.9		%		50-150	24-DEC-19
WG3249117-3 LCSD		**WG3249117-2**						
Aliphatic C6-C8		119.6	129.2		%	7.8	50	24-DEC-19
Aliphatic C>8-C10		102.6	110.5		%	7.4	50	24-DEC-19
Aliphatic C>10-C12		119.0	123.4		%	3.7	50	24-DEC-19
Aliphatic C>12-C16		134.7	140.6		%	4.3	50	24-DEC-19
Aromatic C>8-C10		106.5	112.3		%	5.3	50	24-DEC-19
Aromatic C>10-C12		103.2	108.0		%	4.6	50	24-DEC-19
Aromatic C>12-C16		87.9	97.7		%	11	50	24-DEC-19
WG3249117-1 MB								
Aliphatic C6-C8			<15		ug/m3		15	24-DEC-19
Aliphatic C>8-C10			<15		ug/m3		15	24-DEC-19
Aliphatic C>10-C12			<15		ug/m3		15	24-DEC-19
Aliphatic C>12-C16			<30		ug/m3		30	24-DEC-19
Aromatic C>8-C10			<15		ug/m3		15	24-DEC-19
Aromatic C>10-C12			<15		ug/m3		15	24-DEC-19
Aromatic C>12-C16			<30		ug/m3		30	24-DEC-19
BTEX+NAPH-GCMS-WT	**Canister**							

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTEX+NAPH-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4	**DUP**	**L2393586-1**						
Naphthalene		<0.50	<0.50	RPD-NA	ppb(V)	N/A	30	23-DEC-19
WG3247636-2	**LCS**							
Naphthalene			111.7		%		70-130	23-DEC-19
WG3247636-3	**LCSD**	**WG3247636-2**						
Naphthalene		111.7	96.1		%	15	50	23-DEC-19
WG3247636-1	**MB**							
Naphthalene			<0.50		ppb(V)		0.5	23-DEC-19
Surrogate: 4-Bromofluorobenzene			94.2		%		50-150	23-DEC-19
C1-C5-FID-WT	**Canister**							
Batch R4944650								
WG3239341-4	**DUP**	**L2393570-1**						
Methane		0.00029	0.00027		%	7.3	20	10-DEC-19
Ethane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Ethene		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Propane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Propene		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Butane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Pentane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
WG3239341-8	**DUP**	**L2393610-2**						
Methane		0.00040	0.00030	J	%	0.00010	0.0002	10-DEC-19
Ethane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Ethene		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Propane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Propene		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Butane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Pentane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
WG3239341-1	**LCS**							
Methane			78.8		%		70-130	10-DEC-19
Ethane			88.3		%		70-130	10-DEC-19
Ethene			84.4		%		70-130	10-DEC-19
Propane			88.8		%		70-130	10-DEC-19
Propene			96.7		%		70-130	10-DEC-19
Pentane			92.4		%		70-130	10-DEC-19
WG3239341-5	**LCS**							

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C1-C5-FID-WT	**Canister**							
Batch R4944650								
WG3239341-5 LCS								
Methane			80.6		%		70-130	10-DEC-19
Ethane			90.2		%		70-130	10-DEC-19
Ethene			86.2		%		70-130	10-DEC-19
Propane			90.0		%		70-130	10-DEC-19
Propene			98.8		%		70-130	10-DEC-19
Butane			90.8		%		70-130	10-DEC-19
Pentane			93.7		%		70-130	10-DEC-19
WG3239341-2 LCSD		**WG3239341-1**						
Methane		78.8	82.3		%	4.4	50	10-DEC-19
Ethane		88.3	89.4		%	1.2	50	10-DEC-19
Ethene		84.4	84.6		%	0.1	50	10-DEC-19
Propane		88.8	88.5		%	0.4	50	10-DEC-19
Propene		96.7	96.9		%	0.2	50	10-DEC-19
Pentane		92.4	92.2		%	0.2	50	10-DEC-19
WG3239341-6 LCSD		**WG3239341-5**						
Methane		80.6	80.4		%	0.3	50	10-DEC-19
Ethane		90.2	90.3		%	0.1	50	10-DEC-19
Ethene		86.2	85.8		%	0.5	50	10-DEC-19
Propane		90.0	89.5		%	0.5	50	10-DEC-19
Propene		98.8	98.2		%	0.6	50	10-DEC-19
Butane		90.8	90.5		%	0.3	50	10-DEC-19
Pentane		93.7	93.1		%	0.6	50	10-DEC-19
WG3239341-3 MB								
Methane			<0.00010		%		0.0001	10-DEC-19
Ethane			<0.00020		%		0.0002	10-DEC-19
Ethene			<0.00020		%		0.0002	10-DEC-19
Propane			<0.00020		%		0.0002	10-DEC-19
Propene			<0.00020		%		0.0002	10-DEC-19
Butane			<0.00020		%		0.0002	10-DEC-19
Pentane			<0.00020		%		0.0002	10-DEC-19
WG3239341-7 MB								
Methane			<0.00010		%		0.0001	10-DEC-19
Ethane			<0.00020		%		0.0002	10-DEC-19
Ethene			<0.00020		%		0.0002	10-DEC-19

ALS Environmental

Quality Control Report

Workorder: L2393610 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C1-C5-FID-WT	**Canister**							
Batch R4944650								
WG3239341-7 MB								
Propane			<0.00020		%		0.0002	10-DEC-19
Propene			<0.00020		%		0.0002	10-DEC-19
Butane			<0.00020		%		0.0002	10-DEC-19
Pentane			<0.00020		%		0.0002	10-DEC-19
CAN-DATA-WT	**Canister**							
Batch R4944737								
WG3244055-1 MB								
Pressure on Receipt			-29.8		in Hg			17-DEC-19
F1-F2-GCMS-WT	**Canister**							
Batch R4953507								
WG3249117-4 DUP		**L2393610-1**						
F1 (C6-C10)		53	47		ug/m3	11	50	24-DEC-19
F2 (C10-C16)		61	69		ug/m3	13	50	24-DEC-19
WG3249117-2 LCS								
F1 (C6-C10)			107.6		%		50-150	24-DEC-19
WG3249117-3 LCSD		**WG3249117-2**						
F1 (C6-C10)		107.6	107.7		%	0.1	50	24-DEC-19
WG3249117-1 MB								
F1 (C6-C10)			<15		ug/m3		15	24-DEC-19
F2 (C10-C16)			<15		ug/m3		15	24-DEC-19
Surrogate: 4-Bromofluorobenzene			94.3		%		50-150	24-DEC-19
FIXED GASES-TCD-WT	**Canister**							
Batch R4944389								
WG3236065-8 DUP		**L2393575-4**						
Nitrogen		75.8	76.0		%	0.3	30	13-DEC-19
Oxygen		19.6	19.6		%	0.3	30	13-DEC-19
Carbon Dioxide		2.84	2.76		%	2.7	30	13-DEC-19
Carbon Monoxide		<0.050	<0.050	RPD-NA	%	N/A	30	13-DEC-19
Methane		<0.050	<0.050	RPD-NA	%	N/A	30	13-DEC-19
WG3236065-5 LCS								
Nitrogen			98.5		%		70-130	13-DEC-19
Oxygen			97.5		%		70-130	13-DEC-19
Carbon Dioxide			95.4		%		70-130	13-DEC-19
Carbon Monoxide			95.7		%		70-130	13-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
FIXED GASES-TCD-WT	**Canister**							
Batch R4944389								
WG3236065-5 LCS								
Methane			98.3		%		70-130	13-DEC-19
WG3236065-6 LCSD		**WG3236065-5**						
Nitrogen		98.5	98.6		%	0.1	25	13-DEC-19
Oxygen		97.5	97.6		%	0.2	25	13-DEC-19
Carbon Dioxide		95.4	96.1		%	0.8	25	13-DEC-19
Carbon Monoxide		95.7	95.9		%	0.2	25	13-DEC-19
Methane		98.3	98.3		%	0.0	25	13-DEC-19
WG3236065-7 MB								
Nitrogen			<1.0		%		1	13-DEC-19
Oxygen			<0.10		%		0.1	13-DEC-19
Carbon Dioxide			<0.050		%		0.05	13-DEC-19
Carbon Monoxide			<0.050		%		0.05	13-DEC-19
Methane			<0.050		%		0.05	13-DEC-19
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4 DUP		**L2393586-1**						
1,1,1-Trichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1,2,2-Tetrachloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1,2-Trichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1-Dichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1-Dichloroethene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2,4-Trichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2,4-Trimethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dibromoethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dichloropropane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,3,5-Trimethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,3-Butadiene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,3-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,4-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,4-Dioxane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
2-Hexanone		<1.0	<1.0	RPD-NA	ppb(V)	N/A	30	23-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4 DUP		**L2393586-1**						
4-Ethyltoluene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Acetone		1.97	1.94		ppb(V)	1.5	30	23-DEC-19
Allyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Benzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Benzyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Bromodichloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Bromoform		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Bromomethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Carbon Disulfide		1.30	1.28		ppb(V)	1.2	30	23-DEC-19
Carbon Tetrachloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chloroform		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
cis-1,2-Dichloroethene		0.78	0.72		ppb(V)	8.0	30	23-DEC-19
cis-1,3-Dichloropropene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Cyclohexane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Dibromochloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Dichlorodifluoromethane		0.69	0.68		ppb(V)	2.6	30	23-DEC-19
Ethyl acetate		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Ethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Freon 113		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Freon 114		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Hexachlorobutadiene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Isooctane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Isopropyl alcohol		<1.0	<1.0	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Isopropylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	50	23-DEC-19
m&p-Xylene		0.72	0.70		ppb(V)	3.4	30	23-DEC-19
Methyl ethyl ketone		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Methyl isobutyl ketone		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Methylene chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
MTBE		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
n-Heptane		<0.20	<0.20		ppb(V)			23-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4 DUP		**L2393586-1**						
n-Heptane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
n-Hexane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
o-Xylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Propylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Styrene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Tetrachloroethylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Tetrahydrofuran		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Toluene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
trans-1,2-Dichloroethene		0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
trans-1,3-Dichloropropene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Trichloroethylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Trichlorofluoromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Vinyl acetate		<0.50	<0.50	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Vinyl bromide		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Vinyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
WG3247636-2 LCS								
1,1,1-Trichloroethane			88.6		%		70-130	23-DEC-19
1,1,2,2-Tetrachloroethane			91.9		%		70-130	23-DEC-19
1,1,2-Trichloroethane			86.6		%		70-130	23-DEC-19
1,1-Dichloroethane			92.4		%		70-130	23-DEC-19
1,1-Dichloroethene			90.6		%		70-130	23-DEC-19
1,2,4-Trichlorobenzene			108.3		%		70-130	23-DEC-19
1,2,4-Trimethylbenzene			92.4		%		70-130	23-DEC-19
1,2-Dibromoethane			90.8		%		70-130	23-DEC-19
1,2-Dichlorobenzene			92.5		%		70-130	23-DEC-19
1,2-Dichloroethane			90.4		%		70-130	23-DEC-19
1,2-Dichloropropane			90.0		%		70-130	23-DEC-19
1,3,5-Trimethylbenzene			90.6		%		70-130	23-DEC-19
1,3-Butadiene			89.8		%		70-130	23-DEC-19
1,3-Dichlorobenzene			91.1		%		70-130	23-DEC-19
1,4-Dichlorobenzene			94.2		%		70-130	23-DEC-19
1,4-Dioxane			92.9		%		70-130	23-DEC-19
2-Hexanone			92.2		%		70-130	23-DEC-19

Client:	TETRA TECH CANADA INC. 110, 140 Quarry Park Blvd SE Calgary AB T2C 3G3
Contact:	Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-2 LCS								
4-Ethyltoluene			90.5		%		70-130	23-DEC-19
Acetone			91.2		%		70-130	23-DEC-19
Allyl chloride			88.3		%		70-130	23-DEC-19
Benzene			92.1		%		70-130	23-DEC-19
Benzyl chloride			87.4		%		70-130	23-DEC-19
Bromodichloromethane			88.1		%		70-130	23-DEC-19
Bromoform			88.4		%		70-130	23-DEC-19
Bromomethane			92.9		%		70-130	23-DEC-19
Carbon Disulfide			84.8		%		70-130	23-DEC-19
Carbon Tetrachloride			87.6		%		70-130	23-DEC-19
Chlorobenzene			90.8		%		70-130	23-DEC-19
Chloroethane			90.9		%		70-130	23-DEC-19
Chloroform			94.1		%		70-130	23-DEC-19
Chloromethane			93.2		%		70-130	23-DEC-19
cis-1,2-Dichloroethene			89.8		%		70-130	23-DEC-19
cis-1,3-Dichloropropene			89.0		%		70-130	23-DEC-19
Cyclohexane			92.0		%		70-130	23-DEC-19
Dibromochloromethane			86.9		%		70-130	23-DEC-19
Dichlorodifluoromethane			89.3		%		70-130	23-DEC-19
Ethyl acetate			89.3		%		70-130	23-DEC-19
Ethylbenzene			89.4		%		70-130	23-DEC-19
Freon 113			89.0		%		70-130	23-DEC-19
Freon 114			95.4		%		70-130	23-DEC-19
Hexachlorobutadiene			103.3		%		70-130	23-DEC-19
Isooctane			90.2		%		70-130	23-DEC-19
Isopropyl alcohol			83.3		%		70-130	23-DEC-19
Isopropylbenzene			87.4		%		50-150	23-DEC-19
m&p-Xylene			91.2		%		70-130	23-DEC-19
Methyl ethyl ketone			89.5		%		70-130	23-DEC-19
Methyl isobutyl ketone			89.1		%		70-130	23-DEC-19
Methylene chloride			95.2		%		70-130	23-DEC-19
MTBE			90.7		%		70-130	23-DEC-19
n-Heptane			89.9		%		70-130	23-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-2 LCS								
n-Hexane			90.8		%		70-130	23-DEC-19
o-Xylene			90.5		%		70-130	23-DEC-19
Propylene			88.6		%		70-130	23-DEC-19
Styrene			89.1		%		70-130	23-DEC-19
Tetrachloroethylene			90.2		%		70-130	23-DEC-19
Tetrahydrofuran			92.0		%		70-130	23-DEC-19
Toluene			91.9		%		70-130	23-DEC-19
trans-1,2-Dichloroethene			91.7		%		70-130	23-DEC-19
trans-1,3-Dichloropropene			87.5		%		70-130	23-DEC-19
Trichloroethylene			91.3		%		70-130	23-DEC-19
Trichlorofluoromethane			89.8		%		70-130	23-DEC-19
Vinyl acetate			89.2		%		70-130	23-DEC-19
Vinyl bromide			92.1		%		70-130	23-DEC-19
Vinyl chloride			89.8		%		70-130	23-DEC-19
WG3247636-3 LCSD		**WG3247636-2**						
1,1,1-Trichloroethane		88.6	77.4		%	13	25	23-DEC-19
1,1,2,2-Tetrachloroethane		91.9	80.2		%	14	25	23-DEC-19
1,1,2-Trichloroethane		86.6	74.9		%	14	25	23-DEC-19
1,1-Dichloroethane		92.4	77.3		%	18	25	23-DEC-19
1,1-Dichloroethene		90.6	75.4		%	18	25	23-DEC-19
1,2,4-Trichlorobenzene		108.3	91.8		%	16	25	23-DEC-19
1,2,4-Trimethylbenzene		92.4	79.2		%	15	25	23-DEC-19
1,2-Dibromoethane		90.8	77.8		%	15	25	23-DEC-19
1,2-Dichlorobenzene		92.5	79.7		%	15	25	23-DEC-19
1,2-Dichloroethane		90.4	78.5		%	14	25	23-DEC-19
1,2-Dichloropropane		90.0	78.6		%	13	25	23-DEC-19
1,3,5-Trimethylbenzene		90.6	77.2		%	16	25	23-DEC-19
1,3-Butadiene		89.8	79.7		%	12	25	23-DEC-19
1,3-Dichlorobenzene		91.1	78.3		%	15	25	23-DEC-19
1,4-Dichlorobenzene		94.2	81.2		%	15	25	23-DEC-19
1,4-Dioxane		92.9	82.0		%	12	25	23-DEC-19
2-Hexanone		92.2	81.0		%	13	25	23-DEC-19
4-Ethyltoluene		90.5	78.4		%	14	25	23-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-3 LCSD		**WG3247636-2**						
Acetone		91.2	77.4		%	16	25	23-DEC-19
Allyl chloride		88.3	77.2		%	13	25	23-DEC-19
Benzene		92.1	78.2		%	16	25	23-DEC-19
Benzyl chloride		87.4	76.4		%	13	25	23-DEC-19
Bromodichloromethane		88.1	77.3		%	13	25	23-DEC-19
Bromoform		88.4	74.5		%	17	25	23-DEC-19
Bromomethane		92.9	79.7		%	15	25	23-DEC-19
Carbon Disulfide		84.8	73.4		%	15	25	23-DEC-19
Carbon Tetrachloride		87.6	77.2		%	13	25	23-DEC-19
Chlorobenzene		90.8	78.1		%	15	25	23-DEC-19
Chloroethane		90.9	79.4		%	13	25	23-DEC-19
Chloroform		94.1	80.5		%	16	25	23-DEC-19
Chloromethane		93.2	79.5		%	16	25	23-DEC-19
cis-1,2-Dichloroethene		89.8	79.2		%	12	25	23-DEC-19
cis-1,3-Dichloropropene		89.0	76.0		%	16	25	23-DEC-19
Cyclohexane		92.0	77.5		%	17	25	23-DEC-19
Dibromochloromethane		86.9	76.1		%	13	25	23-DEC-19
Dichlorodifluoromethane		89.3	77.0		%	15	25	23-DEC-19
Ethyl acetate		89.3	75.4		%	17	25	23-DEC-19
Ethylbenzene		89.4	78.0		%	14	25	23-DEC-19
Freon 113		89.0	75.4		%	17	25	23-DEC-19
Freon 114		95.4	82.0		%	15	25	23-DEC-19
Hexachlorobutadiene		103.3	88.9		%	15	25	23-DEC-19
Isooctane		90.2	79.3		%	13	25	23-DEC-19
Isopropyl alcohol		83.3	72.3		%	14	25	23-DEC-19
Isopropylbenzene		87.4	76.3		%	14	50	23-DEC-19
m&p-Xylene		91.2	80.3		%	13	25	23-DEC-19
Methyl ethyl ketone		89.5	78.2		%	13	25	23-DEC-19
Methyl isobutyl ketone		89.1	75.6		%	16	25	23-DEC-19
Methylene chloride		95.2	76.9		%	21	25	23-DEC-19
MTBE		90.7	77.2		%	16	25	23-DEC-19
n-Heptane		89.9	77.9		%	14	25	23-DEC-19
n-Hexane		90.8	78.3		%			23-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-3 LCSD		**WG3247636-2**						
n-Hexane		90.8	78.3		%	15	25	23-DEC-19
o-Xylene		90.5	78.6		%	14	25	23-DEC-19
Propylene		88.6	74.1		%	18	25	23-DEC-19
Styrene		89.1	76.4		%	15	25	23-DEC-19
Tetrachloroethylene		90.2	76.6		%	16	25	23-DEC-19
Tetrahydrofuran		92.0	79.5		%	15	25	23-DEC-19
Toluene		91.9	79.4		%	15	25	23-DEC-19
trans-1,2-Dichloroethene		91.7	77.5		%	17	25	23-DEC-19
trans-1,3-Dichloropropene		87.5	76.1		%	14	25	23-DEC-19
Trichloroethylene		91.3	77.8		%	16	25	23-DEC-19
Trichlorofluoromethane		89.8	77.5		%	15	25	23-DEC-19
Vinyl acetate		89.2	99.98		%	11	25	23-DEC-19
Vinyl bromide		92.1	78.8		%	16	25	23-DEC-19
Vinyl chloride		89.8	78.0		%	14	25	23-DEC-19
WG3247636-1 MB								
1,1,1-Trichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1,2,2-Tetrachloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1,2-Trichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1-Dichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1-Dichloroethene			<0.20		ppb(V)		0.2	23-DEC-19
1,2,4-Trichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,2,4-Trimethylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dibromoethane			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dichloropropane			<0.20		ppb(V)		0.2	23-DEC-19
1,3,5-Trimethylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,3-Butadiene			<0.20		ppb(V)		0.2	23-DEC-19
1,3-Dichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,4-Dichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,4-Dioxane			<0.20		ppb(V)		0.2	23-DEC-19
2-Hexanone			<1.0		ppb(V)		1	23-DEC-19
4-Ethyltoluene			<0.20		ppb(V)		0.2	23-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-1 MB								
Acetone			<0.50		ppb(V)		0.5	23-DEC-19
Allyl chloride			<0.20		ppb(V)		0.2	23-DEC-19
Benzene			<0.20		ppb(V)		0.2	23-DEC-19
Benzyl chloride			<0.20		ppb(V)		0.2	23-DEC-19
Bromodichloromethane			<0.20		ppb(V)		0.2	23-DEC-19
Bromoform			<0.20		ppb(V)		0.2	23-DEC-19
Bromomethane			<0.20		ppb(V)		0.2	23-DEC-19
Carbon Disulfide			<0.20		ppb(V)		0.2	23-DEC-19
Carbon Tetrachloride			<0.20		ppb(V)		0.2	23-DEC-19
Chlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
Chloroethane			<0.20		ppb(V)		0.2	23-DEC-19
Chloroform			<0.20		ppb(V)		0.2	23-DEC-19
Chloromethane			<0.20		ppb(V)		0.2	23-DEC-19
cis-1,2-Dichloroethene			<0.20		ppb(V)		0.2	23-DEC-19
cis-1,3-Dichloropropene			<0.20		ppb(V)		0.2	23-DEC-19
Cyclohexane			<0.20		ppb(V)		0.2	23-DEC-19
Dibromochloromethane			<0.20		ppb(V)		0.2	23-DEC-19
Dichlorodifluoromethane			<0.20		ppb(V)		0.2	23-DEC-19
Ethyl acetate			<0.20		ppb(V)		0.2	23-DEC-19
Ethylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
Freon 113			<0.20		ppb(V)		0.2	23-DEC-19
Freon 114			<0.20		ppb(V)		0.2	23-DEC-19
Hexachlorobutadiene			<0.20		ppb(V)		0.2	23-DEC-19
Isooctane			<0.20		ppb(V)		0.2	23-DEC-19
Isopropyl alcohol			<1.0		ppb(V)		1	23-DEC-19
Isopropylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
m&p-Xylene			<0.40		ppb(V)		0.4	23-DEC-19
Methyl ethyl ketone			<0.20		ppb(V)		0.2	23-DEC-19
Methyl isobutyl ketone			<0.20		ppb(V)		0.2	23-DEC-19
Methylene chloride			<0.20		ppb(V)		0.2	23-DEC-19
MTBE			<0.20		ppb(V)		0.2	23-DEC-19
n-Heptane			<0.20		ppb(V)		0.2	23-DEC-19
n-Hexane			<0.20		ppb(V)		0.2	23-DEC-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-1 MB								
o-Xylene			<0.20		ppb(V)		0.2	23-DEC-19
Propylene			<0.20		ppb(V)		0.2	23-DEC-19
Styrene			<0.20		ppb(V)		0.2	23-DEC-19
Tetrachloroethylene			<0.20		ppb(V)		0.2	23-DEC-19
Tetrahydrofuran			<0.20		ppb(V)		0.2	23-DEC-19
Toluene			<0.20		ppb(V)		0.2	23-DEC-19
trans-1,2-Dichloroethene			<0.20		ppb(V)		0.2	23-DEC-19
trans-1,3-Dichloropropene			<0.20		ppb(V)		0.2	23-DEC-19
Trichloroethylene			<0.20		ppb(V)		0.2	23-DEC-19
Trichlorofluoromethane			<0.20		ppb(V)		0.2	23-DEC-19
Vinyl acetate			<0.50		ppb(V)		0.5	23-DEC-19
Vinyl bromide			<0.20		ppb(V)		0.2	23-DEC-19
Vinyl chloride			<0.20		ppb(V)		0.2	23-DEC-19
Surrogate: 4-Bromofluorobenzene			94.2		%		50-150	23-DEC-19
SILOXANES-GCMS-WT	**Tube**							
Batch R4945277								
WG3242059-2 LCS								
D3(CVMS)			116.0		%		70-130	18-DEC-19
D4(CVMS)			117.6		%		70-130	18-DEC-19
D5(CVMS)			127.7		%		70-130	18-DEC-19
D6(CVMS)			121.6		%		70-130	18-DEC-19
MM(LVMS)			122.0		%		70-130	18-DEC-19
MDM(LVMS)			124.9		%		70-130	18-DEC-19
MD2M(LVMS)			118.9		%		70-130	18-DEC-19
MD3M(LVMS)			114.1		%		70-130	18-DEC-19
WG3242059-3 LCSD		**WG3242059-2**						
D3(CVMS)		116.0	118.1		%	1.7	50	18-DEC-19
D4(CVMS)		117.6	121.2		%	3.0	50	18-DEC-19
D5(CVMS)		127.7	131.7		%	3.1	50	18-DEC-19
D6(CVMS)		121.6	125.5		%	3.2	50	18-DEC-19
MM(LVMS)		122.0	94.5		%	25	50	18-DEC-19
MDM(LVMS)		124.9	123.7		%	0.9	50	18-DEC-19
MD2M(LVMS)		118.9	116.5		%	2.0	50	18-DEC-19
MD3M(LVMS)		114.1	106.2		%	7.2	50	18-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SILOXANES-GCMS-WT	**Tube**							
Batch R4945277								
WG3242059-1 MB								
D3(CVMS)			<10		ng		10	18-DEC-19
D4(CVMS)			<10		ng		10	18-DEC-19
D5(CVMS)			<10		ng		10	18-DEC-19
D6(CVMS)			<10		ng		10	18-DEC-19
MM(LVMS)			<10		ng		10	18-DEC-19
MDM(LVMS)			<10		ng		10	18-DEC-19
MD2M(LVMS)			<10		ng		10	18-DEC-19
MD3M(LVMS)			<10		ng		10	18-DEC-19
Surrogate: 4-Bromofluorobenzene			100.4		%		50-150	18-DEC-19

Quality Control Report

Workorder: L2393610 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Legend:

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

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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

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

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

Batch Proof Report

Batch ID	Canister ID	Parameters	Value	Units	Date	Analyst
B191119.112	01400-0480	1,1,1-Trichloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1,1,2-Tetrachloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1,2,2-Tetrachloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1,2-Trichloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1-Dichloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1-Dichloroethene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2,4-Trichlorobenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2,4-Trimethylbenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dibromoethane	<0.01	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dichlorobenzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dichloroethane	<0.01	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dichloropropane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,3,5-Trimethylbenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,3-Butadiene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,3-Dichlorobenzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,4-Dichlorobenzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,4-Dioxane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	2-Chlorophenol	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	2-Hexanone	<1.0	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	4-Ethyltoluene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Acetone	<0.50	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Allyl Chloride	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Benzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Benzyl Chloride	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromodichloromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromobenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromoform	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromomethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Carbon Disulfide	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Carbon Tetrachloride	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chlorobenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chloroform	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chloromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	cis-1,2-Dichloroethene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	cis-1,3-Dichloropropene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Cyclohexane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Dibromochloromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Dichlorodifluoromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Ethyl Acetate	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Ethyl Benzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Freon 113	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Freon 114	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Hexachlorobutadiene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Isooctane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Isopropyl Alcohol	<1.0	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Isopropylbenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	m&p-Xylene	<0.04	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methyl Ethyl Ketone	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methylcyclohexane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methyl Isobutyl Ketone	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methylene Chloride	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	MTBE	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Naphthalene	<0.05	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	n-Decane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	n-Heptane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	n-Hexane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	o-Xylene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Propylene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Styrene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Tetrachloroethylene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Tetrahydrofuran	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Toluene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	trans-1,2-Dichloroethene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	trans-1,3-Dichloropropene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Trichloroethylene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Trichlorofluoromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Vinyl Acetate	<0.50	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Vinyl Bromide	<0.20	ppb(V)	21-Nov-19	DT1

B191119.112	01400-0480	Vinyl Chloride	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	4-Bromofluorobenzene	103.1	%	21-Nov-19	DT1

L2393610-COFC

60 NORTHLAN
WATERLOO, ON

Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

(ALS) Environmental

AIR QUALITY CHAIN OF CUSTODY FORM - Canister/Tube/Gas Bag

Page 1 of 1

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT of samples received past 3:00 pm or Saturday / Sunday begin the next day.

Specify date required	Service Requested			
	10 day (regular) ☑	Rush 3 day (100%) ☐	Rush 2 day (200%) ☐	
	Rush 5 day (50%) ☐	Rush 1 day (300%) - Enquire ☐		

COMPANY NAME	Tetra Tech Canada Inc.
OFFICE	110, 140 Quarry Park Blvd SE, Calgary, AB T2C 3G3
PROJECT MANAGER	Darby Madalena
PROJECT #	SWM.SWOP04071-01.001 (Great West Adventure Park)
PHONE 403-723-6867	FAX 403-203-3301
ACCOUNT #	
QUOTATION # Q71650	PO # SWM.SWOP04071-01.001

SAMPLE TYPE/REGULATION

Reg 419/05 ☐ Soil Vapor Intrusion ☐

OTHER ☐ Please List ______

REPORT FORMAT/DISTRIBUTION

EMAIL____ FAX____ BOTH ____
SELECT: PDF____ DIGITAL____ BOTH ____
EMAIL 1 ______
EMAIL 2 ______

ANALYSIS REQUEST

All rush work requires lab approval before sample submission

SUBMISSION #:
ENTERED BY:
DATE/TIME ENTERED:
BIN #:

SAMPLING INFORMATION

Sample Date/Time: Date (dd-mmm-yy)	Time (24hr) (hh:mm)	Canister or Tube ID# (e.g. 060000-XXXX or G0XXXXXX SVI)	Regulator Serial # CS1200-XXXX or GXX	Matrix Type	SAMPLE DESCRIPTION TO APPEAR ON REPORT	TUBE AIR VOLUME - L ☒ m³ ☐	C1-C5-FID-WT	FIXED GASES-TCD-WT	TO15,F1F2SFRA+NAP-WT	Siloxanes - GCMS - WT			STARTING PRESSURE - Pre-Sampling ("Hg)	ENDING PRESSURE - Post Sampling ("Hg)	COLLECTION TIME (HRS)	Field Conditions (Rain/Wind/Dust/Odour) Field PID Reading	LAB ID
04-Dec-19	1342	1092	G39	SG	VW-01	1.4	x	x	x				-30	-10	2		
↓	1419	2960	G280	SG	VW-02	1.4	x	x	x				-26	-8	1		
	-	355	D53	SG	19DUP01	1.4	X	X	X				-29	-10	2		
	1656	G0150323SVI	-	SG	VW-01	/				X			/	/	/		
↓	1520	G0150384SVI	-	SG	VW-02	/				X			/	/	/		

SPECIAL INSTRUCTIONS/COMMENTS

This Chain of Custody Form is only to be used for Air Quality Samples

Matrix Type
Soil Gas Vapour = SG
Indoor Air = IA
Ambient Air = AA
Industrial Hygiene = IH

SAMPLE CONDITION AS RECEIVED

FROZEN ☐
COLD ☐
COOLING INITIATED ☐
AMBIENT ☐
MEAN TEMP
OBSERVATIONS
Yes ☐ No ☐
If yes add SIF
INIT

SAMPLED BY: Megan Rowe	DATE & TIME Dec 6/19	RECEIVED BY:	DATE & TIME		
RELINQUISHED BY:	DATE & TIME 1600	RECEIVED AT LAB BY:	DATE & TIME 12/6		

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

REV4-2012

APPENDIX E

HISTORICAL ANALYTICAL RESULTS

Table 1
Soil Vapour and Groundwater Monitoring Well Elevations

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval		
				Bottom	Top	
MW-01	4.3	853.806	854.668	849.506	852.506	3.0
MW-02	4.3	852.765	852.682	848.465	851.465	3.0
MW-03	3.7	852.750	853.740	849.050	851.750	2.7
MW-04	4.4	852.755	853.482	848.355	851.355	3.0
MW-05	5.5	854.307	855.132	848.807	851.807	3.0
VW-01	2.7	853.847	854.605	851.147	851.447	0.3
VW-02	2.4	854.338	855.419	851.938	852.238	0.3
TH-01	853.676	- -	- -	- -	- -	- -
TH-02	854.308	- -	- -	- -	- -	- -
TH-08	854.207	- -	- -	- -	- -	- -
TH-09	854.244	- -	- -	- -	- -	- -
TH-10	854.056	- -	- -	- -	- -	- -
TH-11	854.706	- -	- -	- -	- -	- -
TH-12	854.413	- -	- -	- -	- -	- -
TH-14	853.661	- -	- -	- -	- -	- -
TH-15	853.898	- -	- -	- -	- -	- -
TH-16	854.048	- -	- -	- -	- -	- -
TH-17	854.140	- -	- -	- -	- -	- -
TH-18	853.369	- -	- -	- -	- -	- -
TH-19	856.137	- -	- -	- -	- -	- -
TH-20	856.201	- -	- -	- -	- -	- -
TH-21	853.119	- -	- -	- -	- -	- -
TH-23	853.749	- -	- -	- -	- -	- -

Notes:

1) Geodetic elevations are referenced to multiple ASCMs located within The City of Red Deer.
2) Datum is ASCM #17988 and #294421.
3) MW - Monitoring Well.
4) VW - Soil Vapour Well.
5) TH - Testhole no well instrumentation.
6) NA - Not Applicable.

Table 2
Site Monitoring Results

Test Location	Elevations		Groundwater Elevation (m)		Headspace Vapour			
	Ground (m)	Top of Pipe (m)	09/08/13		09/08/13			
					Combustible	Volatile	Combustible	Volatile
MW-01	853.806	854.668	851.819		155	ND		
MW-02	852.765	852.682	850.762		590	ND		
MW-03	852.750	853.740	851.235		530	ND		
MW-04	852.755	853.482	850.142		135	ND		
MW-05	854.307	855.132	850.965		10	ND		
VW-01	853.847	854.605	- -		95	ND		
VW-02	854.338	855.419	- -		45	ND		

Notes:

1) Measurement of combustible and volatile vapours by RKI Eagle 2. Combustible vapour sensor calibrated to hexane and photoionization detector calibrated to isobutylene.
2) ND - Not Detected, less than the limit of instrument detection.
3) - - No value established.

Table 3A
Analytical Results - Soil - Drill Cuttings (Soil Bag)

Parameter	Detection Limit	Soil Bag 1 of 1	Class II Landfill Acceptance Criteria
pH	0.10	8.47	2-12.5
Flash Point (°C)	30.0	>75	>61
Paint Filter Test	-	PASS	PASS
Total Organic Carbon	0.10	0.69	- -
TCLP Hydrocarbons			
Benzene	0.0050	ND	0.5
Toluene	0.0050	ND	0.5
Ethylbenzene	0.0050	ND	0.5
Xylenes	0.0050	ND	0.5
TCLP Metals			
Antimony (Sb)	5.0	ND	500
Arsenic (As)	0.20	ND	5
Barium (Ba)	5.0	ND	100
Beryllium (Be)	0.50	ND	5
Boron (B)	5.0	ND	500
Cadmium (Cd)	0.050	ND	1
Chromium (Cr)	0.50	ND	5
Cobalt (Co)	5.0	ND	100
Copper (Cu)	5.0	ND	100
Iron (Fe)	5.0	ND	1,000
Lead (Pb)	0.50	ND	5
Mercury (Hg)	0.010	ND	0.2
Nickel (Ni)	0.50	ND	5
Selenium (Se)	0.20	ND	1
Silver (Ag)	0.50	ND	5
Thallium (Tl)	0.50	ND	5
Uranium (U)	1.0	ND	2
Vanadium (V)	5.0	ND	100
Zinc (Zn)	5.0	ND	500
Zirconium (Zr)	5.0	ND	500

Notes:

1) Applicable Waste Screens process for The City of Red Deer Class II waste management facility.
2) Class II Landfill Acceptance Criteria - per Table 2, Part 4 Schedule to the Alberta User Guide for Waste Managers 3/95.
3) All units are mg/L unless otherwise stated.
4) ND - Not Detected
5) Soil Bags were sampled on June 26, 2013.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 3B
Analytical Results - Soil - General Indices & Heavy Metals

Parameters	Units	Detection Limit	TH-17 @ 3.5 m	TH-20 @ 3.9 - 4.6 m	TH-21 @ 2.0 m	Tier 1 Guideline
			09/07/13	07/15/2013	07/18/2013	
Chloride (Cl)	mg/kg	6.7 - 10	115	10.6	101	- -
Nitrate-N	mg/kg	0.33 - 0.51	ND	ND	ND	- -
Nitrite-N	mg/kg	0.33 - 0.51	ND	ND	ND	- -
Metals						
Antimony (Sb)	mg/kg	0.20	3.16	0.33	0.39	20
Arsenic (As)	mg/kg	0.20	7.04	4.63	5.92	17
Barium (Ba)	mg/kg	5.0	292	200	262	500
Beryllium (Be)	mg/kg	1.0	ND	ND	ND	5
Cadmium (Cd)	mg/kg	0.50	ND	ND	ND	10
Chromium (Cr)	mg/kg	0.50	16.4	9.55	14.0	64
Cobalt (Co)	mg/kg	1.0	6.3	4.3	6.0	20
Copper (Cu)	mg/kg	2.0	15.2	8.0	14.6	63
Lead (Pb)	mg/kg	5.0	**398**	6.4	8.1	140
Mercury (Hg)	mg/kg	0.050	ND	ND	ND	6.6
Molybdenum (Mo)	mg/kg	1.0	1.2	ND	ND	4
Nickel (Ni)	mg/kg	2.0	19.3	13.5	19.4	50
Selenium (Se)	mg/kg	0.50	ND	ND	ND	1.0
Silver (Ag)	mg/kg	1.0	ND	ND	ND	20
Thallium (Tl)	mg/kg	0.50	ND	ND	ND	1.0
Tin (Sn)	mg/kg	2.0	ND	ND	ND	5
Uranium (U)	mg/kg	2.0	ND	ND	ND	23
Vanadium (V)	mg/kg	1.0	23.5	17.2	24.2	130
Zinc (Zn)	mg/kg	10	80	78	56	200
Hexavalent Chromium	mg/kg	0.10	ND	ND	ND	0.4
Boron (B), Hot Water Ext.	- -	0.10	1.37	1.24	0.34	2

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the reference criteria.
4) Bold & Shaded - Exceeds the referenced Alberta Tier 1 and CCME guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 3C
Analytical Results - Soil - VOCs

Parameters	Units	Detection Limit	TH-17 @ 3.5 m	TH-20 @ 3.9 - 4.6 m	TH-21 @ 2.0 m	Tier 1 Guideline
			09/07/13	07/15/2013	07/18/2013	
Hydrocarbons						
F1 (C_6-C_{10})	mg/kg	10	ND	ND	ND	24
F2 (C_{10}-C_{16})	mg/kg	25	ND	ND	ND	130
F3 (C_{16}-C_{34})	mg/kg	50	ND	ND	ND	300
F4 (C_{34}-C_{50})	mg/kg	50	ND	ND	ND	2,800
Total Hydrocarbons (C_6-C_{50})	mg/kg	50	ND	ND	ND	- -
Volatile Organic Compounds						
Benzene	mg/kg	0.010	ND	ND	ND	0.073
Bromobenzene	mg/kg	0.010	ND	ND	ND	- -
Bromochloromethane	mg/kg	0.010	ND	ND	ND	- -
Bromodichloromethane	mg/kg	0.010	ND	ND	ND	- -
Bromoform	mg/kg	0.010	ND	ND	ND	- -
Bromomethane	mg/kg	0.10	ND	ND	ND	- -
n-Butylbenzene	mg/kg	0.010 - 0.070	ND	ND	ND	- -
sec-Butylbenzene	mg/kg	0.010	ND	ND	ND	- -
tert-Butylbenzene	mg/kg	0.010	ND	ND	ND	- -
Carbon tetrachloride	mg/kg	0.010	ND	ND	ND	0.00056
Chlorobenzene	mg/kg	0.010	ND	ND	ND	0.018
Dibromochloromethane	mg/kg	0.010	ND	ND	ND	0.27
Chloroethane	mg/kg	0.10	ND	ND	ND	- -
Chloroform	mg/kg	0.010	ND	ND	ND	0.001
Chloromethane	mg/kg	0.10	ND	ND	ND	- -
2-Chlorotoluene	mg/kg	0.010	ND	ND	ND	- -
4-Chlorotoluene	mg/kg	0.010	ND	ND	ND	- -
1,2-Dibromo-3-chloropropane	mg/kg	0.010	ND	ND	ND	- -
1,2-Dibromoethane	mg/kg	0.010	ND	ND	ND	- -
Dibromomethane	mg/kg	0.010	ND	ND	ND	- -
1,2-Dichlorobenzene	mg/kg	0.010	ND	ND	ND	0.18
1,3-Dichlorobenzene	mg/kg	0.010	ND	ND	ND	- -
1,4-Dichlorobenzene	mg/kg	0.010	ND	ND	ND	0.098
Dichlorodifluoromethane	mg/kg	0.010	ND	ND	ND	- -
1,1-Dichloroethane	mg/kg	0.010	ND	ND	ND	- -
1,2-Dichloroethane	mg/kg	0.010	ND	ND	ND	0.0027
1,1-Dichloroethene	mg/kg	0.010	ND	ND	ND	0.021
cis-1,2-Dichloroethene	mg/kg	0.010	ND	ND	ND	- -
trans-1,2-Dichloroethene	mg/kg	0.010	ND	ND	ND	- -
Methylene chloride	mg/kg	0.010	ND	0.013	ND	0.095
1,2-Dichloropropane	mg/kg	0.010	ND	ND	ND	- -
1,3-Dichloropropane	mg/kg	0.010	ND	ND	ND	- -
2,2-Dichloropropane	mg/kg	0.010	ND	ND	ND	- -
1,1-Dichloropropene	mg/kg	0.010	ND	ND	ND	- -
cis-1,3-Dichloropropene	mg/kg	0.010	ND	ND	ND	- -
trans-1,3-Dichloropropene	mg/kg	0.010	ND	ND	ND	- -
Ethylbenzene	mg/kg	0.010	ND	ND	ND	0.21
Hexachlorobutadiene	mg/kg	0.010	ND	ND	ND	0.0067
Isopropylbenzene	mg/kg	0.010	ND	ND	ND	- -
p-Isopropyltoluene	mg/kg	0.010	ND	0.019	ND	- -
n-Propylbenzene	mg/kg	0.010	ND	ND	ND	- -
Styrene	mg/kg	0.010	ND	ND	ND	0.8
1,1,1,2-Tetrachloroethane	mg/kg	0.010	ND	ND	ND	- -
1,1,2,2-Tetrachloroethane	mg/kg	0.050	ND	ND	ND	- -
Tetrachloroethene	mg/kg	0.010	ND	ND	ND	0.16
Toluene	mg/kg	0.010	0.021	ND	ND	0.49
1,2,3-Trichlorobenzene	mg/kg	0.010	ND	ND	ND	0.26
1,2,4-Trichlorobenzene	mg/kg	0.010 - 0.020	ND	ND	ND	0.23
1,1,1-Trichloroethane	mg/kg	0.010	ND	ND	ND	- -
1,1,2-Trichloroethane	mg/kg	0.010	ND	ND	ND	- -
Trichloroethene	mg/kg	0.010	ND	ND	ND	0.012
Trichlorofluoromethane	mg/kg	0.010	ND	ND	ND	- -
1,2,3-Trichloropropane	mg/kg	0.020	ND	ND	ND	- -
1,2,4-Trimethylbenzene	mg/kg	0.010	ND	0.083	ND	- -
1,3,5-Trimethylbenzene	mg/kg	0.010	ND	0.027	ND	- -
Vinyl chloride	mg/kg	0.20	ND	ND	ND	0.00034
Xylenes	mg/kg	0.1	ND	ND	ND	12

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the reference criteria.
4) Bold & Shaded - Exceeds the referenced Alberta Tier 1 and CCME guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4A
Groundwater Indices at Time of Sampling

Monitoring Well	pH	Electrical Conductivity (µg/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Total Dissolved Solid (mg/L)	Redox (±mV)
MW-01	6.84	894	11.4	2.29	786.50	-17.3
MW-02	6.94	672	11.8	1.57	585.00	-65.2
MW-03	6.85	1,206	9.6	0.87	1,111.50	-46.6
MW-04	6.90	1,028	9.2	1.80	955.50	+57.2
MW-05	7.13	1,047	6.8	0.62	1,040.00	-52.2

Notes:

1) Samples collected on August 9, 2013
2) Groundwater indies measured by YSI Pro Plus multi-meter.

Table 4B
Analytical Results - Groundwater - General Water Quality

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-03	MW-04	MW-05	Tier 1 Guideline
			08/09/2013					
General Water Quality								
Biochemical Oxygen Demand	mg/L	2.0	3.4	ND	ND	2.9	ND	- -
Chemical Oxygen Demand	mg/L	5.0	260	70	26	190	58	- -
Conductivity	µS/cm	1.0	1,200	910	1,800	1,500	1,600	- -
pH	Unitless	0.1	7.72	7.84	7.66	7.81	7.85	6.5 - 8.5
Total Organic Carbon (C)	mg/L	0.50	9.4	7.5	4.5	8.4	4.1	- -
Dissolved Cadmium (Cd)	µg/L	0.005	NT	NT	0.057	0.058	0.029	- -
Total Cadmium (Cd)	µg/L	0.0050	**1.1**	**0.39**	**0.055**	**1.5**	**0.19**	0.060*
Alkalinity ($CaCO_3$)	mg/L	0.50	460	370	580	500	460	- -
Bicarbonate (HCO_3)	mg/L	0.50	560	450	710	600	560	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	ND	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	ND	ND	ND	- -
Sulphates (SO_4)	mg/L	1.0	140	54	89	130	60	- -
Chlorides (Cl)	mg/L	2.0	40	37	190	130	210	- -
Total Ammonia (NH_3-N)	mg/L	0.050	0.26	0.23	0.19	0.11	0.060	1.37*
Total Phosphorus (P)	mg/L	0.030	2.6	0.26	ND	2.2	0.21	- -
Total Nitrogen (N)	mg/L	0.050	17	1.6	0.51	18	0.49	- -
Total Kjeldahl Nitrogen (TKN)	mg/L	0.50	17	1.6	0.38	17	0.47	- -
Nitrite (NO_2)	mg/L	0.0030	0.0050	ND	0.0070	0.0060	ND	- -
Nitrate (NO_3)	mg/L	0.0030	0.033	ND	0.12	0.58	0.017	- -
Nitrate plus Nitrite (N)	mg/L	0.0030	0.038	ND	0.13	0.59	0.017	- -
Trace Organics								
Acetic Acid	mg/L	50	NT	NT	ND	ND	ND	- -
Formic Acid	mg/L	50	NT	NT	ND	ND	ND	- -
Propionic Acid	mg/L	50	NT	NT	ND	ND	ND	- -
Adsorbable Organic Halogen	mg/L	0.004	NT	NT	0.090	0.087	0.427	- -

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential land use.
2) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) guidelines are referenced.
3) ND - Not Detected, less than the limit of method detection.
4) NT - Not Tested.
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds the referenced Alberta Tier 1 and CCME guidelines.
7) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4C
Analytical Results - Groundwater - Metals

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-03	MW-04	MW-05	Tier 1 Guideline
			08/09/2013					
Total Metals								
Aluminum (Al)	mg/L	0.0030	**6.4**	**5.0**	0.037	**24**	**3.4**	0.1*
Antimony (Sb)	mg/L	0.00060	0.0011	0.00072	ND	0.0011	0.00064	0.006
Arsenic (As)	mg/L	0.00020	**0.014**	**0.011**	**0.0067**	**0.039**	0.0047	0.005
Barium (Ba)	mg/L	0.010	0.43	0.39	0.25	**1.2**	0.26	1
Beryllium (Be)	mg/L	0.0010	ND	ND	ND	0.0024	ND	- -
Boron (B)	mg/L	0.020	0.079	0.052	0.20	0.27	0.056	1.5
Calcium (Ca)	mg/L	0.30	260	120	220	440	190	- -
Chromium (Cr)	mg/L	0.0010	**0.020**	**0.0082**	ND	**0.097**	**0.010**	0.001*
Cobalt (Co)	mg/L	0.00030	0.017	0.0053	0.0019	0.028	0.0045	- -
Copper (Cu)	mg/L	0.00020	**0.038**	**0.012**	0.0011	**0.074**	**0.0098**	0.003*
Iron (Fe)	mg/L	0.060	**23**	**12**	**7.5**	**83**	**8.2**	0.3
Lead (Pb)	mg/L	0.00020	**0.024**	**0.011**	ND	**0.044**	**0.0043**	0.004*
Lithium (Li)	mg/L	0.020	0.021	0.021	0.024	0.069	0.031	- -
Magnesium (Mg)	mg/L	0.20	46	32	44	110	47	- -
Manganese (Mn)	mg/L	0.0040	**3.2**	**1.6**	**0.66**	**2.9**	**0.48**	0.05
Molybdenum (Mo)	mg/L	0.00020	0.0045	0.0038	0.0012	0.0071	0.0030	- -
Nickel (Ni)	mg/L	0.00050	0.040	0.013	0.0057	0.084	0.013	0.11*
Phosphorus (P)	mg/L	0.10	0.93	0.32	ND	2.6	0.29	- -
Potassium (K)	mg/L	0.30	4.8	4.3	4.3	10	5.9	- -
Selenium (Se)	mg/L	0.00020	**0.0013**	0.00062	ND	**0.0053**	0.00080	0.001
Silicon (Si)	mg/L	0.10	19	18	7.0	58	13	- -
Silver (Ag)	mg/L	0.00010	**0.00028**	ND	ND	**0.00071**	**0.00012**	0.0001*
Sodium (Na)	mg/L	0.50	55	54	110	69	110	- -
Strontium (Sr)	mg/L	0.020	0.61	0.81	0.94	1.2	0.85	- -
Sulphur (S)	mg/L	0.20	39	18	29	42	20	- -
Thallium (Tl)	mg/L	0.00020	ND	ND	ND	0.00036	ND	- -
Tin (Sn)	mg/L	0.0010	ND	0.0011	ND	0.0021	ND	- -
Titanium (Ti)	mg/L	0.0010	0.076	0.10	0.0020	0.21	0.10	- -
Uranium (U)	mg/L	0.00010	0.0045	0.0020	0.0030	0.0077	0.0043	0.02
Vanadium (V)	mg/L	0.0010	0.023	0.011	0.0011	0.083	0.011	- -
Zinc (Zn)	mg/L	0.0030	**0.11**	**0.062**	0.0072	**0.25**	**0.039**	0.03
Dissolved Metals								
Aluminum (Al)	mg/L	0.0030	NT	NT	ND	0.0035	ND	- -
Antimony (Sb)	mg/L	0.00060	NT	NT	ND	ND	ND	- -
Arsenic (As)	mg/L	0.00020	NT	NT	0.0060	0.00022	0.00055	- -
Barium (Ba)	mg/L	0.010	NT	NT	0.25	0.13	0.15	- -
Beryllium (Be)	mg/L	0.0010	NT	NT	ND	ND	ND	- -
Boron (B)	mg/L	0.020	NT	NT	0.18	0.23	0.041	- -
Calcium (Ca)	mg/L	0.30	NT	NT	220	200	170	- -
Chromium (Cr)	mg/L	0.0010	NT	NT	ND	ND	ND	- -
Cobalt (Co)	mg/L	0.00030	NT	NT	0.0015	0.00062	0.0015	- -
Copper (Cu)	mg/L	0.00020	NT	NT	0.0018	0.0023	0.0012	- -
Iron (Fe)	mg/L	0.060	NT	NT	7.3	ND	0.32	- -
Lead (Pb)	mg/L	0.00020	NT	NT	ND	ND	ND	- -
Lithium (Li)	mg/L	0.020	NT	NT	0.023	0.027	0.026	- -
Magnesium (Mg)	mg/L	0.20	NT	NT	41	44	43	- -
Manganese (Mn)	mg/L	0.0040	NT	NT	0.59	0.11	0.31	- -
Molybdenum (Mo)	mg/L	0.00020	NT	NT	0.0013	0.00099	0.0023	- -
Nickel (Ni)	mg/L	0.00050	NT	NT	0.0049	0.0043	0.0031	- -
Phosphorus (P)	mg/L	0.10	NT	NT	ND	ND	ND	- -
Potassium (K)	mg/L	0.30	NT	NT	4.2	5.4	5.2	- -
Selenium (Se)	mg/L	0.00020	NT	NT	ND	0.0025	0.00031	- -
Silicon (Si)	mg/L	0.10	NT	NT	6.2	4.9	4.9	- -
Silver (Ag)	mg/L	0.00010	NT	NT	ND	ND	ND	- -
Sodium (Na)	mg/L	0.50	NT	NT	100	68	110	- -
Strontium (Sr)	mg/L	0.020	NT	NT	0.91	0.91	0.81	- -
Sulphur (S)	mg/L	0.20	NT	NT	26	40	19	- -
Thallium (Tl)	mg/L	0.00020	NT	NT	ND	ND	ND	- -
Tin (Sn)	mg/L	0.0010	NT	NT	ND	ND	ND	- -
Titanium (Ti)	mg/L	0.0010	NT	NT	ND	ND	ND	- -
Uranium (U)	mg/L	0.00010	NT	NT	0.0027	0.0042	0.0036	- -
Vanadium (V)	mg/L	0.0010	NT	NT	ND	ND	ND	- -
Zinc (Zn)	mg/L	0.0030	NT	NT	0.0099	0.0041	0.0060	- -

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential land use.
2) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) guidelines are referenced.
3) ND - Not Detected, less than the limit of method detection.
4) NT - Not Tested.
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds the referenced Alberta Tier 1 and CCME guidelines.
7) For further laboratory information, refer to specific laboratory report in Appendix A.

Table 4D
Analytical Results - Groundwater - VOCs

Parameter	Detection Limit	MW-01	MW-02	MW-03	MW-04	MW-05	Tier 1 Guideline
		08/09/2013					
Volatiles							
Benzene	0.00040	ND	ND	ND	ND	ND	0.005
Toluene	0.00040	ND	ND	ND	ND	ND	0.024
Ethylbenzene	0.00040	ND	ND	ND	ND	ND	0.0024
Xylenes (Total)	0.00080	ND	ND	ND	ND	ND	0.3
F1 (C_6-C_{10})	0.10	ND	ND	ND	ND	ND	0.81
F2 (C_{10}-C_{16})	0.10	ND	ND	ND	ND	ND	1.1
Total Trihalomethanes	0.0020	ND	ND	ND	ND	ND	0.1
Bromodichloromethane	0.00050	ND	ND	ND	ND	ND	- -
Bromoform	0.00050	ND	ND	ND	ND	ND	- -
Bromomethane	0.0020	ND	ND	ND	ND	ND	- -
Carbon tetrachloride	0.00050	ND	ND	ND	ND	ND	0.00056
Chlorobenzene	0.00050	ND	ND	ND	ND	ND	0.0013
Chlorodibromomethane	0.0010	ND	ND	ND	ND	ND	- -
Chloroethane	0.0010	ND	ND	ND	ND	ND	- -
Chloroform	0.00050	ND	ND	ND	ND	ND	0.0018
Chloromethane	0.0020	ND	ND	ND	ND	ND	- -
1,2-dibromoethane	0.00050	ND	ND	ND	ND	ND	- -
1,2-dichlorobenzene	0.00050	ND	ND	ND	ND	ND	0.0007
1,3-dichlorobenzene	0.00050	ND	ND	ND	ND	ND	- -
1,4-dichlorobenzene	0.00050	ND	ND	ND	ND	ND	0.001
1,1-dichloroethane	0.00050	ND	ND	ND	ND	ND	- -
1,2-dichloroethane	0.00050	ND	ND	ND	ND	ND	0.005
1,1-dichloroethene	0.00050	ND	ND	ND	ND	ND	0.014
cis-1,2-dichloroethene	0.00050	ND	ND	ND	ND	ND	- -
trans-1,2-dichloroethene	0.00050	ND	ND	ND	ND	ND	- -
Dichloromethane	0.0020	ND	ND	ND	ND	ND	0.05
1,2-dichloropropane	0.00050	ND	ND	ND	ND	ND	- -
cis-1,3-dichloropropene	0.00050	ND	ND	ND	ND	ND	- -
trans-1,3-dichloropropene	0.00050	ND	ND	ND	ND	ND	- -
Methyl methacrylate	0.00050	ND	ND	ND	ND	ND	0.47
Methyl-tert-butylether (MTBE)	0.00050	ND	ND	ND	ND	ND	0.015
Styrene	0.00050	ND	ND	ND	ND	ND	0.072
1,1,1,2-tetrachloroethane	0.0020	ND	ND	ND	ND	ND	- -
1,1,2,2-tetrachloroethane	0.0020	ND	ND	ND	ND	ND	- -
Tetrachloroethene	0.00050	ND	ND	ND	ND	ND	0.03
1,2,3-trichlorobenzene	0.0010	ND	ND	ND	ND	ND	0.008
1,2,4-trichlorobenzene	0.0010	ND	ND	ND	ND	ND	0.015
1,3,5-trichlorobenzene	0.00050	ND	ND	ND	ND	ND	0.014
1,1,1-trichloroethane	0.00050	ND	ND	ND	ND	ND	- -
1,1,2-trichloroethane	0.00050	ND	ND	ND	ND	ND	- -
Trichloroethene	0.00050	ND	ND	ND	ND	ND	0.005
Trichlorofluoromethane	0.00050	ND	ND	ND	ND	ND	- -
1,2,4-trimethylbenzene	0.00050	ND	ND	ND	ND	ND	- -
1,3,5-trimethylbenzene	0.00050	ND	ND	ND	ND	ND	- -
Vinyl chloride	0.00050	ND	ND	ND	ND	ND	0.0011

Notes:

1) Tier 1 Guideline- Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) ND - Not Detected, less than the limit of method detection.
3) Unless specified all units are mg/L
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 and CCME guidelines.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 5A

Summary of Parameters Measured During Sampling of Soil Vapour

Parameter	Well Diameter	Well Depth	Headspace Volume	Purge Rate	Purge Time	Pressure	
Unit	(mm)	(m)	(cm^3)	(cm^3/min)	(min)	Ambient (psi)	Vapour Well (psi)
VW-01	25	3.7	1,816	943.30	6	15.26	15.26
VW-02	25	2.7	1,325	943.30	5.3	15.17	15.19

Notes:

1) Measurement of pressure by digital Cole-Parmer absolute pressure gauge.
2) Purge time is minimum elapsed time prior to the collection of a soil vapour sample.
3) Screen set at base of well.
4) Soil vapour sampling was completed Friday, August 9, 2013.

Table 5B

Analytical Results - Soil Vapour - General Indices

Parameter	Unit	Detection Limit	VW-01	VW-02
			08/09/2013	
Gauge Pressure				
Pressure after sampling	psi	- -	-5.0	-5.0
Pressure on receipt	psig	- -	-2.9	-3.6
Fixed Gases				
Oxygen	% v/v	0.2	13.4	19.9
Nitrogen	% v/v	0.2	84.6	78.5
Carbon Monoxide	% v/v	0.2	ND	ND
Methane	% v/v	0.2	ND	ND
Carbon Dioxide	% v/v	0.2	2.1	1.7

Notes:

1) Results are from sampling performed on Friday, August 09, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit.
4) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5C
Analytical Results - Soil Vapour - VOCs

Parameter	Unit	Detection Limit	VW-01	VW-02
			08/09/2013	
Hydrocarbon Fractions				
Aliphatic >C_5-C_6	μg/m^3	5.0	6.1	5.8
Aliphatic >C_6-C_8	μg/m^3	5.0	18.9	20.1
Aliphatic >C_8-C_{10}	μg/m^3	5.0	34.2	57.8
Aliphatic >C_{10}-C_{12}	μg/m^3	5.0	62.9	122
Aliphatic >C_{12}-C_{16}	μg/m^3	5.0	10.1	28.0
Aromatic >C_7-C_8 (TEX Excluded)	μg/m^3	5.0	ND	ND
Aromatic >C_8-C_{10}	μg/m^3	5.0	13.6	31.7
Aromatic >C_{10}-C_{12}	μg/m^3	5.0	17.0	36.0
Aromatic >C_{12}-C_{16}	μg/m^3	5.0	ND	ND
Select Volatile Gases				
Acetylene	ppm	0.21 - 0.22	ND	ND
Ethane	ppm	0.21 - 0.22	ND	0.33
Ethylene	ppm	0.21 - 0.22	ND	ND
Methane	ppm	4.2 - 4.5	32	8.8
n-Butane	ppm	0.42 - 0.45	ND	ND
n-Pentane	ppm	0.21 - 0.22	ND	ND
Propane	ppm	0.21 - 0.22	ND	ND
Propene	ppm	0.21 - 0.22	ND	ND
Propyne	ppm	0.42 - 0.45	ND	ND
Volatile Organic Compounds				
Dichlorodifluoromethane (FREON 12)	ppbv	0.2	0.86	0.73
1,2-Dichlorotetrafluoroethane	ppbv	0.2	ND	ND
Chloromethane	ppbv	0.3	0.56	0.52
Vinyl Chloride	ppbv	0.2	ND	ND
Chloroethane	ppbv	0.3	ND	ND
1,3-Butadiene	ppbv	0.5	ND	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.2	0.32	0.38
Ethanol (ethyl alcohol)	ppbv	4.6 - 9.2	177	331
Trichlorotrifluoroethane	ppbv	0.2	ND	ND
2-propanol	ppbv	3.0	ND	ND
2-Propanone	ppbv	0.8	11.6	15.9
Methyl Ethyl Ketone (2-Butanone)	ppbv	3.0	ND	ND
Methyl Isobutyl Ketone	ppbv	3.2	ND	ND
Methyl Butyl Ketone (2-Hexanone)	ppbv	2.0	ND	ND
Methyl t-butyl ether (MTBE)	ppbv	0.2	ND	0.33
Ethyl Acetate	ppbv	2.2	ND	ND
1,1-Dichloroethylene	ppbv	0.3	ND	ND
cis-1,2-Dichloroethylene	ppbv	0.2	ND	ND
trans-1,2-Dichloroethylene	ppbv	0.2	ND	ND
Methylene Chloride(Dichloromethane)	ppbv	0.8	ND	ND
Chloroform	ppbv	0.3	0.87	0.42
Carbon Tetrachloride	ppbv	0.3	ND	ND
1,1-Dichloroethane	ppbv	0.2	ND	ND
1,2-Dichloroethane	ppbv	0.2	ND	ND
Ethylene Dibromide	ppbv	0.2	ND	ND
1,1,1-Trichloroethane	ppbv	0.3	ND	ND
1,1,2-Trichloroethane	ppbv	0.2	ND	ND
1,1,2,2-Tetrachloroethane	ppbv	0.2	ND	ND
cis-1,3-Dichloropropene	ppbv	0.2	ND	ND
trans-1,3-Dichloropropene	ppbv	0.2	ND	ND
1,2-Dichloropropane	ppbv	0.4	ND	ND
Bromomethane	ppbv	0.2	ND	ND
Bromoform	ppbv	0.2	ND	ND
Bromodichloromethane	ppbv	0.2	ND	ND
Dibromochloromethane	ppbv	0.2	ND	ND
Trichloroethylene	ppbv	3.0	ND	ND
Tetrachloroethylene	ppbv	0.2	3.65	3.17
Benzene	ppbv	0.2	0.71	0.59
Toluene	ppbv	0.2	3.08	3.34
Ethylbenzene	ppbv	0.2	0.44	0.73
p+m-Xylene	ppbv	0.4	1.73	3.28
o-Xylene	ppbv	0.2	0.74	1.33
Styrene	ppbv	0.2	ND	ND
4-ethyltoluene	ppbv	2.2	ND	ND
1,3,5-Trimethylbenzene	ppbv	0.5	ND	0.60
1,2,4-Trimethylbenzene	ppbv	0.5	0.52	0.88
Chlorobenzene	ppbv	0.2	ND	ND
Benzyl chloride	ppbv	1.0	ND	ND
1,3-Dichlorobenzene	ppbv	0.4	ND	ND
1,4-Dichlorobenzene	ppbv	0.4	ND	ND
1,2-Dichlorobenzene	ppbv	0.4	ND	ND
1,2,4-Trichlorobenzene	ppbv	2.0	ND	ND
Hexachlorobutadiene	ppbv	3.0	ND	ND
Hexane	ppbv	0.3	0.72	0.57
Heptane	ppbv	0.3	ND	0.43
Cyclohexane	ppbv	0.2	0.89	ND
Tetrahydrofuran	ppbv	0.4	3.51	6.04
1,4-Dioxane	ppbv	2.0	ND	ND
Xylene (Total)	ppbv	0.6	2.47	4.61
Vinyl Bromide	ppbv	0.2	ND	ND
Propene	ppbv	0.3	ND	ND
2,2,4-Trimethylpentane	ppbv	0.2	0.21	ND
Carbon Disulfide	ppbv	0.5	2.81	1.65
Vinyl Acetate	ppbv	0.2	ND	ND

Notes:

1) Results are from sampling performed on Friday, August 09, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5D
Analytics Results - Soil Vapour - Siloxanes

Parameter	Detection Limit		VW-01		VW-02	
			08/09/2013			
	mg/m^3	ppm	mg/m^3	ppm	mg/m^3	ppm
Trimethylsilyl Fluoride	- -		ND	ND	ND	ND
Tetramethylsilane	0.0001	0.0002	ND	ND	ND	ND
Methoxytrimethylsilane	0.0033 - 0.0043	0.0008 - 0.0010	ND	ND	ND	ND
Ethoxytrimethylsilane	0.0032 - 0.0042	0.0007 - 0.0009	ND	ND	ND	ND
Trimethylsilanol	- -	- -	0.0284	0.0077	0.0077	0.0021
Isopropoxytrimethylsilane	0.0013 - 0.0018	0.0002 - 0.0003	ND	ND	ND	ND
Trimethoxymethyl Silane #	- -	- -	ND	ND	ND	ND
Hexamethyl Disiloxane - L2	0.0001 - 000002	0.0001	ND	ND	ND	ND
Propoxytrimethylsilane	0.0036 - 0.0048	0.0007 - 0.0009	ND	ND	ND	ND
1-Methylbutoxytrimethylsilane *	- -	- -	ND	ND	ND	ND
Butoxytrimethylsilane *	- -	- -	ND	ND	ND	ND
Trimethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	- -	0.0172	0.0019	0.0119	0.0013
Octamethyl Trisiloxane - L3	0.0002 - 0.0003	0.0001	ND	ND	ND	ND
Triethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND
Triethoxyethyl Silane #	- -	- -	ND	ND	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	- -	0.0118	0.0010	0.0098	0.0008
Decamethyl Tetrasiloxane - L4	0.0003 - 0.0004	0.0001	ND	ND	ND	ND
Tetraethylsilicate #	- -	- -	ND	ND	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	- -	0.0201	0.0013	0.0644	0.0042
Dodecamethyl Pentasiloxane - L5	0.0031 - 0.0040	0.0002 - 0.0003	ND	ND	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	- -	- -	0.0422	0.0023	0.0718	0.0040
Sum	- -	- -	0.1349	0.0169	0.1856	0.0159

Notes:

1) Soil vapour samples collected on Friday, August 09, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit.
4) V=200 mL, where V is volume of air/gas sampled.
5) * - Semiquanititative (response factor set at 5).
6) # - Unstable, poor detectability, commercial standards tested.
7) For further information, the reader should refer to the laboratory report in Appendix A.