2022 and 2023 Groundwater and Soil Vapour Monitoring Report
Red Deer Motors Site
SE 08-38-27 W4M

PRESENTED TO
City of Red Deer

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EXECUTIVE SUMMARY

The City of Red Deer (The City) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct the 2022 and 2023 groundwater and vapour monitoring program at a former landfill located at legal location Lot 3MR, Block 2, Plan 8422279 within the southeast quarter of Section 08-38-27 W4M. The site is known as the Red Deer Motors (RDM) historical waste disposal site, here in after referred to as the site.

The objectives of the monitoring program are to assess the environmental condition of the site and potential impacts on the environment and adjacent receptors from potential risks related to the site's former use as a landfill and to provide recommendations related to risk management activities at the site.

The current groundwater monitoring network at the site consists of six monitoring wells (MW-01, MW-02, MW-03, MW-04A, MW-04B, and MW-05). The current vapour monitoring network consists of three vapour monitoring wells (VW-01, VW-02, and VW-04); VW-01 and VW-02 and were installed in 2013 and VW-04 was installed in 2021. VW-04 was installed on the northeast side of the site to replace VW-03, which was likely destroyed during the development of the parking lot on the property directly to the east of the site. VW-04 was reinstalled in the same borehole in 2022 to a shallower depth. Groundwater samples from monitoring wells MW-01, MW-04A, and MW-05 and a soil vapour sample from VW-04 were collected and analyzed in 2022.

Tetra Tech's scope of work for the 2022 and 2023 monitoring and sampling program at the RDM site included conducting semi-annual vapour monitoring, annual groundwater sampling, annual vapour sampling, reinstalling VW-04, updating the hazard quotients, reviewing and updating previous recommendations for the site, and preparing an annual report. The analytical groundwater parameters included pH, electrical conductivity (EC), major ions, total dissolved solids (TDS), nutrients, dissolved metals, phenol, benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbon (PHC) fractions F1 and F2, and volatile organic compounds (VOCs). The analytical vapour well parameters included matrix gases including oxygen, carbon dioxide, methane, and nitrogen, VOCs, BTEX, and PHCs.

Key findings of the 2022 and 2023 environmental monitoring program and conclusions include the following:

- The groundwater elevation contours for December 2022 infer the groundwater flow is directed towards the west-northwest and Waskasoo Creek, which is consistent with previous findings.
- Monitoring well MW-02 was located in 2021 and included in the monitoring. The analytical results from MW-02 suggest that it is an appropriate background groundwater monitoring well and is not interpreted to have quality impacts related to municipal solid waste (MSW) landfill leachate; therefore, the well was not sampled in 2022.
- There is evidence of impact to groundwater by leachate at MW-01, MW-04A, and MW-05, similar to the previous results:
  - Parameters that exceeded the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines) at one or more groundwater monitoring wells in 2022 included TDS, sodium, chloride, and dissolved arsenic, iron, manganese, and uranium. Concentrations of the VOC vinyl chloride was also greater than the Tier 1 Guidelines at MW-01 and MW-05. In addition, detectable concentrations of chlorinated VOCs for which no Tier 1 Guidelines has been established [cis and trans 1,2- dichloroethane (1,2-DCE)] were measured at MW-01, MW-04A (cis 1,2-DCE only), and MW-05. The measured concentrations of one or more of these parameters suggest leachate has impacted the groundwater quality at MW-01, MW-04A, and MW-05. The measured concentrations of these parameters were consistent with previous results.

  - During the December 2022 sampling events, chloride concentrations greater than the Tier 1 Guidelines (120 mg/L) were measured at monitoring wells MW-01, MW-04A, and MW-05, and the concentrations were consistent with previous results. The highest chloride concentration was 349 mg/L at MW-04A.

  - Concentrations of toluene, ethylbenzene, xylenes, and PHC fractions F1 and F2 in 2022 were less than the analytical detection limits at all groundwater monitoring wells. Benzene was detected at MW-01 (0.00116 mg/L) and at MW-05 (0.00132 mg/L); however, the concentrations were less than the Tier 1 Guidelines value of 0.005 mg/L.

- Landfill gas (LFG) is present beneath the site at perimeter locations, similar to previous results:

  - Field measured concentrations of methane were not detected at VW-01 or VW-02 in December 2022; however, the integrity of VW-01 is suspected to be compromised and the results are not considered representative of in situ conditions. Historically methane concentrations greater than the lower explosive limit (LEL) were measured at this location. The methane concentration at VW-04 was 30.3% in December 2022 and 9.7% in June 2023. Both VW-01 and VW-04 are situated within the waste footprint, and concentrations in native soils beyond the footprint are not known. Soil vapour well VW-04 was reinstalled in the same borehole in December 2022 as it had water levels above the top of the screened interval during previous monitoring events.

  - The soil vapour sample collected from VW-04 in November 2021 did not exceed the corresponding target risk and hazard levels. The measured concentrations of dichlorodifluoromethane and vinyl chloride in December 2022 at this location were greater than the screening criteria and concentrations of these parameters increased in 2022 for both parameters compared to 2021. It should be noted that the vapour well was reinstalled to a shallower depth (in the same borehole) in December 2022 and the recent results are likely more representative of in situ conditions.

  - The cumulative risk level for carcinogens in the 2022 sample from VW-04 was 1.6×10^{-4}, which was greater than the target risk level of 1×10^{-5}. The cumulative hazard level identified in the sample from VW-04 for the non-carcinogens was 2.68 which is greater than the target of 1.0. Several individual hazard levels in the sample from VW-04 were greater than the individual target of 0.2. Historically, risk and hazard levels were similarly exceeded at VW-01.

Based on the above, the groundwater at interpreted hydraulically down-gradient locations (MW-01, MW-04A, and MW-05) was identified to exhibit leachate impacts; however, the 2022 results were similar to 2019 and 2021. The groundwater at the background monitoring well (MW-02) does not exhibit leachate impacts. In 2021, one of the two vapour wells (VW-01, situated in the northwest corner of the site) exhibited impacts by LFG, as evidenced by elevated methane and PHCs. In the 2021 groundwater and soil vapour monitoring report, this was not identified as a concern related to current developments near the site. No new information for VW-01 was obtained due to suspected well integrity issues. Should a change in development be contemplated, or based on future soil vapour sampling information, this conclusion may need to be revised.

Soil vapour results at VW-04 show elevated VOC concentrations above the vapour screening level and the measured concentrations exceeded the individual and/or cumulative risks and hazards.

The results of the groundwater and vapour monitoring program in 2022 and previous years, indicate there are residual impacts to groundwater and vapours, and buried landfill waste remains in place beneath the site; therefore, ongoing risk management is required. Risk management is recommended to include ongoing monitoring and administrative actions.

The following recommendations are made according to these risk management elements.

Ongoing Monitoring:

- Monitoring wells MW-01, MW-04A, and MW-05 should continue to be sampled for routine groundwater chemistry parameters, dissolved metals, BTEX, PHC fractions F1 and F2, and VOCs following the proposed schedule provided below.
- Continued vapour monitoring is considered warranted to confirm conditions following the proposed schedule provided below. The suggested monitoring included measurements of headspace pressures and methane concentrations in the vapour wells and headspace methane concentrations in the monitoring wells. VW-01 appears to be compromised and is recommended to be reinstalled.
- Based on the results of the soil vapour sample from VW-01 in 2021 and the results of the soil vapour sample at VW-04 in 2022, there is a potential vapour intrusion risk in the northwest and northeast corners of the site from PHCs and/or VOCs. Continued vapour sampling of VW-01 and VW-04 is recommended following the proposed schedule provided below.
- Conduct annual groundwater and vapour monitoring and sampling program at the site in 2024 to confirm concentrations measured to date and to monitor trends. If results remain consistent, reduce the monitoring and sampling frequency over time, as illustrated in the table below.

Proposed Groundwater and Vapour Monitoring Program

Activity	2024	2025	2026	2027	2028	2029	2030	2031
Annual (Summer) Groundwater Monitoring and Sampling Event of Three Monitoring Wells	X			X				X
Annual (Winter) Vapour Monitoring and Sampling Event of Two Vapour Wells	X			X				X

Additional Assessment:

- Based on the thin soil cover identified in the earlier work by Tiamat Environmental Consultants Ltd. (Tiamat), continue to conduct a basic site walkover during field monitoring events to document potential erosion, cracking, and/or exposed wastes. This information may be used to evaluate whether potential repairs to the cap are warranted.

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.
- Ensure that the site is clearly identified within The City's utility mapping system. Elevated gas concentrations are present in the subsurface proximate to the 32 Street right-of-way (ROW). Future activities in this vicinity (e.g., utility work, repairs, paving) should consider the potential presence of gas and a site-specific safety plan should be developed for work undertaken to limit the potential for exposure to site workers.

Further to the above recommendations, as noted, the site remains an historical landfill. 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 2022 and 2023 groundwater and vapour monitoring program at a former landfill located at legal location Lot 3MR, Block 2, Plan 8422279 within the southeast quarter of Section 08-38-27 W4M. The site is known as the Red Deer Motors (RDM) historical waste disposal site, here in after referred to as the site.

The scope for 2022 and 2023 presented in Section 1.1 was based on Tetra Tech's 2021 groundwater and soil vapour monitoring and sampling program conducted at the site. Those results were presented and discussed in the 2021 Groundwater and Soil Vapour Monitoring Report – Red Deer Motors Site (Tetra Tech 2022a).

The objectives of the monitoring program are to assess the environmental condition of the site and potential impacts on the environment and adjacent receptors from potential risks related to the sites former use as a landfill and to provide recommendations related to risk management activities at the site.

The field components of the monitoring program were completed using Tetra Tech's detailed work plans encompassing the scope of work outlined in Section 1.1 below. The current 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.

1.1 Scope of Work

Based on the 2021 findings and recommendations (Tetra Tech 2022a), the 2022 and 2023 monitoring program scope of work was outlined in a proposal that was sent to The City Deer on October 21, 2022 (Tetra Tech 2022b). The work conducted in 2022 and 2023 included the following activities:

- Conducting annual vapour monitoring events (December 2022 and June 2023), including measuring headspace vapours and groundwater levels within each vapour monitoring well and observing monitoring well integrity. Prior to monitoring, well materials of soil vapour well VW-04 were removed and the well was reinstalled in the same borehole in December 2022.
- Conducting one vapour sampling event by collecting a vapour sample into a Summa canister for analysis from VW-04.
- Conducting an annual groundwater monitoring event in December 2022 at six monitoring wells, including measuring methane concentrations in headspace vapours and groundwater levels within each groundwater monitoring well and observing monitoring well integrity.
- Conducting one groundwater sampling event in December 2022 at three monitoring wells (MW-01, MW-04A, and MW-05). At the time of sampling, field measurements for electrical conductivity (EC), pH, and temperature were recorded. The samples were then submitted for laboratory chemical analyses. The 2021 report recommended that monitoring well MW-02 be excluded from the sampling program; therefore, the well was not sampled in 2022.
- Collecting one duplicate groundwater sample for quality assurance/quality control (QA/QC) purposes.
- Conducting monitoring well repairs, as required.
- Completing site walkovers during each monitoring event to evaluate the cover for potential erosion, cracking, and/or exposed wastes.
- Preparing an annual report summarizing the field activities, interpreting the groundwater and soil vapour analytical results, updating soil vapour screening criteria, updating the hazard quotients, and providing recommendations for future monitoring activities at the site.

2.0 BACKGROUND INFORMATION

2.1 General Information

The site is located within SE 08-38-27 W4M, at Lot 3MR Block 2 Plan 8422279. The site location is shown on Figure 1. The site is zoned A2 – Environmental Preservation District and is across Taylor Drive from Red Deer Polytechnic. The site is located east of Taylor Drive and Waskasoo Creek, south of 32 Street and south and west of commercial buildings. A general site plan is shown on Figure 2. The site is undeveloped and consists of natural areas including, grasses, trees, and shrubs with power lines extending north to south on the west side. Additional information on the site history, historical groundwater monitoring investigations, geology and hydrogeology can be found in Appendix B. Cross-sections that were prepared using the wells previously installed at the site in 2013 are included in Appendix C [from Tiamat Environmental Consultants Ltd. (Tiamat) 2014]. Borehole logs are included in Appendix F.

2.2 2023 Conceptual Site Model Summary

The selection of comparative guidelines is based on the conceptual site model (CSM), which outlines the rationale for the selection of applicable exposure pathways and receptors at the site. This evaluation is based on guidance presented in the Alberta Tier 1 Soil and Groundwater Remediation Guidelines [Tier 1 Guidelines, Alberta Environment and Parks[1] (AEP) 2022]. The CSM that was described in the 2021 groundwater and soil vapour monitoring report (Tetra Tech 2022a) included 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 chemicals of potential concern (COPCs) identified in earlier investigations.
- Description of known and reported historical releases, including locations and status of any subsequent environmental site assessments (ESAs) and remediation.
- Identification of applicable exposure pathways and receptors.

The CSM is summarized in the following table.

Summary of Exposure Pathways and Receptors for Soil and Groundwater

Release Mechanism	COPC	Migration Pathway	Potential Receptor
Leachate infiltration into foundation soils or seepage through cover.	Inorganic parameters and nutrients, metals, petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs), and other indicator parameters [i.e., biological oxygen demand (BOD) and chemical oxygen demand (COD)].	Direct soil contact.	Human users of the parkland; ecological plants and soil invertebrates.
		Migration to groundwater users (water wells); migration to Waskasoo Creek via groundwater or surface seeps.	Domestic use aquifer (DUA) drinking water; freshwater aquatic life (FAL) in Waskasoo Creek.
		Nutrient and energy cycling.	Microbial functioning of the soil.
Landfill gas (LFG) emissions.	VOCs, methane, benzene, toluene, ethylbenzene, and xylenes (BTEX), PHC fractions, and siloxanes.	Vapour inhalation.	Human users of the parkland; inhabitants of buildings near the parkland; workers in excavations.

[1] Currently Alberta Environment and Protected Areas (AEPA).

2.2.1 Data Evaluation

To establish the appropriate guidelines for the site, residential land use criteria was used. The receptors are a combination of the degree of potential exposure, the exposure pathway, and the contaminants of concern. Human receptor exposures applicable to the site include the direct soil contact, FAL, and inhalation pathways. The ecological receptor exposures applicable to the site include direct soil contact and nutrient and energy cycling. Previous investigations at the site have determined that the dominant soil stratigraphy governing transport at the site is coarse grained.

To determine the appropriate guidelines to compare the vapour sampling results to, indoor air risk calculations were undertaken and methane explosive risks were evaluated.

The CSM determined that the most applicable guidelines for groundwater, surface water, and vapour results for the site included the following:

- Groundwater concentrations at the site were compared to the Tier 1 Guidelines (AEP 2022) under residential and parkland land uses for coarse-grained soils with the FAL pathway included.
- Surface water analytical results were compared to the AEP Environmental Quality Guidelines for Alberta Surface Waters for the most conservative values (chronic or acute) for the protection of FAL (Government of Alberta 2018). Based on previous findings, and as recommended in the 2021 groundwater and soil vapour monitoring report (Tetra Tech 2022a), surface water sampling was not conducted in 2022 and 2023. Surface water quality results for the two sampling events in 2021 are included in Table 4.
- Soil vapour analytical results were compared to soil vapour screening criteria developed from Canadian Council of Minister of the Environment's (CCME's) document A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours (CCME 2014) under residential land use for both slab-on-grade and basement for coarse-grained soils. As part of the 2021 report, the 2019 criteria was updated using the most up to date toxicity reference values (TRVs) from Health Canada (Health Canada 2012) and the United States Environmental Protection Agency (USEPA).

2.3 Monitoring Well and Sampling Network

The current groundwater monitoring network at the site consists of six monitoring wells (MW-01, MW-02, MW-03, MW-04A, MW-04B, and MW-05). Monitoring wells MW-04A, MW-04B, and MW-05 were presumably installed by Alberta Environmental Protection in the 1980s and completion details for these three wells are not known.

Surface water locations along Waskasoo Creek were sampled in 2021 but were not part of the monitoring program in 2022/2023. The locations are identified as SW-01, which is adjacent/downstream to the site, and SW-02, which is upstream of the site.

The current vapour monitoring network consists of three vapour monitoring wells (VW-01, VW-02, and VW-04). Vapour wells VW-01 and VW-02 were installed in 2013 and vapour well VW-04 was installed in 2021 (and reinstalled in 2022).

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

3.0 FIELD METHODOLOGY

3.1 Groundwater Monitoring and Sampling

A discussion of the methods used for the groundwater monitoring and sampling fieldwork and laboratory testing is presented in the following section. In 2022, Tetra Tech conducted groundwater monitoring on December 6 and groundwater sampling was conducted on December 9.

3.1.1 Groundwater Monitoring and Sampling Methodology

Groundwater monitoring consisted of measuring methane in monitoring well headspace, and static groundwater levels in each monitoring well using an electronic water level indicator.

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 methane headspace concentrations in each well using an RKI Eagle Hydrocarbon Surveyor II (RKI Eagle) calibrated to methane.
- Measuring liquid levels in each monitoring well with an interface probe and recording total depths confirming absence of non-aqueous phase liquids (NAPL).
- Recording of 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 required wells using the procedures identified below:

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

3.1.2 Groundwater Analytical Program

The analytical program for the groundwater monitoring wells was developed based on the recommendations in Section 1.1 and is summarized below:

- Routine water chemistry including ammonia.
- Dissolved metals.
- BTEX and PHC fractions F1 and F2.
- VOCs.

3.2 Vapour Field Program

Tetra Tech conducted vapour monitoring and sampling on December 8 and 9, 2022. An additional vapour monitoring event was conducted on June 2, 2023.

On December 8, 2022, the well materials of soil vapour well VW-04 were removed by hand and the well was reinstalled in the same borehole with a hand auger as it was noted to be blinded (installed below the shallow water table) after initial installation. The well was reinstalled within the waste material to a depth of 2.40 m below grade (mbg) with a 1.30 m screen interval.

The second soil vapour well VW-01, located within the northwest corner of the site near monitoring well MW-01 was found to be blinded both in December 2022 and June 2023. Based on the water level recorded at adjacent monitoring well MW-01, the screen of the vapour well is considerably above the water table and field observations suggest the soil vapour well casing is compromised, possibly due to frost heave. The observations and well testing with vapour testing equipment suggest that the compromised casing has allowed surface water to ingress into VW-01 and the well should be reinstalled. Consequently, no soil vapour data was obtained in 2022 and 2023 at VW-01.

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

Each soil vapour probe was 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.

After purging, gas composition measurements for methane, carbon dioxide, oxygen, balance gas, and hydrogen sulphide were recorded using a CES-Landtec GEM 5000 (GEM) LFG 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 screen 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 a helium gas 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 probe (VW-04) was based on the methodology of the CCME sampling guidelines, and is summarized as follows:

- Prior to collecting the soil vapour probe samples, the well was purged of three well volumes, or until headspace readings stabilized.
- A 1.4 L Summa vacuum canister was used for sample collection at the soil vapour probe monitoring location.
- 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.
- The soil vapour probe sampling port was returned to the closed position and the well was securely locked.

3.2.1 Vapour Well Analytical Program

The analytical program for the vapour monitoring probe is summarized below:

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

4.0 FIELD RESULTS AND DISCUSSION

This section presents the results of the fieldwork conducted in 2022 and 2023 at RDM and discussions of these results.

4.1 Groundwater Well Headspace Monitoring

Tetra Tech monitored six groundwater monitoring wells (MW-01, MW-02, MW-03, MW-04A, MW-04B, and MW-05) during each monitoring event for measurements of methane in well headspace using an RKI Eagle. The RKI Eagle detection limit ranges from 5 parts per million (ppm) to 100% of the lower explosive limit (LEL). For methane, 500 ppm is equivalent to 1% LEL; 20% LEL is equivalent to 1% Gas.

During the December 2022 monitoring event, monitoring well headspace methane concentrations ranged from non-detect at monitoring wells MW-04A to 55 ppm at MW-03.

The methane headspace concentrations for 2022 are presented in Table 1.

4.2 Groundwater Elevations

The measured groundwater levels and calculated groundwater elevations for 2022 are presented in Table 1.

Figure 3 presents the groundwater elevation trends (hydrographs) for the groundwater monitoring wells. Overall, the groundwater elevations in 2022 were similar to the elevations measured historically.

The average depth to groundwater at MW-01, MW-02, MW-03, MW-04A, MW-04B, and MW-05 in December 2022 was 2.92 mbg, which increased slightly from November 2021 (3.07 mbg).

The groundwater elevations and interpreted elevation contours for December 2022 for the monitoring wells are shown on Figure 4. The groundwater elevation contours infer a direction of groundwater flow to the west-northwest towards Waskasoo Creek. The groundwater elevation contours for December 2022 are consistent with the historical results.

The average horizontal gradient in December 2022 was approximately 0.05 m/m.

4.3 Groundwater Field Parameters

Field measurements for temperature, pH, and EC in December 2022 are shown in Table 2. A discussion of the results of the field tests is summarized in this section.

Groundwater temperatures ranged from 4.2°C (MW-01) to 4.8°C (MW-04A).

Field pH values ranged from 6.77 (MW-01) to 7.23 (MW-04A) in December 2022. Field pH differed slightly from laboratory pH at all monitoring wells; the difference between field recorded and laboratory pH values may be due to limitations of the field equipment and differences in sample temperature.

In December 2022, field EC measurements ranged from 1,296 µS/cm (MW-05) to 1,717 µS/cm (MW-04A). All field EC results were less than the laboratory measured EC results, which may be due to limitations of the field equipment.

4.4 Groundwater Analytical Results

The groundwater analytical data for 2022 is summarized in Table 2. The 2022 laboratory analytical reports are included in Appendix D and historical analytical tables are included in Appendix E.

4.4.1 Background Groundwater Quality

Monitoring well MW-02 is located on the hydraulically up-gradient portion of the site. MW-02 was sampled in 2013 and 2021.

In November 2021, the concentration of dissolved manganese at MW-02 was 1.48 mg/L, greater than the Tier 1 Guidelines (0.05 mg/L). The concentration of dissolved manganese may be related to natural groundwater quality. The concentration of dissolved iron was less than the analytical detection limit, which was less than all other concentrations measured in 2021. The concentration of chloride was 54.1 mg/L, and the concentration of sodium was 16.7 mg/L, which are an order of magnitude less than most wells at the site in 2021. Concentrations of BTEX, PHC fractions F1 and F2, and VOCs were less than the analytical detection limits.

Overall, the groundwater analytical results for MW-02 in 2021 were similar to the 2013 results and do not suggest groundwater quality impacts related to municipal solid waste (MSW) landfill leachate at this location hydraulically up-gradient of the site.

4.4.2 Routine Water Chemistry Parameters

In 2022, total dissolved solids (TDS) concentrations ranged from 1,340 mg/L (MW-05) to 1,840 mg/L (MW-04A). TDS concentrations were similar to the concentrations measured previously and all monitoring wells were greater than the Tier 1 Guidelines in 2022 (500 mg/L).

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 due to the mobile and conservative (non-reactive) nature of the ion. Chloride concentrations ranged from 179 mg/L at MW-05 to 381 mg/L at MW-01. Concentrations of chloride exceeded the Tier 1 Guidelines (120 mg/L) at MW-01 (381 mg/L), MW-04A (349 mg/L), and MW-05 (179 mg/L) in 2022 and were comparable to previous results.

The sodium concentration was greater than the Tier 1 Guidelines (200 mg/L) at monitoring wells MW-01 (238 mg/L) and MW-04A (289 mg/L) in 2022. The sodium concentration at MW-05 was 177 mg/L and less than the Tier 1 Guidelines.

Ammonia concentrations at the site in December 2022 ranged from 0.103 mg-N/L at MW-04A to 5.59 mg-N/L at MW-05. The elevated concentrations of ammonia at MW-01 (2.82 mg-N/L) and MW-05 suggest groundwater quality impacts by MSW landfill leachate. The two monitoring wells with the highest ammonia concentrations (MW-01 and MW-05) exhibit low sulphate concentrations. This is expected to be an indication of anoxic (sulphate reducing) redox conditions, which are often observed in leachate impacted groundwater. Similar to chloride, the ammonia concentrations are consistent with previous results, albeit with a greater variability, which is expected as the parameter is more susceptible to adsorption and redox dependant reactions (e.g., formation and degradation) than chloride.

4.4.3 Dissolved Metals

Concentrations of dissolved arsenic were greater than the Tier 1 Guidelines (0.005 mg/L) at most monitoring wells in 2022, with the exception of MW-04A. Dissolved arsenic concentrations exhibited marginal changes from the concentrations measured in 2021, with the exception of MW-04A, where the concentration decreased to less than the Tier 1 Guidelines in 2022. Arsenic is known to be strongly adsorbed onto iron(hydr)oxides, and when these minerals dissolve, arsenic will also go into solution (Hem 1992). The concentrations of arsenic are likely correlated to the presence of dissolved iron and anoxic conditions due to leachate impacts.

Iron and manganese are redox-sensitive parameters that naturally occur in groundwater under anoxic conditions and can help determine whether the groundwater quality is affected by biodegradation reactions, for instance related to landfill leachate. The dissolved iron and manganese concentrations were greater than the Tier 1 Guidelines (0.30 mg/L and 0.05 mg/L, respectively) at all monitoring wells during the sampling event in 2022. Dissolved iron and manganese concentrations were similar to previous results.

The dissolved uranium concentration was greater than the guideline of 0.015 mg/L at MW-04A (0.0919 mg/L) in 2022, which is consistent with historical results. Dissolved uranium concentrations may be naturally occurring and not necessarily of concern.

4.4.4 Organic Parameters

Concentrations of toluene, ethylbenzene, xylenes, and PHC fractions F1 to F2 were less than the analytical detection limits at all monitoring wells. Benzene was detected at MW-01 (0.0016 mg/L) and MW-05 (0.00132 mg/L) in 2022; however, the concentrations were less than the Tier 1 Guidelines value of 0.005 mg/L.

In 2022, monitoring wells MW-01 (0.0087 mg/L) and MW-05 (0.0074 mg/L) had concentrations of vinyl chloride greater than the Tier 1 Guidelines (0.0011 mg/L). The vinyl chloride concentration increased at MW-01 when compared to 2021, and the concentration at MW-05 was slightly lower than the concentration measured in 2021. The 2021 and 2022 concentrations at both wells were an order of magnitude lower than the 2019 concentrations.

Both monitoring wells that exhibited exceedances for vinyl chloride also had detectable concentrations of other (chlorinated) VOCs for which Tier 1 Guidelines have not been established [cis and trans isomers of 1,2-dichloroethene (1,2-DCE)]. Cis-1,2-DCE was also detected at MW-04A in 2022. Vinyl chloride and 1,2-DCE are breakdown products of dry-cleaning solvents and are commonly present in MSW leachate.

4.5 Soil Vapour Monitoring Results

The soil vapour monitoring results are presented in Table 5.

Pressures at all vapour wells were negligible during the December 2022 and June 2023 monitoring events.

Concentrations of methane ranged from non-detect at VW-01 and VW-02 (December 2022) to 30.3% at VW-04 in December 2022. VW-01 was blinded during the June 2023 event and the methane concentration at VW-04 was 9.7%. VW-01 and VW-04 are located within the waste footprint. The methane concentrations at VW-01 have shown a decrease since 2013; however, due to suspected integrity issues as described in Section 3.2, the trend may not be representative of in situ conditions.

4.6 Soil Vapour Analytical Results

Table 6 summarizes the soil vapour analytical results collected for 2022 from VW-04 and compares them to the soil vapour screening criteria protective of vapour intrusion into indoor air. The 2022 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, coarse-grained soil. The soil vapour analytical results for VW-04 had measurable concentrations of xylenes and PHC fractions F1 and F2; however, the concentrations were less than the soil vapour screening criteria, which are protective of vapour intrusion into indoor air.

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

VOCs (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use, coarse-grained soil. Several parameters were detected at concentrations greater than the analytical detection limits in the soil vapour sample from VW-04. The measured concentrations of dichlorodifluoromethane (3,920 µg/m^3) and vinyl chloride (1,130 µg/m^3) were greater than the screening criteria (3,584 µg/m^3 and 70 µg/m^3, respectively). The concentrations of these parameters increased in 2022 for both parameters compared to 2021.

The methane concentration in the soil vapour sample at VW-04 (33.8%) was similar to the field measured value (30.3%).

4.7 Quality Assurance/Quality Control

4.7.1 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 groundwater sample during the sampling program; and
- Documenting field procedures and sampling activities.

4.7.2 Groundwater Quality Assurance/Quality Control Results

The QA/QC results for groundwater sampling are included in Table 3. 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:

$$\text{RPD} = \left[\frac{(V_1 - V_2)}{\frac{(V_1 + V_2)}{2}}\right] * 100\%$$

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.

The duplicate RPD in the groundwater sample was greater than 20% for dissolved aluminum (23%). As the analytical results for dissolved aluminum were less than the Tier 1 Guidelines for both samples and that the other RPDs were less than 5%, the sample methods and results are considered acceptable.

5.0 UPDATED HAZARD QUOTIENT RESULTS

Using the soil vapour screening levels and calculations described in the 2021 groundwater and soil vapour monitoring report (Tetra Tech 2022a), the soil vapour sampling results, estimated cancer risks (for carcinogens), and estimated hazard quotients (for non-carcinogens) were calculated for the site.

Table 7 summarizes the properties of the compounds being assessed, which has been updated with 2021 toxicological data. Table 8 summarizes the soil properties used for calculations. Table 9 summarizes the building properties used for the calculations and Table 10 presents the generic soil vapour criteria calculated. Table 11 presents the estimated risk and hazard for the volatile compounds that were detected in soil vapour.

The cumulative risk level for carcinogens in sample VW-04 was 1.6×10^{-4}, which was greater than the target risk level of 1×10^{-5}.

The cumulative hazard level identified in sample VW-04 collected for the non-carcinogens was 2.68 and several individual hazard levels were greater than 0.2 (PHC fraction F1, aliphatics (C_6 to C_8), cis-1,2-DCE, dichlorodifluoromethane, hexane, and vinyl chloride).

The detection limits for several parameters (noted with an asterix in Table 6) were less than the analytical detection limits but were associated with a detection limit greater than the screening level. As noted in the laboratory results, some analytical detection limits were elevated due to matrix interference from the PHCs in the sample. Other than 1,2-DCE, which was previously measured at VW-01 greater than the screening level, it is not suspected that any of these chemicals are present at concentrations in excess of screening criteria.

As shown in Table 11, the estimated individual and cumulative risks and hazards associated with soil vapour sample VW-04 collected in December 2022 exceeded the corresponding target risk and hazard levels. Soil vapour well VW-04 is located on the northeastern portion of the site and is approximately 240 m to the nearest residential building and approximately 60 m from the nearest commercial building. A storm system right-of-way (ROW) is located in close proximity and could be a preferential pathway for the soil vapour.

The 2021 soil vapour results from VW-01 demonstrated that the estimated individual and cumulative risks and hazards indicate a potential risk from vapour intrusion to indoor air. Soil vapour well VW-01 is located in the northwest corner of the site and is bounded by roads on the north and west. It is approximately 315 m from the nearest residential building and approximately 80 m from the nearest commercial building; however, utility corridors are present along the road ROWs, which could be a preferential pathway for the soil vapour. The distance to existing buildings would presumably result in a decrease in concentrations from this location. Soil vapour well VW-01 could not be sampled in 2022 or 2023, and due to suspected integrity issues, it is recommended to be reinstalled.

6.0 EVALUATION OF SITE CONDITIONS

6.1 Summary of Site Conditions

Based on the 2022 and 2023 monitoring and sampling events and historical data for the site, there are concerns related to the presence of the former historical landfill at RDM. With respect to the groundwater quality, monitoring wells that are considered to be hydraulically down-gradient exhibit elevated concentrations of parameters that are typical of MSW leachate, including chloride, ammonia, and VOCs. The concentrations identified in 2022 were overall consistent with the results from 2019 and 2021. Previous groundwater analytical results collected for monitoring well MW-02, located to the east and hydraulically up-gradient, do not suggest MSW leachate impacts at that location. The overall consistent groundwater quality results are expected due to the fact that the landfill was closed decades ago and support a monitoring and sampling frequency less than once a year, as presented in the previous report (Tetra Tech 2022a).

Previous results from 2013 did not identify elevated LFG concentrations at the east side of the property (VW-02 and VW-03); however, elevated concentrations of methane were identified at VW-01 near 32 Avenue in 2013 and 2019. Further, elevated concentrations of several VOCs greater than the analytical detection limits and/or soil vapour screening criteria were measured at VW-01 in 2019 and 2021. This well is located on the northwest corner of the property and the closest buildings to VW-01 are located approximately 80 m north, across 32 Street. Soil vapour well VW-01 could not be sampled in 2022 or 2023. LFG concentrations at VW-01 should continue to be monitored after the well is replaced and risk management measures as recommended below should be considered.

Based on monitoring results in 2021 for VW-02 (located on the southern portion of the site near the Northland Apartments building), and monitoring results for VW-02 in 2019, the potential risk associated with LFG to adjacent buildings to the southeast is considered low. However, waste was encountered during the installation of VW-04 (located further north of VW-02 and immediately adjacent to the east site boundary) and elevated concentrations of methane have been measured at this location. The well screen was blinded at VW-04 at the time of monitoring during the July 2021 and November 2021 events and it was reinstalled to a shallower depth in December 2022. The December 2022 and June 2023 concentrations at VW-04 are considered to be representative of the LFG present. The 2022 soil vapour results at VW-04 indicate individual and cumulative risk and hazards associated with impacted soil vapour; however, there is uncertainty in the results with the well being blinded historically and further monitoring is warranted. The building nearest to VW-04 is a commercial building (interpreted to be an autobody shop for the Wheaton Chevrolet dealership) at a distance of approximately 60 m to the east that was built in 2020/2021.

During the 2022 and 2023 monitoring events, a site walkover was conducted to assess the thin soil cover identified in the earlier work by Tiamat, to evaluate for potential erosion, cracking, and/or exposed wastes. No potential erosion, cracking, and/or exposed waste was identified during the site walkovers in December 2022 and June 2023.

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.

6.2 Summary of Hazard Quotient Results

A summary of the 2014 hazard quotients from the 2014 risk management plan (RMP) and mitigative measures for the site that was completed by Tiamat is attached in Appendix B.

For consistency with the approach prepared in 2018 by XCG Consulting Limited (XCG 2018), we compared individual hazard quotients with the individual target hazard level (0.2). Based on the 2022 program, the greatest individual hazard quotient calculated for the site was 1.09 (vs target hazard level of 0.2), the greatest cumulative hazard quotient was 2.68 (vs target hazard level of 1.0), and the greatest estimated cancer risk was 1.6×10^{-4} (vs target Risk of 1.0×10^{-5}). While development at the site is not currently proposed, for illustrative purposes, based on these hazard quotients and cancer risk levels calculated from the 2021 and 2022 vapour data. Passive Level B (synthetic liner with type of material, thickness, and installation details dependent on design professional) measures would be required for development within the setback area. We note that the above is based on data collected at VW-01 in 2021 and from data at VW-04 in 2022. Based on discussions with The City, a relatively new commercial building is present approximately 90 m east of VW-04. The building is associated with a car dealership and thought to be used for motor vehicle repair and includes a paint spray booth, which implies it would not be a sensitive receptor for potential LFG migration.

Future applications for development of sensitive land use 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.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the groundwater and vapour monitoring and sampling conducted in 2022 and 2023 and previous years, Tetra Tech has developed the following conclusions:

- The groundwater elevation contours for December 2022 infer the groundwater flow is directed towards the west-northwest and Waskasoo Creek, which is consistent with previous findings.
- Monitoring well MW-02 was located in 2021 and included in the monitoring events. The analytical results from MW-02 suggest that it is an appropriate background groundwater monitoring well and is not interpreted to have quality impacts related to MSW landfill leachate; therefore, the well was not sampled in 2022.
- There is evidence of impact to groundwater by leachate, similar to the previous results:
  - Parameters that exceeded the Tier 1 Guidelines at one or more groundwater monitoring wells in 2022 included TDS, sodium, chloride, and dissolved arsenic, iron, manganese, and uranium. The VOC vinyl chloride was also greater than the Tier 1 Guidelines at MW-01 and MW-05. In addition, detectable concentrations of chlorinated VOCs for which no Tier 1 Guidelines has been established (cis and trans-1,2-DCE) were measured at MW-01, MW-04A (cis 1,2-DCE only), and MW-05. The measured concentrations of one or more of these parameters suggest leachate has impacted the groundwater quality at MW-01, MW-04A, and MW-05. The measured concentrations of these parameters were consistent with previous results.
  - During the December 2022 sampling events, chloride concentrations greater than the Tier 1 Guidelines (120 mg/L) were measured at monitoring wells MW-01, MW-04A, and MW-05, and the concentrations were consistent with previous results. The highest chloride concentration was 349 mg/L at MW-04A.
  - Concentrations of toluene, ethylbenzene, xylenes, and PHC fractions F1 and F2 in 2022 were less than the analytical detection limits at all groundwater monitoring wells. Benzene was detected at MW-01 (0.00116 mg/L) and at MW-05 (0.00132 mg/L); however, the concentrations were less than the Tier 1 Guidelines value of 0.005 mg/L.
- LFG is present beneath the site at perimeter locations, similar to previous results:
  - Field measured concentrations of methane were not detected at VW-01 or VW-02 in December 2022; however, the integrity of VW-01 is suspected to be compromised and the results are not considered representative of in situ conditions. Historically methane concentrations above the LEL were measured at this location. The methane concentration at VW-04 was 30.3% in December 2022 and 9.7% in June 2023. Both VW-01 and VW-04 are situated within the waste footprint, and concentrations in native soils beyond the footprint are not known. Soil vapour well VW-04 was reinstalled in the same borehole in December 2022 as it had water levels above the top of the screened interval during previous monitoring events.
  - The soil vapour sample collected from VW-04 in November 2021 did not exceed the corresponding target risk and hazard levels. The measured concentrations of dichlorodifluoromethane and vinyl chloride in December 2022 at this location were greater than the screening criteria and concentrations of these parameters increased in 2022 for both parameters compared to 2021. It should be noted that the vapour well was reinstalled to a shallower depth in December 2022 and the recent results are likely more representative of in situ conditions.
  - The cumulative risk level for carcinogens in the 2022 sample from VW-04 was 1.6×10^{-4}, which was greater than the target risk level of 1×10^{-5}. The cumulative hazard level identified in the sample from VW-04 for the non-carcinogens was 2.68 which is greater than the target of 1.0.Several individual hazard levels in the sample from VW-04 were greater than the individual target of 0.2. Historically, risk and hazard levels were similarly exceeded at VW-01.

Based on the above, the groundwater at interpreted hydraulically down-gradient locations (MW-01, MW-04A, and MW-05) was identified to exhibit leachate impacts; however, the 2022 results were similar to 2019 and 2021. The groundwater at the background monitoring well (MW-02) does not exhibit leachate impacts. In 2021, one of the two vapour wells (VW-01, situated in the northwest corner of the site) exhibited impacts by LFG, as evidenced by elevated methane and PHCs. In previous reporting (Tetra Tech 2022a), this was not identified as a concern related to current developments near the site. No new information for VW-01 was obtained due to suspected well integrity issues. Should a change in development be contemplated, or based on future soil vapour sampling information, this conclusion may need to be revised.

Soil vapour results at VW-04 show elevated VOC concentrations above the vapour screening level and the measured concentrations exceeded the individual and/or cumulative risks and hazards.

The results of the groundwater and vapour monitoring program in 2022 and previous years, indicate there are residual impacts to groundwater and vapours, and buried landfill waste remains in place beneath the site; therefore, ongoing risk management is required. Risk management is recommended to include ongoing monitoring and administrative actions.

The following recommendations are made according to these risk management elements.

Ongoing Monitoring:

- Monitoring wells MW-01, MW-04A, and MW-05 should continue to be sampled for routine groundwater chemistry parameters, dissolved metals, BTEX, PHC fractions F1 and F2, and VOCs following the proposed schedule provided below.
- Continued vapour monitoring is considered warranted to confirm conditions following the proposed schedule provided below. The suggested monitoring included measurements of headspace pressures and methane concentrations in the vapour wells and headspace methane concentrations in the monitoring wells. VW-01 appears to be compromised and is recommended to be reinstalled.
- Based on the results of the soil vapour sample from VW-01 in 2021 and the results of the soil vapour sample at VW-04 in 2022, there is a potential vapour intrusion risk in the northwest and northeast corners of the site from PHCs and/or VOCs. Continued vapour sampling of VW-01 and VW-04 is recommended following the proposed schedule provided below.
- Conduct annual groundwater and vapour monitoring and sampling program at the site in 2024 to confirm concentrations measured to date and to monitor trends. If results remain consistent, reduce the monitoring and sampling frequency over time, as illustrated in the table below.

Proposed Groundwater and Vapour Monitoring Program

Activity	2024	2025	2026	2027	2028	2029	2030	2031
Annual (Summer) Groundwater Monitoring and Sampling Event of Three Monitoring Wells	X			X				X
Annual (Winter) Vapour Monitoring and Sampling Event of Two Vapour Wells	X			X				X

Additional Assessment:

- Based on the thin soil cover identified in the earlier work by Tiamat, continue to conduct a basic site walkover during field monitoring events to document potential erosion, cracking, and/or exposed wastes. This information may be used to evaluate whether potential repairs to the cap are warranted.

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.
- Ensure that the site is clearly identified within The City's utility mapping system. Elevated gas concentrations are present in the subsurface proximate to the 32 Street ROW. Future activities in this vicinity (e.g., utility work, repairs, paving) should consider the potential presence of gas and a site-specific safety plan should be developed for work undertaken to limit the potential for exposure to site workers.

Further to the above recommendations, as noted the site remains an historical landfill. 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.

8.0 CLOSURE

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

Respectfully submitted,
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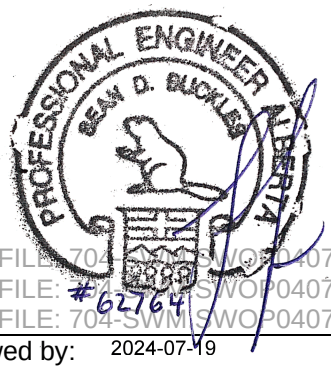

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

RM SIGNATURE: _____

RM APEGA ID #: 62764

DATE: 2024-07-19

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

REFERENCES

Alberta Environment and Parks. 2022. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. ISBN 978-1-4601-5501-1.

Canadian Council of Ministers of the Environment. 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Exposure Protection of Human Exposures via Inhalation of Vapours. Available online: http://ceqg-rcqe.ccme.ca/en/index.html#void.

Government of Alberta. 2018. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta.

Health Canada. 2012. Federal Contaminated Site Risk Assessment in Canada: Toxicological Reference Values (TRVs), version 3.0.

Hem, J.D. 1992. Study and Interpretation of the Chemical Characteristics of Natural Water U.S. Geological Survey, Water Supply Paper 2254.

Tiamat Environmental Consultants Ltd. 2014. Phase II Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. February 26, 2014.

Tetra Tech Canada Inc. 2020. 2019 Groundwater and Soil Vapour Monitoring Report – Red Deer Motors. Prepared for The City of Red Deer. October 2020. Project Number: 704-SWM.SWOP04071-01.006.

Tetra Tech Canada Inc. 2022a. 2021 Groundwater and Soil Vapour Monitoring Report – Red Deer Motors. Prepared for The City of Red Deer. June 2022. Project Number: 704-SWM.SWOP04071-02.005.

Tetra Tech Canada Inc. 2022b. 2022 and 2023 Work Scope and Cost Estimate – Red Deer Pre-1972 Landfills. Prepared for The City of Red Deer. October 21, 2022. Project Number: 704-PSWM.SWOP04071-02.

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

TABLES

Table 1: Groundwater Monitoring Results

Monitoring Well		MW-01	MW-02	MW-03	MW-04A	MW-04B	MW-05
Total Drilled Depth (m)		6.1	6.6	5.1	4.6	6.0	4.6
Top of Screened Interval (mbg)		872.5	-	-	-	-	-
Bottom of Screened Interval (mbg)		867.9	-	-	-	-	-
Stick up (m)		1.09	0.79	0.01	0.20	0.78	0.52
Ground Elevation (m)		874.01	877.30	877.30	871.28	871.28	872.75
TPC Elevation (m)		875.10	878.10	877.31	871.48	872.20	873.50
Depth to Groundwater (mBTPC)	Aug-13	4.17	3.03	-	-	-	-
	Jun-19	5.04	CNL	CNL	-	-	-
	Dec-19	5.37	CNL	CNL	2.97	1.80	3.18
	Jul-21	5.20	3.72	-	2.03	1.77	3.42
	Nov-21	5.44	4.61	3.51	3.09	1.77	3.38
	Dec-22	5.41	4.10	3.53	2.96	1.68	3.21
Groundwater Elevation (m)	Aug-13	869.84	874.28	-	-	-	-
	Jun-19	870.06	-	-	-	-	-
	Dec-19	869.73	-	-	868.52	870.39	870.32
	Jul-21	869.90	874.38	-	869.45	870.43	870.08
	Nov-21	869.66	873.49	873.79	868.39	870.43	870.12
	Dec-22	869.19	873.99	873.77	868.53	870.52	870.28
Volatile Organic Compounds* (VOCs) (ppm)	Jun-19	12	CNL	CNL	-	-	-
	Dec-19	1	CNL	CNL	ND	ND	ND
Combustible Vapour Concentrations (CVCs) (ppm)**	Jun-19	190	CNL	CNL	-	-	-
	Dec-19	10	CNL	CNL	ND	ND	ND
Methane Concentrations (ppm)**	Jul-21	ND	ND	-	25	ND	5
	Nov-21	35	420	90	60	15	ND
	Dec-22	35	25	55	ND	25	15

Notes:
mbg - Metres below grade.
mBTPC - Metres below top of plastic pipe casing.
- Not monitored/information unavailable.
ND - Non-detect.
CNL - Could not locate.
ppm - Parts per million.
*- Measured using an RKI Eagle II calibrated to hexane and isobutylene operated in methane elimination mode.
**- Measured using an RKI Eagle II calibrated to methane.

Table 2: Groundwater Analytical Results

Parameter	Units	Tier 1 Guideline [1,2]	MW-01			MW-02		MW-04A			MW-04B	MW-05		
			6-Dec-2019	23-Nov-2021	09-Dec-2022	23-Nov-2021	23-Nov-2021	6-Dec-2019	23-Nov-2021	09-Dec-2022	6-Dec-2019	6-Dec-2019	23-Nov-2021	09-Dec-2022
Field Testing														
Field Temperature	°C	-	6.6	5.7	4.2	4.4	-	5.5	4.1	4.79	4.6	2.2	6.0	4.4
Field Electric Conductivity	µS/cm	-	2,213	1821	1,505	965	-	1,754	2,061	1,717	1,282	1,918	1,131	1,296
Field pH	pH Units	6.5 to 8.5	8.32	7.28	6.77	7.38	-	7.90	7.47	7.23	8.40	7.81	6.28	6.88
Routine														
pH	pH Units	6.5 to 8.5	7.71	7.32	7.17	7.56	7.58	8.10	7.75	7.78	7.80	7.76	7.40	7.76
Electrical Conductivity (EC)	µS/cm	-	2,220	2220	2,470	1040	1040	1,250	2670	2,740	1,260	1,930	2270	2,060
Total Dissolved Solids (TDS)	mg/L	500	**1,300**	**1350**	**1,560**	**645**	**645**	**1,840**	**1780**	**1,840**	**1,040**	**1,060**	**1460**	**1,340**
Hardness as $CaCO_3$	mg/L	-	811	815	877	544	557	1,140	953	1,010	201	812	904	908
Alkalinity (total as $CaCO_3$)	mg/L	-	564	537	772	517	510	559	710	737	881	581	1110	970
Bicarbonate	mg/L	-	688	655	941	631	623	682	866	899	1,070	709	1350	1,180
Carbonate	mg/L	-	<5.0	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<1.0	<1.0
Hydroxide	mg/L	-	<5.0	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<1.0	<1.0
Calcium	mg/L	-	161	162	170	133	137	249	210	206	49.8	161	174	169
Magnesium	mg/L	-	99.4	99.8	110	51.6	52.1	126	104	120	18.6	99.6	114	118
Potassium	mg/L	-	9.55	7.41	8.61	7.48	7.51	5.29	5.21	4.62	3.37	9.91	9.21	8.52
Sodium	mg/L	200	189	173	**238**	16.7	17.0	**284**	**262**	**289**	**256**	177	183	177
Chloride	mg/L	120	**423**	**450**	**381**	54.1	52.6	**450**	**363**	**349**	6.8	**167**	**187**	**179**
Fluoride	mg/L	1.5	0.12	0.240	0.253	0.193	0.196	0.14	0.259	0.266	0.35	<0.10	0.163	0.235
Phosphorus - Total	mg/L	-	1.72	-	-	-	-	0.761	-	-	0.085	2.29	-	-
Sulphate	mg/L	429 [3]	79.1	70.0	118	43.5	43.4	394	393	416	174	94.9	79.6	68.9
Ionic Balance	N/A	-	101	100	102	101	101	110	102	99.1	71.4	135	102	103
Nutrients														
Ammonia as N	mg/L	0.456 to 83.0 [6]	**7.2**	2.12	2.82	0.111	0.130	0.450	0.372	0.103	0.306	**7.1**	6.43	5.59
Nitrate (as NO_3-N)	mg/L	3	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.100
Nitrite (as NO_2-N)	mg/L	0.080 to 0.20 [4]	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate and Nitrite (as N)	mg/L	-	<0.11	-	<0.112	-	-	<0.11	-	<0.112	<0.11	<0.11	-	<0.112
Total Kjeldahl Nitrogen (TKN)	mg/L	-	9.9	-	-	-	-	10.9	-	-	0.51	8.9	-	-
Carbon														
Dissolved Organic Carbon (DOC)	mg/L	-	10.6	-	-	-	-	23.0	-	-	7.4	18.3	-	-
Dissolved Metals														
Aluminum	mg/L	0.032 to 0.050 [5]	0.0016	0.0061	0.0064	0.0028	0.0024	0.0027	<0.0050	0.0084	0.0027	0.0028	<0.0050	<0.0050
Antimony	mg/L	0.006	<0.00010	0.00053	<0.00050	<0.00010	<0.00010	0.00147	0.00502	0.00183	<0.00010	0.00021	<0.00050	<0.00050
Arsenic	mg/L	0.005	**0.0225**	**0.0210**	**0.0202**	0.000160	0.00018	**0.0146**	**0.0125**	0.00356	**0.00711**	**0.0134**	**0.0139**	**0.00591**
Barium	mg/L	1	0.604	0.531	0.540	0.139	0.140	0.0479	0.0429	0.0452	0.0228	0.794	0.708	0.665
Beryllium	mg/L	-	-	<0.00010	-	<0.000020	<0.000020	-	<0.00010	-	-	-	<0.00010	-
Bismuth	mg/L	-	-	<0.000205	-	<0.000050	<0.000050	-	<0.000205	-	-	-	<0.000205	-
Boron	mg/L	1.5	0.079	0.068	0.075	0.064	0.066	0.142	0.138	0.156	0.214	0.169	0.215	0.210
Cadmium	mg/L	0.00028 to 0.00037 [3]	0.0000142	<0.0000250	<0.0000250	0.0000574	0.0000579	0.0000150	0.0000420	<0.0000250	0.0000275	0.0000461	0.0000301	0.0000365
Chromium	mg/L	0.05	0.00013	<0.0025	<0.00050	<0.00050	<0.00050	0.00023	<0.0025	<0.00050	<0.00010	0.00029	<0.0025	<0.00050
Cobalt	mg/L	0.0014 to 0.0018 [3]	-	0.00302	-	0.00166	0.00171	-	0.0031	-	-	-	0.0151	-
Copper	mg/L	0.007	0.00033	<0.0010	<0.00100	0.00056	0.00060	0.00358	0.00149	0.00231	0.00037	**0.00753**	<0.0010	<0.00100
Iron	mg/L	0.30	**24.4**	**24.1**	**24.8**	<0.010	<0.010	**1.23**	**0.425**	**0.315**	0.025	**7.43**	**10.4**	**6.58**
Lead	mg/L	0.0070 [3]	<0.000050	<0.000250	<0.000250	<0.000050	<0.000050	0.000225	0.000302	<0.000250	<0.000050	0.000246	<0.000250	<0.000250
Lithium	mg/L	-	-	0.0455	-	0.0489	0.0508	-	0.115	-	-	-	0.0787	-
Manganese	mg/L	0.020	**1.91**	**1.95**	**2.11**	**1.48**	**1.49**	**0.732**	**0.578**	**0.399**	**0.178**	**1.28**	**1.62**	**1.51**
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	-	-	0.00243	-	0.000335	0.000316	-	0.0133	-	-	-	0.00281	-
Nickel	mg/L	0.094 to 0.409 [3]	0.0135	0.00921	0.0103	0.00246	0.00236	0.0346	0.0329	0.0212	<0.00050	0.0262	0.0275	0.0260
Phosphorus	mg/L	-	-	<0.25	-	<0.050	<0.050	-	<0.25	-	-	-	<0.25	-
Selenium	mg/L	0.002	0.000074	<0.00025	<0.000250	<0.000050	<0.000050	0.000172	0.000255	0.000324	<0.000050	0.000245	<0.00025	<0.000250
Silicon	mg/L	-	-	14.6	-	9.89	10.1	-	5.55	-	-	-	10.4	-
Silver	mg/L	0.0001	<0.000010	<0.000050	<0.000050	<0.000010	<0.000010	<0.000010	<0.000050	<0.000050	<0.000010	<0.000010	<0.000050	<0.000050
Strontium	mg/L	-	-	1.52	-	0.988	1.02	-	1.62	-	-	-	1.79	-
Thallium	mg/L	-	-	<0.000050	-	0.000036	0.000034	-	<0.000050	-	-	-	<0.000050	-
Tin	mg/L	-	-	<0.00050	-	<0.00010	<0.00010	-	<0.00050	-	-	-	<0.00050	-
Titanium	mg/L	-	-	<0.00150	-	<0.00030	<0.00030	-	<0.00150	-	-	-	<0.00150	-
Uranium	mg/L	0.015	0.00196	0.00151	0.00384	0.00910	0.00938	**0.0391**	**0.0993**	**0.0919**	0.00217	0.00927	0.0131	0.0122
Vanadium	mg/L	-	-	<0.0025	-	<0.00050	<0.00050	-	<0.0025	-	-	-	<0.0025	-
Zinc	mg/L	0.03	0.0015	<0.0050	<0.0050	0.0034	0.0032	0.0034	<0.0050	<0.0050	<0.0010	0.0060	0.0055	<0.0050
Zirconium	mg/L	-	-	<0.0010	-	<0.00020	<0.00020	-	<0.0010	-	-	-	0.00204	-
Organics														
AOX	mg/L	-	ND	-	-	-	-	ND	-	-	ND	ND	-	-

Notes:

[1] Alberta Environment and Protected Areas (AEPA). 2022. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. 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 (FAL). Most conservative values applied (chronic or acute).

[3] Guideline varies with hardness. Values shown based on site hardness range of 201 mg/L to 1140 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 6.8 mg/L to 450 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 6.28 to 8.40.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 6.28 to 8.40 and temperature range of 2.18°C to 6.55°C.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

Italic - Detection limit greater than Tier 1 guideline

N/A - Not applicable.

Table 2: Groundwater Analytical Results

Parameter	Units	Tier 1 Guideline [1,2]	MW-01			MW-02		MW-04A			MW-04B	MW-05		
			6-Dec-2019	23-Nov-2021	09-Dec-2022	23-Nov-2021	23-Nov-2021	6-Dec-2019	23-Nov-2021	09-Dec-2022	6-Dec-2019	6-Dec-2019	23-Nov-2021	09-Dec-2022
Hydrocarbons														
Benzene	mg/L	0.005	0.00060	<0.00050	0.00116	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00189	0.00143	0.00132
Toluene	mg/L	0.021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<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	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes (m & p)	mg/L	-	<0.00050	<0.00040	<0.00040	<0.00040	<0.00040	<0.00050	<0.00040	<0.00040	<0.00050	<0.00050	<0.00040	<0.00040
Xylene (o)	mg/L	-	<0.00050	<0.00030	<0.00030	<0.00030	<0.00030	<0.00050	<0.00030	<0.00030	<0.00050	<0.00050	<0.00030	<0.00030
Xylenes Total	mg/L	0.020	<0.00071	<0.00050	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.00050	<0.00071	<0.00071	<0.00050	<0.00050
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
F1 (C_6-C_{10})	mg/L	-	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.100
F1 (C_6-C_{10}) - BTEX	mg/L	0.81	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.100
F2 (C_{10}-C_{16})	mg/L	1.1	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.10	<0.100	<0.10	<0.10	<0.10	<0.100
Total BTEX	mg/L	-	-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	-	-	0.0014	-
Volatile Fatty/Carboxylic Acids														
Acetic Acid	mg/L	-	<10	-	-	-	-	<10	-	-	<10	<10	-	-
Butyric Acid	mg/L	-	<1.0	-	-	-	-	<1.0	-	-	<1.0	<1.0	-	-
Formic Acid	mg/L	-	<50	-	-	-	-	<50	-	-	<50	<50	-	-
Hexanoic Acid	mg/L	-	<1.0	-	-	-	-	<1.0	-	-	<1.0	<1.0	-	-
iso-Butyric Acid	mg/L	-	<1.0	-	-	-	-	<1.0	-	-	<1.0	<1.0	-	-
Isovaleric acid	mg/L	-	<1.0	-	-	-	-	<1.0	-	-	<1.0	<1.0	-	-
Propionic Acid	mg/L	-	<5.0	-	-	-	-	<5.0	-	-	<5.0	<5.0	-	-
Valeric Acid	mg/L	-	<1.0	-	-	-	-	<1.0	-	-	<1.0	<1.0	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)														
Naphthalene	mg/L	0.001	-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	-	-	<0.0010	-
Volatile Organic Compounds (VOCs)														
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,1-Dichloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,1-Dichloroethene	mg/L	0.014	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,2,4-Trichlorobenzene	mg/L	0.015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromoethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<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	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethene (cis)	mg/L	-	0.0096	0.0032	0.0147	<0.0010	<0.0010	0.0019	0.0018	0.0013	<0.0010	0.222	0.189	0.184
1,2-Dichloroethene (trans)	mg/L	-	0.00187	<0.0010	0.0023	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	0.018	0.0127	0.0134
1,2-Dichloropropane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichlorobenzene	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene	mg/L	-	-	<0.0015	<0.0015	<0.0015	<0.0015	-	<0.0015	<0.0015	-	-	<0.0015	<0.0015
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	mg/L	0.001	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromobenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromochloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromodichloromethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Bromoform	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon tetrachloride	mg/L	0.0015	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Chlorobenzene	mg/L	0.0013	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	mg/L	0.018	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Chloromethane	mg/L	-	<0.0010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0010	<0.0050	<0.0050	<0.0010	<0.0010	<0.0050	<0.0050
Dibromochloromethane	mg/L	0.19	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Dibromomethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<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	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methyl t-Butyl Ether (MTBE)	mg/L	0.015	-	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	-	-	<0.00050	<0.00050
Methylene Chloride	mg/L	0.05	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
n-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
sec-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
tert-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	mg/L	0.01	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Trichloroethene	mg/L	0.00032	*<0.00050*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	<0.00050	*<0.0010*	*<0.0010*	*<0.00050*	<0.00050	*<0.0010*	*<0.0010*
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trihalomethanes	mg/L	0.1	-	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020	<0.0020	-	-	<0.0020	<0.0020
Vinyl chloride	mg/L	0.0011	**0.0124**	**0.0039**	**0.0087**	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.00050	**0.0132**	**0.0090**	**0.0074**

Notes:

[1] Alberta Environment and Protected Areas (AEPA). 2022. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. 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 (FAL). Most conservative values applied (chronic or acute).

[3] Guideline varies with hardness. Values shown based on site hardness range of 201 mg/L to 1140 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 6.8 mg/L to 450 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 6.28 to 8.40.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 6.28 to 8.40 and temperature range of 2.18°C to 6.55°C.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

Italic - Detection limit greater than Tier 1 guideline

N/A - Not applicable.

Table 3: Groundwater Quality Assurance/Quality Control Analytical Results

Parameter	Units	RDL	MW-01	DUPLICATE	RPD (%)
			09-Dec-2022	09-Dec-2022	
Routine					
pH	pH Units	0.1	7.17	7.19	0.3
Electrical Conductivity (EC)	µS/cm	2	2,470	2,470	0
Total Dissolved Solids (TDS)	mg/L	1	1,560	1,560	0
Hardness as $CaCO_3$	mg/L	0.5	877	865	1
Alkalinity (total as $CaCO_3$)	mg/L	2	772	770	0.3
Bicarbonate	mg/L	5	941	940	0.1
Carbonate	mg/L	5	<1.0	<1.0	-
Hydroxide	mg/L	5	<1.0	<1.0	-
Calcium	mg/L	0.05	170	170	0
Magnesium	mg/L	0.005	110	107	3
Potassium	mg/L	0.05	8.61	8.43	2
Sodium	mg/L	0.05	238	232	3
Chloride	mg/L	2.5	381	393	3
Fluoride	mg/L	0.1	0.253	0.231	-
Sulphate	mg/L	1.5	118	120	2
Ionic Balance	N/A	0.01	102	99	3
Nutrients					
Ammonia as N	mg/L	0.05	2.82	2.8	0.7
Nitrate (as NO_3-N)	mg/L	0.1	<0.100	<0.100	-
Nitrite (as NO_2-N)	mg/L	0.05	<0.050	<0.050	-
Nitrate and Nitrite (as N)	mg/L	0.11	<0.112	<0.112	-
Dissolved Metals					
Aluminum	mg/L	0.001	0.0064	0.0081	**23**
Antimony	mg/L	0.0001	<0.00050	<0.00050	-
Arsenic	mg/L	0.0001	0.0202	0.0195	4
Barium	mg/L	0.0001	0.54	0.534	1
Boron	mg/L	0.01	0.075	0.074	1
Cadmium	mg/L	0.000005	<0.0000250	<0.0000250	-
Chromium	mg/L	0.0001	<0.00050	<0.00050	-
Copper	mg/L	0.0002	<0.00100	<0.00100	-
Iron	mg/L	0.01	24.8	24.1	3
Lead	mg/L	0.00005	<0.000250	<0.000250	-
Manganese	mg/L	0.0001	2.11	2.08	1
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	-
Nickel	mg/L	0.0005	0.0103	0.0103	0
Selenium	mg/L	0.00005	<0.000250	<0.000250	-
Silver	mg/L	0.00001	<0.000050	<0.000050	-
Uranium	mg/L	0.00001	0.00384	0.00399	4
Zinc	mg/L	0.001	<0.0050	<0.0050	-
Hydrocarbons					
Benzene	mg/L	0.0005	0.00116	0.0011	-
Toluene	mg/L	0.0005	<0.00050	<0.00050	-
Ethylbenzene	mg/L	0.0005	<0.00050	<0.00050	-
Xylenes (m & p)	mg/L	0.0005	<0.00040	<0.00040	-
Xylene (o)	mg/L	0.0005	<0.00030	<0.00030	-
Xylenes Total	mg/L	0.00071	<0.00050	<0.00050	-
Styrene	mg/L	0.0005	<0.00050	<0.00050	-
F1 (C_6-C_{10})	mg/L	0.1	<0.100	<0.100	-
F1 (C_6-C_{10}) - BTEX	mg/L	0.1	<0.100	<0.100	-
F2 (C_{10}-C_{16})	mg/L	0.1	<0.100	<0.100	-
Volatile Organic Compounds (VOCs)					
1,1,1,2-Tetrachloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1,1-Trichloroethane	mg/L	0.0005	<0.0010	<0.0010	-
1,1,2,2-Tetrachloroethane	mg/L	0.0005	<0.0010	<0.0010	-
1,1,2-Trichloroethane	mg/L	0.0005	<0.0010	<0.0010	-
1,1-Dichloroethane	mg/L	0.0005	<0.0010	<0.0010	-
1,1-Dichloroethene	mg/L	0.0005	<0.0010	<0.0010	-
1,1-Dichloropropene	mg/L	0.001	<0.0010	<0.0010	-
1,2,3-Trichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2,3-Trichloropropane	mg/L	0.0005	<0.0010	<0.0010	-
1,2,4-Trichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2,4-Trimethylbenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dibromo-3-chloropropane	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dibromoethane	mg/L	0.0005	<0.0010	<0.0010	-
1,2-Dichlorobenzene	mg/L	0.0005	<0.00050	<0.00050	-
1,2-Dichloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dichloroethene (cis)	mg/L	0.001	0.0147	0.014	5
1,2-Dichloroethene (trans)	mg/L	0.0005	0.0023	0.0022	-
1,2-Dichloropropane	mg/L	0.0005	<0.0010	<0.0010	-
1,3,5-Trimethylbenzene	mg/L	0.001	<0.0010	<0.0010	-
1,3-Dichlorobenzene	mg/L	0.0005	<0.0010	<0.0010	-
1,3-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
1,3-Dichloropropene	mg/L	0.0015	<0.0015	<0.0015	-
1,3-Dichloropropene [cis]	mg/L	0.0005	<0.0010	<0.0010	-
1,3-Dichloropropene [trans]	mg/L	0.001	<0.0010	<0.0010	-
1,4-Dichlorobenzene	mg/L	0.0005	<0.0010	<0.0010	-
2,2-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
2-Chlorotoluene	mg/L	0.001	<0.0010	<0.0010	-
4-Chlorotoluene	mg/L	0.001	<0.0010	<0.0010	-
Bromobenzene	mg/L	0.001	<0.0010	<0.0010	-
Bromochloromethane	mg/L	0.001	<0.0010	<0.0010	-
Bromodichloromethane	mg/L	0.0005	<0.0010	<0.0010	-
Bromoform	mg/L	0.0005	<0.0010	<0.0010	-
Bromomethane	mg/L	0.001	<0.0010	<0.0010	-
Carbon tetrachloride	mg/L	0.0005	<0.00050	<0.00050	-
Chlorobenzene	mg/L	0.0005	<0.0010	<0.0010	-
Chloroethane	mg/L	0.001	<0.0010	<0.0010	-
Chloroform	mg/L	0.0005	<0.0010	<0.0010	-
Chloromethane	mg/L	0.001	<0.0050	<0.0050	-
Dibromochloromethane	mg/L	0.0005	<0.0010	<0.0010	-
Dibromomethane	mg/L	0.0005	<0.0010	<0.0010	-
Dichlorodifluoromethane	mg/L	0.0005	<0.0010	<0.0010	-
Hexachlorobutadiene	mg/L	0.001	<0.0010	<0.0010	-
iso-Propylbenzene (cumene)	mg/L	0.001	<0.0010	<0.0010	-
Methyl t-Butyl Ether (MTBE)	mg/L	0.0005	<0.00050	<0.00050	-
Methylene Chloride	mg/L	0.001	<0.0010	<0.0010	-
n-Butylbenzene	mg/L	0.001	<0.0010	<0.0010	-
n-Propylbenzene	mg/L	0.001	<0.0010	<0.0010	-
p-Isopropyltoluene	mg/L	0.001	<0.0010	<0.0010	-
sec-Butylbenzene	mg/L	0.001	<0.0010	<0.0010	-
tert-Butylbenzene	mg/L	0.001	<0.0010	<0.0010	-
Tetrachloroethene	mg/L	0.0005	<0.0010	<0.0010	-
Trichloroethene	mg/L	0.0005	<0.0010	<0.0010	-
Trichlorofluoromethane	mg/L	0.001	<0.0010	<0.0010	-
Trihalomethanes	mg/L	0.002	<0.0020	<0.0020	-
Vinyl chloride	mg/L	0.0005	0.0087	0.0082	6

Notes:

RDL - Reportable detection limit

RPD - Relative Percentage Difference calculated as RPD(%)=(|V1-V2|)/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.

"-" Indicates RPD not calculated. RPDs have only been considered where both concentrations are greater than 5 times the RDL

N/A - Not applicable

BOLD - RPD value greater than 20%

Table 4: Historical Surface Water Analytical Results

Parameter	Unit	Guideline[1]	SW-01 DOWNSTREAM		SW-02 UPSTREAM	
			13 Jul 2021	09 Sep 2021	13 Jul 2021	09 Sep 2021
Routine						
pH	pH Units	6.5-9	8.28	8.47	8.41	8.41
Electrical Conductivity (EC)	µS/cm	-	1,130	1,140	1,110	1,260
Total Dissolved Solids (TDS)	mg/L	-	680	664	672	763
Hardness as CaCO3	mg/L	-	457	469	440	573
Alkalinity (total as CaCO3)	mg/L	20	390	325	386	413
Bicarbonate	mg/L	-	475	364	442	474
Carbonate	mg/L	-	<5.0	15.7	14.3	14.9
Hydroxide	mg/L	-	<5.0	<5.0	<5.0	<5.0
Calcium	mg/L	-	93.5	77.4	89.6	119
Magnesium	mg/L	-	54.4	67.0	52.5	67.0
Potassium	mg/L	-	6.56	7.18	6.49	7.06
Sodium	mg/L	-	78.1	76.2	78.1	74.5
Chloride	mg/L	120	120	**146**	119	**146**
Fluoride	mg/L	-	0.20	0.14	0.20	0.16
Sulphate	mg/L	128-429[#1]	87.2	90.5	90.1	92.8
Ionic Balance	%	-	97.1	102	94.8	103
Nutrients						
Ammonia as N	mg/L	0.018-19.5[#2]	-	<0.050	-	0.058
Nitrate (as NO3-N)	mg/L	3	1.34	1.01	0.90	1.96
Nitrite (as NO2-N)	mg/L	0.02-0.2[#3]	<0.050	<0.050	<0.050	<0.050
Nitrate and Nitrite (as N) (mg/L)	mg/L	-	1.34	1.01	0.90	1.96
Total Metals						
Aluminum	mg/L	0.007-0.05[#4]	0.0390	0.0090	0.0193	**0.0550**
Antimony	mg/L	-	0.00023	0.00034	0.00023	0.00047
Arsenic	mg/L	0.005	0.00327	0.00163	0.00241	0.00216
Barium	mg/L	-	0.200	0.222	0.167	0.307
Boron	mg/L	1.5	0.063	0.084	0.061	0.085
Cadmium	mg/L	4E-05-0.00037[#1]	0.0000169	<0.0000050	**0.0000690**	0.0000118
Chromium	mg/L	0.001	0.00015	0.00014	0.00013	0.00022
Copper	mg/L	0.007[#1]	0.00107	0.00135	0.00123	0.00194
Iron	mg/L	0.3	**0.349**	0.231	0.181	**0.526**
Lead	mg/L	0.001-0.007[#1]	0.000133	<0.000050	0.000089	0.000100
Manganese	mg/L	-	0.0888	0.0194	0.0167	0.103
Mercury	mg/L	0.000005	<0.0000050	-	<0.0000050	-
Nickel	mg/L	0-0.17[#1]	**0.00255**	**0.00261**	**0.00242**	**0.00294**
Selenium	mg/L	0.002	0.000500	0.000813	0.000404	0.000853
Silver	mg/L	0.00025	<0.000010	<0.000010	<0.000010	<0.000010
Uranium	mg/L	0.015	0.00547	0.00821	0.00502	0.00818
Zinc	mg/L	0.03	0.0112	0.0030	0.0059	0.0139
Hydrocarbons						
Benzene	mg/L	0.04	<0.00050	<0.00050	<0.00050	<0.00050
Toluene	mg/L	0.0005	<0.00050	<0.00050	<0.00050	<0.00050
Ethylbenzene	mg/L	0.09	<0.00050	<0.00050	<0.00050	<0.00050
Xylene (o)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes (m & p)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes Total	mg/L	0.03	-	<0.00071	-	<0.00071
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.00050	<0.00050
F1 (C6-C10_)	mg/L	-	<0.10	<0.10	<0.10	<0.10
F1 (C6-C10) - BTEX	mg/L	-	<0.10	<0.10	<0.10	<0.10
F2 (C10-C16 Hydrocarbons)	mg/L	0.11	<0.10	<0.10	<0.10	<0.10

Notes:

[1] Government of Alberta. 2018. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta. Table 1 Surface water quality guidelines for the protection of freshwater aquatic life (PAL). Most conservative values applied (chronic or acute).

[#1] Guideline varies with hardness. Values shown based on hardness range of 440 to 573 mg/L.

[#2] Guideline varies with pH and temperature. Values shown based on pH range of 7.99 to 8.43 and temperature range of 13.9 oC 16.7 oC.

[#3] Guideline varies with chloride. Values shown based on chloride range of 119 mg/L to 210 mg/L.

[#4] Guideline varies with pH. Values shown based on pH range of 7.99 to 8.43.

*2021 Field pH results confirmed that the 2019 field pH results were not valid.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 4: Historical Surface Water Analytical Results

Parameter	Unit	Guideline[1]	SW-01 DOWNSTREAM		SW-02 UPSTREAM	
			13 Jul 2021	09 Sep 2021	13 Jul 2021	09 Sep 2021
Volatile Organic Compounds (VOCs)						
Bromobenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Bromochloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Bromodichloromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Bromoform	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
n-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
sec-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
tert-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Carbon tetrachloride	mg/L	0.0133	<0.00050	<0.00050	<0.00050	<0.00050
Chlorobenzene	mg/L	0.0013	<0.00050	<0.00050	<0.00050	<0.00050
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	mg/L	0.0018	<0.00050	<0.00050	<0.00050	<0.00050
Chloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromoethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Dibromomethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichlorobenzene	mg/L	0.15	<0.00050	<0.00050	<0.00050	<0.00050
1,4-Dichlorobenzene	mg/L	0.026	<0.00050	<0.00050	<0.00050	<0.00050
1,1-Dichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloroethane	mg/L	0.1	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloroethene (cis)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethene (trans)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloropropane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.0010	<0.0010
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Methylene Chloride	mg/L	0.0981	<0.0010	<0.0010	<0.0010	<0.0010
iso-Propylbenzene (cumene)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Tetrachloroethene	mg/L	0.11	<0.00050	<0.00050	<0.00050	<0.00050
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	mg/L	0.024	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Trichloroethene	mg/L	0.021	<0.00050	<0.00050	<0.00050	<0.00050
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl chloride	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050

Notes:

[1] Government of Alberta. 2018. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta. Table 1 Surface water quality guidelines for the protection of freshwater aquatic life (PAL). Most conservative values applied (chronic or acute).

[#1] Guideline varies with hardness. Values shown based on hardness range of 440 to 573 mg/L.

[#2] Guideline varies with pH and temperature. Values shown based on pH range of 7.99 to 8.43 and temperature range of 13.9 oC 16.7 oC.

[#3] Guideline varies with chloride. Values shown based on chloride range of 119 mg/L to 210 mg/L.

[#4] Guideline varies with pH. Values shown based on pH range of 7.99 to 8.43.

*2021 Field pH results confirmed that the 2019 field pH results were not valid.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 5: Soil Vapour Monitoring Results

Parameter	Gas Well																				
	VW-01							VW-02						VW-03					VW-04[4]			
	Aug-13	Jun-19	Dec-19	Jul-21	Nov-21	Dec-22	Jun-23	Aug-13	Jun-19	Dec-19	Jul-21	Nov-21	Dec-22	Aug-13	Jun-19	Dec-19	Jul-21	Nov-21	Jul-21	Nov-21	Dec-22	Jun-23
Total Drilled Depth (m)	3.5							6.1						7.6					4.0			
Top of Screen Interval (mbg)	3.2							5.80						7.3					2.5			
Bottom of Screened Interval (mbg)	3.5							6.10						7.6					4.0			
Stick up (m)	0.84							0.92						0.00					-0.02			
Pressure (kPa)[1]		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0						0.0	0.0	0.0	0.0
CH_4 (%)	26.0	11.7	0.0	5.1	3.9	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0					4.1	2.0	30.3	9.7
CO (ppm)[2]	0.0	8.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0					2.0	0.0	11.0	2.0
CO_2 (%)	13.1	13.7	0.2	17.7	17.7	0.8	Blinded	4.6	0.1	0.2	0.1	0.1	0.2	1.9	Destroyed				9.7	5.1	20.3	18.9
O_2 (%)	8.4	3.3	20.9	0.2	5.0	22.1		17.2	19.9	21.3	20.6	22.7	22.5	19.8					12.4	16.8	1.6	2.8
Balance (% v/v)	52.5	71.3	78.8	77.1	73.5	77.1		77.8	80.1	78.4	79.3	77.2	77.3	78.3					73.8	76.1	47.7	69.0
Static Water Level (mbtoc)[3]		Dry	Dry	Dry	Dry	CNM	3.65		Dry	Dry	Dry	Dry	Dry						1.30	1.84	1.71	1.65

Notes:

[1] Kpa - Kilopascal.

[2] ppm - Parts per million.

[3] mbtoc - Meters below top of casing.

[4] mbtoc - Well blinded during July and November 2021 - results may not be valid.

CNM - Could not measure.

Table 6: Soil Vapour Analytical Results

Location Code		Generic Soil Vapour Criteria - Residential Coarse-Grained ($\mu g/m^3$)[1]	VW-01			VW-02	VW-04		
Field ID			VW-01	19DUP01	VW-01	VW-02	VW-04	DUPLICATE	VW-04
Sample Date			5-Dec-2019	5-Dec-2019	23-Nov-2021	5-Dec-2019	23-Nov-2021	23-Nov-2021	09-Dec-2022
Lab Report Number			L2393599	L2393599	L2671038	L2393599	L2671038	L2671038	CG2217083
Laboratory ID			L2393599-1 / L2393599-4	L2393599-3	L2671038-1	L2393599-2 / L2393599-5	L2671038-2	L2671038-3	CG2217083-1
Parameter	**Units**	$\mu g/m^3$							
Field Testing									
Air Volume	L		0.06	-	-	0.06	-	-	-
Initial Pressure	in Hg		-11.4	-9.6	15	-4.9	-11	-4	-6
Aliphatic/Aromatic PHC Sub-Fractionation									
Aliphatics (C_6-C_8)	$\mu g/m^3$	740,737	56,400	56,200	-	1,300	-	-	447,000
Aliphatics (>C_8-C_{10})	$\mu g/m^3$	40,257	21,500	21,100	-	728	-	-	931
Aliphatics (>C_{10}-C_{12})	$\mu g/m^3$	40,257	9,920	9,690	-	179	-	-	135
Aliphatics (>C_{12}-C_{16})	$\mu g/m^3$	40,257	880	840	-	<30	-	-	<30
Aromatics (>C_8-C_{10})	$\mu g/m^3$	805	<390	<360	-	<15	-	-	189
Aromatics (C_6-C_8)	$\mu g/m^3$	740,737	-	-	-	-	-	-	2,340
Aromatics (>C_{10}-C_{12})	$\mu g/m^3$	8,051	490	470	-	<15	-	-	41
Aromatics (>C_{12}-C_{16})	$\mu g/m^3$	8,051	<770	<730	-	<30	-	-	<30
Linear & Cyclic Methyl Siloxanes									
Hexamethylcyclotrisiloxane, D3(CVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Octamethylcyclotetrasiloxane, D4(CVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Decamethylcyclopentasiloxane, D5(CVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Dodecamethylcyclohexasiloxane, D6(CVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Hexamethyldisiloxane, MM(LVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Octamethyltrisiloxane, MDM(LVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Decamethyltetrasiloxane, MD2M(LVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Dodecamethylpentasiloxane, MD3M(LVMS)	$\mu g/m^3$	NG	<170	-	-	<170	-	-	-
Hydrocarbons									
Benzene	$\mu g/m^3$	41	<16	<15	<15	1.4	20	<15	<65.5
Toluene	$\mu g/m^3$	75,190	<19	<17	<36	1.31	<36	<36	<21.9
Ethylbenzene	$\mu g/m^3$	68,650	<22	<20	<42	<0.87	<42	<42	<21
Xylenes (m & p)	$\mu g/m^3$	NG	<43	<39	<84	<1.7	<84	<84	21
Xylene (o)	$\mu g/m^3$	NG	<22	<20	<42	<0.87	<42	<42	92
Xylenes Total	$\mu g/m^3$	3,520	<48	<43	<96	<2.0	<96	<96	113
Styrene	$\mu g/m^3$	3,220	<21	<19	<41	<0.85	<41	<41	<41.2
F1 (C_6-C_{10})	$\mu g/m^3$	867,383	62,900	62,500	63,900	1,720	4980	3540	404,000
F2 (C_{10}-C_{16})	$\mu g/m^3$	52,495	19,300	18,900	**67,500**	380	<720	<720	303
Alcohols									
Isopropanol	$\mu g/m^3$	6,219	<61	<56	-	<2.5	-	-	-
High Level Fixed Gases									
Nitrogen	%	NG	66.3	69.8	-	74.9	75.7	76.6	45.9
Oxygen	%	NG	7.04	7.49	-	20.3	18.0	19.6	3.63
Carbon Dioxide	%	NG	11.1	11.5	12.9	0.391	4.06	2.77	16.6
Carbon Monoxide	%	NG	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.072
Methane	%	NG	5.26	5.46	2.03	<0.050	2.21	1.47	33.8
Hydrocarbon Gases (C_1-C_5)									
Methane	%	NG	-	-	-	0.00333	-	-	-
Ethane	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	0.00067	0.00044	-
Ethene	%	NG	0.00026	0.00025	<0.00020	<0.00020	<0.00020	<0.00020	-
Propane	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	-
Propene	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	-
Butane	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	-
Pentane	%	NG	0.00021	0.0002	<0.00020	<0.00020	<0.00020	<0.00020	-
Polycyclic Aromatic Hydrocarbons (PAHs)									
Naphthalene	$\mu g/m^3$	380	<66	<60	<50	<2.6	<50	<50	<25.3

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 Tables 7 to 10 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

* = Detection limit raised above criteria.

Table 6: Soil Vapour Analytical Results

Location Code		Generic Soil Vapour Criteria - Residential Coarse-Grained ($\mu g/m^3$)[1]	VW-01			VW-02	VW-04		
Field ID			VW-01	19DUP01	VW-01	VW-02	VW-04	DUPLICATE	VW-04
Sample Date			5-Dec-2019	5-Dec-2019	23-Nov-2021	5-Dec-2019	23-Nov-2021	23-Nov-2021	09-Dec-2022
Lab Report Number			L2393599	L2393599	L2671038	L2393599	L2671038	L2671038	CG2217083
Laboratory ID			L2393599-1 / L2393599-4	L2393599-3	L2671038-1	L2393599-2 / L2393599-5	L2671038-2	L2671038-3	CG2217083-1
Parameter	**Units**	**$\mu g/m^3$**							
Volatile Organic Compounds (VOCs)									
1,1,1-Trichloroethane	$\mu g/m^3$	1,693,510	<27	<25	<52	<1.1	<52	<52	<52.7
1,1,2,2-Tetrachloroethane	$\mu g/m^3$	11	<34*	<31*	<66*	<1.4	<66*	<66*	<66.3*
1,1,2-Trichloroethane	$\mu g/m^3$	7	<27*	<25*	<52*	<1.1	<52*	<52*	<52.7*
1,1-Dichloroethane	$\mu g/m^3$	430	<20	<18	<39	<0.81	<39	<39	<9.66
1,1-Dichloroethene	$\mu g/m^3$	6,470	<20	<18	<38	<0.79	<38	<38	<38.3
1,2,4-Trichlorobenzene	$\mu g/m^3$	365	<37	<34	<71	<1.5	<71	<71	<71.7
1,2,4-Trimethylbenzene	$\mu g/m^3$	2,235	<25	<22	<47	<0.98	<47	<47	<47.5
1,2-Dibromoethane	$\mu g/m^3$	2.2	<38*	<35*	<74*	<1.5	<74*	<74*	<74.2*
1,2-Dichlorobenzene	$\mu g/m^3$	7,072	<30	<27	<58	<1.2	<58	<58	<58.1
1,2-Dichloroethane	$\mu g/m^3$	24	**45**	**33**	<39*	<0.81	<39*	<39*	<39.1*
1,2-Dichloroethene (cis)	$\mu g/m^3$	242	34	22	<38	<0.79	<38	<38	50
1,2-Dichloroethene (trans)	$\mu g/m^3$	1,400	24	<18	<38	<0.79	<38	<38	50
1,2-Dichloropropane	$\mu g/m^3$	135	<23	<21	<44	<0.92	<44	<44	<44.6
1,2-Dichlorotetrafluoroethane	$\mu g/m^3$	566,335	65	47	<67	7.6	230	181	669
1,3,5-Trimethylbenzene	$\mu g/m^3$	2,235	172	126	129	<0.98	<47	<47	<47.5
1,3-Butadiene	$\mu g/m^3$	17	<11	<10	<21*	<0.44	<21*	<21*	<23.7*
1,3-Dichlorobenzene	$\mu g/m^3$	64	<30	<27	<58	<1.2	<58	<58	<58.1
1,3-Dichloropropene [cis]	$\mu g/m^3$	163	<23	<21	<44	<0.91	<44	<44	<43.8
1,3-Dichloropropene [trans]	$\mu g/m^3$	149	<23	<21	<44	<0.91	<44	<44	<43.8
1,4-Dichlorobenzene	$\mu g/m^3$	64	<30	<27	<58	<1.2	<58	<58	<58.1
1,4-Dioxane	$\mu g/m^3$	105	<18	<16	<35	<0.72	<35	<35	<34.8
1-Methyl-4 ethyl benzene	$\mu g/m^3$	14,461	<25	<22	<47	<0.98	<47	<47	<47.5
2-Butanone (MEK)	$\mu g/m^3$	167,364	<15	<13	<28	0.74	<28	<28	245
2-Hexanone (MBK)	$\mu g/m^3$	1,053	<100	<93	<200	<4.1	<200	<200	<198
4-Methyl-2-pentanone (MIBK)	$\mu g/m^3$	102,977	<20	<19	<39	<0.82	<39	<39	<39.6
Acetone	$\mu g/m^3$	918,788	<460	<320	<57	9.0	<57	<57	323
Allyl chloride	$\mu g/m^3$	32	<16	<14	<30	<0.63	<30	<30	<30.2
Benzyl chloride	$\mu g/m^3$	34	<26	<24	<50*	<1.0	<50*	<50*	<50*
Bromodichloromethane	$\mu g/m^3$	28	<34*	<30*	<64*	<1.3	<64*	<64*	<64.7*
Bromoform	$\mu g/m^3$	1,494	<52	<47	<99	<2.1	<99	<99	<99.8
Bromomethane	$\mu g/m^3$	173	<19	<18	<37	<0.78	<37	<37	<37.5
Carbon disulfide	$\mu g/m^3$	21,713	<16	<14	<30	2.75	<30	<30	<75.4
Carbon tetrachloride	$\mu g/m^3$	113	<31	<29	<61	<1.3	<61	<61	<60.8
Chlorobenzene	$\mu g/m^3$	347	<23	<21	<44	<0.92	<44	<44	<44.5
Chloroethane	$\mu g/m^3$	124,080	<13	<12	<25	<0.53	<25	<25	<25.5
Chloroform	$\mu g/m^3$	27	<24	<22	<47*	<0.98	<47*	<47*	<47.2*
Chloromethane	$\mu g/m^3$	2,657	<10	<9.4	<20	1.1	<20	<20	<19.9
Cyclohexane	$\mu g/m^3$	201,510	6,700	6,450	2890	45	1180	800	699
Dibromochloromethane	$\mu g/m^3$	6,070	<43	<39	<82	<1.7	<82	<82	<82.3
Dichlorodifluoromethane	$\mu g/m^3$	3,584	31	<22	<48	47.8	555	397	**3,920**
Ethyl acetate	$\mu g/m^3$	2,509	<18	<16	<35	<0.72	<35	<35	<34.8
Freon 113	$\mu g/m^3$	230,627	<38	<35	<74	<1.5	<74	<74	<74
Heptane	$\mu g/m^3$	14,461	4,210	2,880	691	16.5	<39	<39	672
Hexachlorobutadiene	$\mu g/m^3$	51	<53*	<48	<100*	<2.1	<100*	<100*	<103*
Hexane	$\mu g/m^3$	18,839	11,700	11,600	3000	79.8	562	391	3,980
Isooctane	$\mu g/m^3$	14,917	1,050	720	382	4.45	115	80	58.9
iso-Propylbenzene (cumene)	$\mu g/m^3$	14,461	<25	<22	<47	<0.98	<47	<47	<47.5
Methyl t-Butyl Ether (MTBE)	$\mu g/m^3$	1,153	<18	<16	<35	<0.72	<35	<35	<34.8
Methylene Chloride	$\mu g/m^3$	18,764	<17	<16	<33	<0.69	<33	<33	<33.6
Propene	$\mu g/m^3$	91,723	676	474	146	<0.34	81	58	1,010
Tetrachloroethene	$\mu g/m^3$	1,390	<34	<31	<65	252	<65	<65	<9.66
Tetrahydrofuran	$\mu g/m^3$	62,828	<15	<13	<28	<0.59	<28	<28	1,800
Trichloroethene	$\mu g/m^3$	70	<27	<24	<52	7.6	<52	<52	<65.5
Trichlorofluoromethane	$\mu g/m^3$	34,325	<28	<26	<54	60.2	<54	<54	<54.3
Vinyl acetate	$\mu g/m^3$	6,586	<44	<40	260	<1.8	<85	<85	<268
Vinyl bromide (bromoethene)	$\mu g/m^3$	40	<22	<20	<42*	<0.87	<42*	<42*	<42.2*
Vinyl chloride	$\mu g/m^3$	70	**926**	**664**	62	3.98	<25	<25	**1,130**

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 Tables 7 to 10 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

* = Detection limit raised above criteria.

Table 7: 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		--	0.000625	0.225	0.088	1.00E-05	10	--	--	--
Toluene		2.3	--	0.274	0.087	9.20E-06	10	--	--	--
Ethylbenzene		2	--	0.358	0.075	8.50E-06	10	--	--	--
Xylenes		0.1	--	0.252	0.078	9.90E-06	10	--	--	--
Naphthalene		0.01	--	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	0.000017	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		0.06	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		4	--	0.073	0.271	0.000012	10	--	--	--
Chloroform		0.028	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		0.08949	--	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		3	--	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		0.04	0.038462	1.077	0.072	0.000008	10	--	--	--
Tetrahydrofuran		2	--	0.003	0.099	0.000011	10	--	--	--
trans-1,2-Dichloroethene		0.04	--	0.277	0.071	0.000012	10	--	--	--
trans-1,3-Dichloropropene		0.02	0.002500	0.053	0.087	0.000010	10	--	--	--
Trichloroethylene		0.002	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	0.000667	0.260	0.100	0.000012	10	--	--	--
Vinyl chloride		0.1	0.001136	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* .
Health Canada. 2021. Federal Contaminated Site Risk Assessment in Canada: Toxicological Reference Values (TRVs), version 3.0.

Table 8: 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 9: 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 10: Generic Soil Vapour Criteria

Parameter	Units	Residential Land Use		
		Basement and Slab-on-Grade		
		Coarse-Grained	Units	Coarse-Grained
Benzene		0.041		41
Toluene		75		75,190
Ethylbenzene		69		68,650
Xylenes		4		3,520
PHC F1		867		867,380
PHC F2		53		52,500
Naphthalene		0.38		380
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		0.0022		2.2
1,2-Dichlorobenzene		7.07		7,072
1,2-Dichloroethane		0.02		24
1,2-Dichloroethene (cis)		0.24		242
1,2-Dichloroethene (trans)		1.40		1,400
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)		103		102,977
Acetone	mg/m^3	919	$\mu g/m^3$	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		124		124,080
Chloroform		0.03		27
Chloromethane		2.66		2,657
Cyclohexane		202		201,510
Dibromochloromethane		6.07		6,070
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		1.39		1,390
Tetrahydrofuran		62.83		62,828
Trichloroethene		0.07		70
Trichlorofluoromethane		34.32		34,325
Vinyl acetate		6.59		6,586
Vinyl bromide (bromoethene)		0.04		40
Vinyl chloride		0.07		70

Notes:

mg/m3 milligrams per cubic metre

µg/m3 micrograms per cubic metre

Table 11: 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	VW-01	VW-02	VW-04	VW-04	VW-01	VW-01	VW-02	VW-04	VW-04	VW-01	VW-01	VW-02	VW-04	VW-04
			5-Dec-19	23-Nov-21	5-Dec-19	23-Nov-21	9-Dec-22	5-Dec-19	23-Nov-21	5-Dec-19	23-Nov-21	9-Dec-22	5-Dec-19	23-Nov-21	5-Dec-19	23-Nov-21	9-Dec-22
Benzene	µg/m^3	41	<16	<15	1.4	20	<65.5	ND	ND	3.4E-07	4.9E-06	ND	-	-	-	-	-
Toluene	µg/m^3	75,190	<19	<36	1.31	<36	<21.9	-	-	-	-	-	ND	ND	1.74E-05	ND	ND
Xylenes	µg/m^3	3520	<48	<96	<2	<96	113	-	-	-	-	-	ND	ND	ND	ND	3.21E-02
F1 (C_6-C_{10})	µg/m^3	867,383	62,900	63,900	1720	4980	404,000	-	-	-	-	-	7.25E-02	7.37E-02	1.98E-03	5.74E-03	**4.66E-01**
F2 (C_{10}-C_{16})	µg/m^3	52,495	19,300	67,500	380	<720	303	-	-	-	-	-	**3.68E-01**	**1.29E+00**	7.24E-03	-	5.77E-03
Aliphatics (C_6-C_8)	µg/m^3	740,737	56,400	-	1300	-	447,000	-	-	-	-	-	7.61E-02	-	1.76E-03	-	**6.03E-01**
Aliphatics (>C_8-C_{10})	µg/m^3	40,257	21,500	-	728	-	931	-	-	-	-	-	**5.34E-01**	-	1.81E-02	-	2.31E-02
Aliphatics (>C_{10}-C_{12})	µg/m^3	40,257	9,920	-	179	-	135	-	-	-	-	-	**2.46E-01**	-	4.45E-03	-	3.35E-03
Aliphatics (>C_{12}-C_{16})	µg/m^3	40,257	880	-	<30	-	<30	-	-	-	-	-	2.19E-02	-	ND	-	ND
Aromatics (C_6-C_8)	µg/m^3	740,737	-	-	-	-	2,340					-	-	-	-	-	3.16E-03
Aromatics (>C_{10}-C_{12})	µg/m^3	8,051	490	-	<15	-	41	-	-	-	-	-	6.09E-02	ND	ND	ND	5.09E-03
1,2-Dichloroethane	µg/m^3	217 / 24[e]	45	<39*	<0.81	<39*	<39.1	1.9E-05	ND	ND	ND	ND	**2.07E-01**	ND	ND	ND	ND
1,2-Dichloroethene (cis)	µg/m^3	242	34	<38	<0.79	<38	50	-	-	-	-	-	1.41E-01	ND	ND	ND	**2.07E-01**
1,2-Dichloroethene (trans)	µg/m^3	1,400	24	<38	<0.79	<38	50	-	-	-	-	-	1.71E-02	ND	ND	ND	3.57E-02
1,2-Dichlorotetrafluoroethane	µg/m^3	566,335	65	<67	7.6	181	669	-	-	-	-	-	1.15E-04	ND	1.34E-05	3.20E-04	1.18E-03
1,3,5-Trimethylbenzene	µg/m^3	2,235	172	129	<0.98	<47	<47.5	-	-	-	-	-	7.70E-02	5.77E-02	ND	ND	ND
2-Butanone (MEK)	µg/m^3	167,364	<15	<28	0.74	<28	245	-	-	-	-	-	ND	ND	4.42E-06	ND	1.46E-03
Acetone	µg/m^3	918,788	<460	<57	9.0	<57	323	-	-	-	-	-	ND	ND	9.80E-06	ND	3.52E-04
Carbon disulfide	µg/m^3	21,713	<16	<30	2.75	<30	<75.4	-	-	-	-	-	ND	ND	1.27E-04	ND	ND
Chloromethane	µg/m^3	2,657	<10	<20	1.1	<20	<19.9	-	-	-	-	-	ND	ND	4.14E-04	ND	ND
Cyclohexane	µg/m^3	201,510	6,700	2890	45	1180	699	-	-	-	-	-	3.32E-02	1.43E-02	2.23E-04	5.86E-03	3.47E-03
Dichlorodifluoromethane	µg/m^3	3,584	31	<48	47.8	555	3920	-	-	-	-	-	8.65E-03	ND	1.33E-02	1.55E-01	**1.09E+00**
Heptane	µg/m^3	14,461	4,210	691	16.5	<39	672	-	-	-	-	-	**2.91E-01**	4.78E-02	1.14E-03	ND	4.65E-02
Hexane	µg/m^3	18,839	11,700	3000	79.8	562	3980	-	-	-	-	-	**6.21E-01**	1.59E-01	4.24E-03	2.98E-02	**2.11E-01**
Isooctane	µg/m^3	14,917	1,050	382	4.45	115	58.9	-	-	-	-	-	7.04E-02	2.56E-02	2.98E-04	7.71E-03	3.95E-03
Propene	µg/m^3	91,723	676	146	<0.34	81	1010	-	-	-	-	-	7.37E-03	1.59E-03	ND	8.83E-04	1.10E-02
Tetrachloroethene	µg/m^3	1,392 / 2,679[e]	<34	<65	252	<65	<65.5	ND	ND	9.4E-07	ND	ND	ND	ND	1.81E-01	ND	ND
Tetrahydrofuran	µg/m^3	62,828	<15	<28	<0.59	<28	1,800	-	-	-	-	-	ND	ND	ND	ND	2.86E-02
Trichloroethene	µg/m^3	67 / 153[e]	<27	<52	7.6	<52	<51.9	ND	ND	5.0E-07	ND	ND	ND	ND	1.13E-01	ND	ND
Trichlorofluoromethane	µg/m^3	34,325	<28	<54	60.2	<54	<54.3	-	-	-	-	-	ND	ND	1.75E-03	ND	ND
Vinyl acetate	µg/m^3	6,586	<44	260	<1.8	<85	<268	-	-	-	-	-	ND	3.95E-02	ND	ND	ND
Vinyl chloride	µg/m^3	3,086 / 70[e]	926	62	3.98	<25	1,130	**1.3E-04**	8.9E-06	5.7E-07	ND	**1.6E-04**	**3.00E-01**	2.01E-02	1.29E-03	ND	**3.66E-01**
Cumulative Risk and Hazard Index [d]								**1.5E-04**	8.9E-06	2.3E-06	4.9E-06	**1.6E-04**	**2.713**	**1.725**	0.342	0.205	**2.680**
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}, individual hazards of 0.2, and/or target hazard level of 1.

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

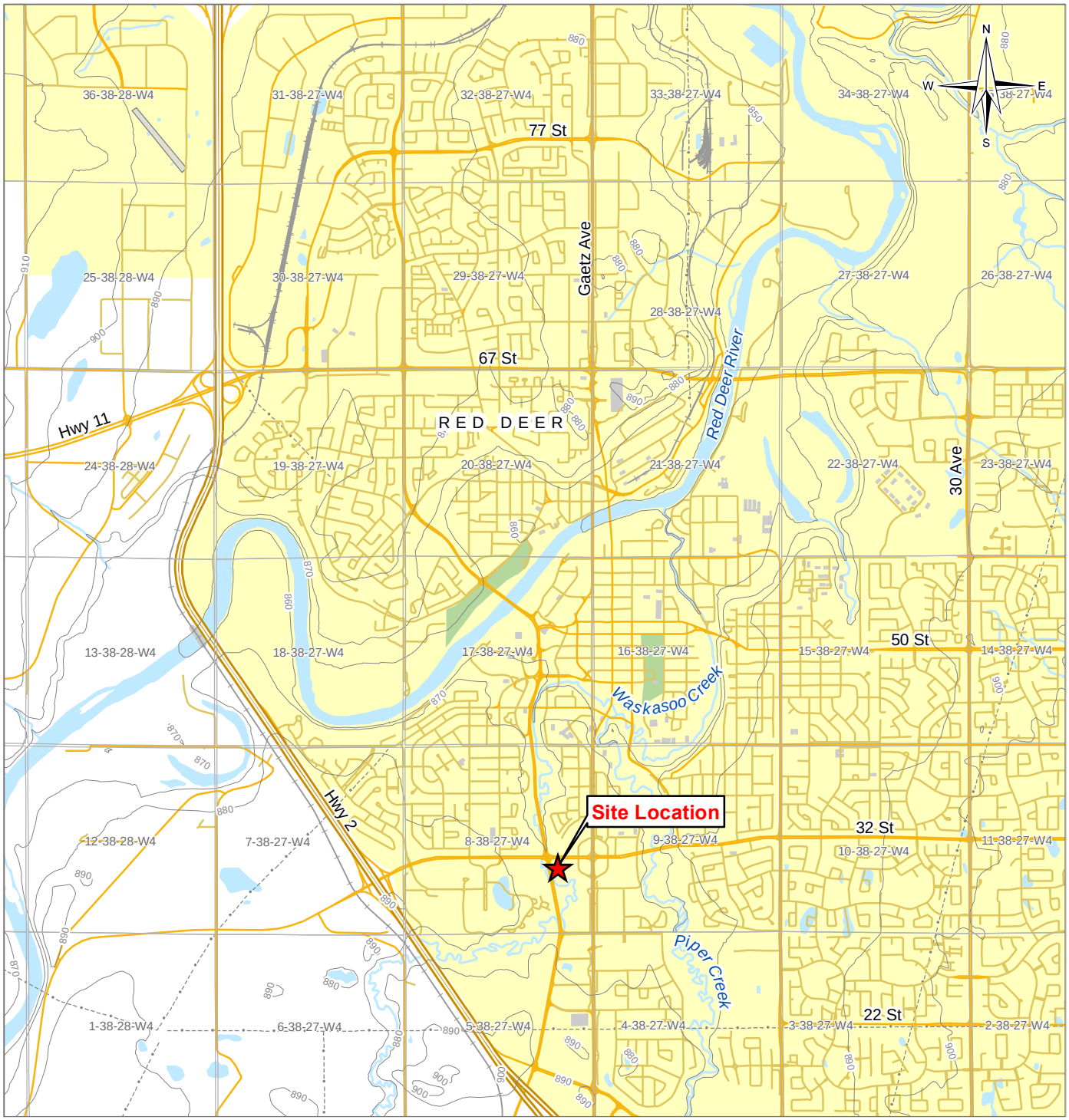
[b] Estimated cancer risk = (soil vapour concentration/cancer soil vapour screening level) x 10^{-5}.

[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



LEGEND

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

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

STATUS
ISSUED FOR USE

2022 AND 2023 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

Site Location Plan

PROJECTION 3TM 114	**DATUM** NAD83			**CLIENT** The City of Red Deer
Scale: 1:50,000 — 1 0.5 0 1 — Kilometres				TETRA TECH
FILE NO. SWOP04071-03_Figure01_SiteLocation.mxd				
OFFICE Tt-EDM	**DWN** SL	**CKD** MRV	**APVD** RM	**REV** 0
DATE July 2024	**PROJECT NO.** SWM.SWOP04071-03.004			**Figure 1**

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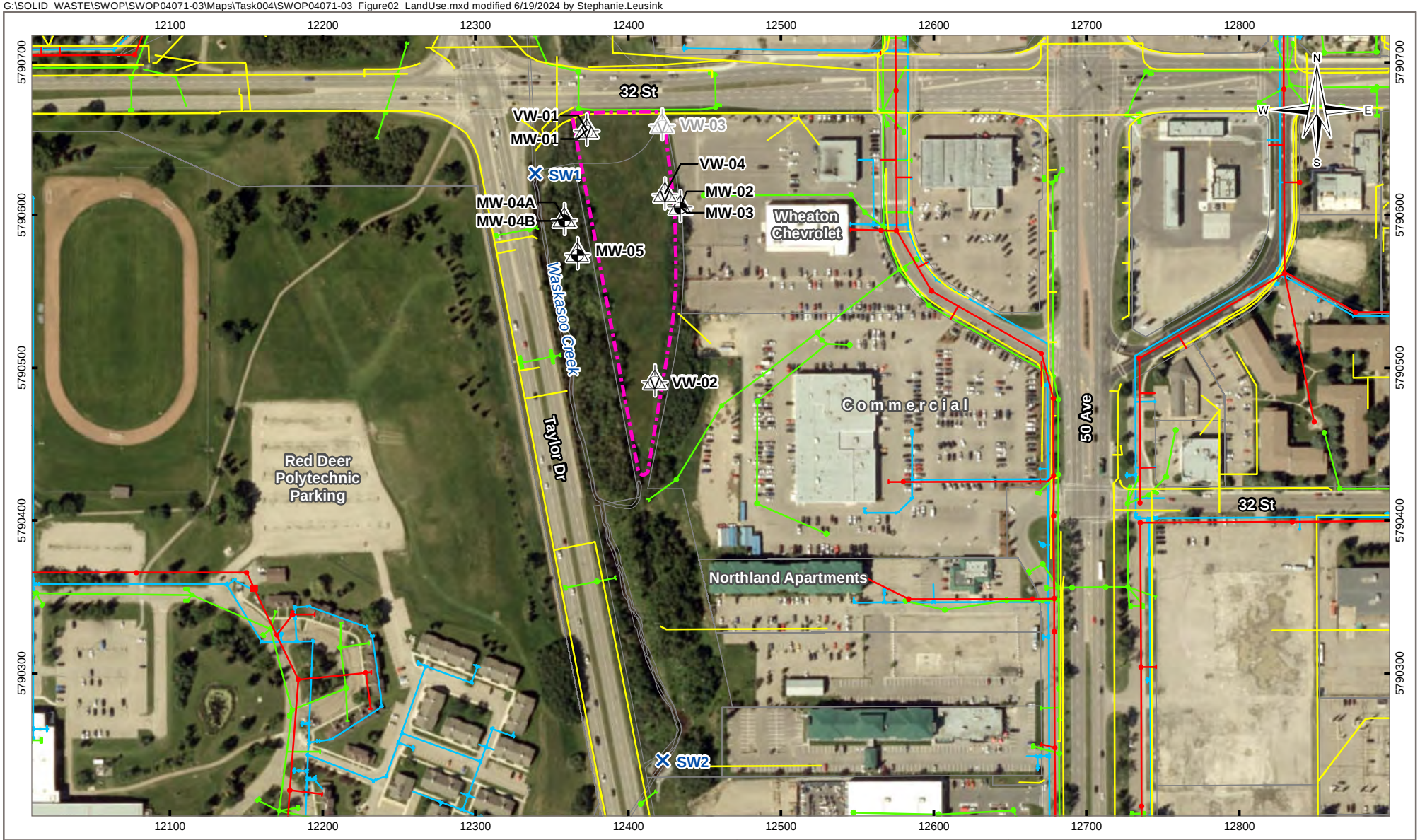
G:\SOLID_WASTE\SWOP\SWOP04071-03\Maps\Task004\SWOP04071-03_Figure02_LandUse.mxd modified 6/19/2024 by Stephanie.Leusink



LEGEND

- Monitoring Well
- Vapour Well - Faded symbol indicates a presumably destroyed well
- Surface Water
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Lot Boundary

Utilities

- Electrical
- Sanitary
- Storm
- Water

NOTES

Base data source: Imagery provided by ESRI; Red Deer County (2022)
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.
VW-03 was not located.

STATUS
ISSUED FOR USE

Scale: 1:3,500

50 25 0 50

Metres

PROJECTION	DATUM
3TM 114	NAD83

FILE NO.
SWOP04071-03_Figure02_LandUse.mxd

CLIENT
The City of Red Deer

TETRA TECH

2023 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

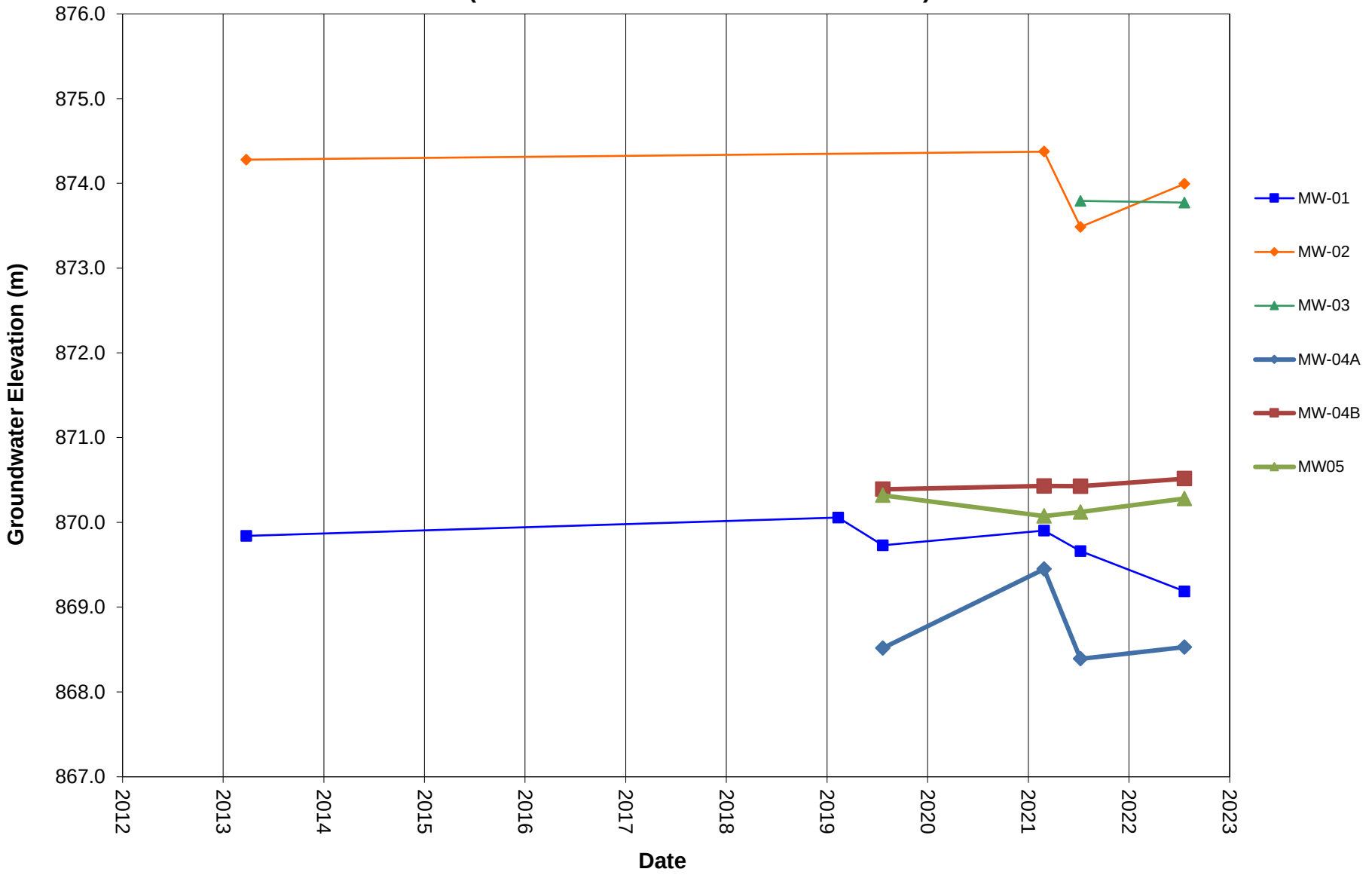
Site Plan and Surrounding Land Use

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

DATE	PROJECT NO.
July 024	SWM.SWOP04071-03.004

Figure 2

FIGURE 3
HISTORICAL GROUNDWATER ELEVATIONS
(GROUNDWATER MONITORING WELLS)



TETRA TECH

LEGEND

- Monitoring Well
- Vapour Well
- Presumably Destroyed Vapour Well
- Surface Water
- (8XX.XX) Groundwater Elevation (masl)
- Interpreted Groundwater Elevation Contour (1 masl)
- Inferred Groundwater Flow Direction
- Historic Waste Disposal (Provided by Tiamat, 2014)

NOTES
Base data source: Imagery provided by ESRI; Red Deer County (2022)
Roads from City of Red Deer Open Data, 2018
VW-03 was not located
masl - metres above sea level
[1] Well excluded from groundwater contouring

STATUS
ISSUED FOR USE

2022 AND 2023 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

Groundwater Elevations December 2022

PROJECTION	DATUM	CLIENT
3TM 114	NAD83	The City of Red Deer

Scale: 1:2,500
50 25 0 50
Metres

FILE NO. SWOP04071-03_Figure04_GW_Dec2022.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRB	BB	JG	0

DATE July 2024
PROJECT NO. SWM.SWOP04071-03.004

TETRA TECH

Figure 4

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APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

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1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

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.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

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 exploration, 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.

1.7 NOTIFICATION OF AUTHORITIES

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

SITE HISTORY, HISTORICAL INFORMATION, SITE SETTING, CONCEPTUAL SITE MODEL, AND REVIEW OF 2014 RISK MANAGEMENT PLAN

1.0 SITE HISTORY

The following section summarizes the history of the site and was developed for the 2019 groundwater and soil vapour monitoring report[1].

Municipal records indicate that waste disposal at the site occurred between approximately 1967 and 1968. This indicates that the estimated age of the waste material would be approximately 55 years old. Records indicate the waste as being municipal solid waste (MSW) consisting of plastics, cans, paper, metal, wire, glass, and rubber. Some construction debris was also identified in areas consisting of bricks, wood, and concrete. The former landfill is listed as inactive and closed.

Historical waste disposal was identified during the Phase II environmental site assessment[2] (ESA) throughout the entire site up to 32 Street at the north end. Estimated waste areas are identified on Figure 2. The Phase II ESA estimated the total area of buried waste at approximately 9,600 m^2 on-site and approximately 1,580 m^2 off-site (south of the 32 Street roadway).

Results of the Phase II ESA conducted by Tiamat Environmental Consultants Ltd. (Tiamat) indicated a thin surficial layer of sod, sand, and loam was overlying a sand and clay fill. The fill ranged from 3.0 m to 4.6 m deep in the areas of the site without MSW. Within the waste footprint, MSW was observed beneath the sod and loam layer to a depth of up to 4.6 m. The testholes along the east boundary of site had large amounts of MSW waste up to 3 m deep. MSW was overlying native clay. The investigation was conducted to depths of up to 7.6 m and bedrock was not encountered at any locations[2].

The Red Deer College historical landfill is situated west of the site, immediately west of Taylor Drive.

2.0 HISTORICAL GROUNDWATER MONITORING AND INVESTIGATION SUMMARY

The following section provides the historical environmentally monitoring results for the site.

Previous reports prepared by Tiamat for the site include:

- Phase I Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. September 24, 2013[3].
- Phase II Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. February 26, 2014[2].
- Environmental Risk Management Plan, Historic Waste Disposal Sites, Red Deer College & Red Deer Motors, The City of Red Deer. November 27, 2014[4].

[1] Tetra Tech Canada Inc. 2019 Groundwater and Soil Vapour Monitoring Report – Red Deer Motors. Prepared for The City of Red Deer. October 2020. Project Number: 704-SWM.SWOP04071-01.006.

[2] Tiamat Environmental Consultants Ltd. 2014a. Phase II Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. February 26, 2014.

[3] Tiamat Environmental Consultants Ltd. 2013. Phase I Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. September 24, 2013.

[4] Tiamat Environmental Consultants Ltd. 2014b. Environmental Risk Management Plan, Historic Waste Disposal Sites, Red Deer College & Red Deer Motors, The City of Red Deer. November 27, 2014.

The Phase I ESA[3] indicated that a sanitary waste permit existed for the site and environmental concerns could include the following listed below. The status of the permit is unknown and it was not reviewed.

- Generation of leachate from infiltration and percolation of precipitation into the first water-bearing zone.
- Generation of landfill gas (LFG), which may contain methane and other volatile organic compounds (VOCs) with the decomposition of the biomass materials and petroleum derived products.
- Differential ground settlement as waste material decomposes and consolidates.

Six testholes (TH-03, TH-05, TH-06, TH-07, TH-08, and TH-09) were advanced in 2013 as part of the Phase II ESA, and three vapour wells (VW-01 to VW-03) and three monitoring wells (MW-01 to MW-03) were installed. Tiamat noted that three previously installed by Alberta Environmental Protection[5] monitoring wells were on the west boundary of the site prior to conducting the Phase II ESA. No information regarding the Alberta Environmental Protection wells was included in the Phase I ESA or Phase II ESA for the site, and borehole logs were not available for review. These wells are identified as MW-04A, MW-04B, and MW-05.

The results of the Phase II ESA[2] indicated the following:

- Waste material on site is located on native sand or clay till.
- In 2013, the average groundwater depth was 4.2 m, which is situated within the waste material. The estimated horizontal hydraulic gradient was 2% to the northwest. Tiamat presented an estimated horizontal groundwater flow velocity of 4.7 m/year; however, it is unclear whether these calculations were for the adjacent Red Deer College site or for the subject site.
- VOCs and other petroleum hydrocarbons (PHCs) had detectable concentrations in 2013 at the monitoring wells at the down-gradient end of the site. These parameters were indicative of leachate. The leachate was characterized showing negative redox potentials and near anoxic conditions for dissolved oxygen.
- Several commercial businesses and residential developments are nearby the Red Deer Motors site.
- Differential settlement of cap material had occurred at the site. No activities located on adjacent lands were interpreted to be contributing environmental concerns.
- Light petroleum gases were detected at vapour wells on site and PHCs were detected at the northwest portion of site.
- The vapour wells detected volatile PHCs to carbon chain 12 and semi-volatile, oxygenated, and halogenated volatile hydrocarbons and ketones were detected in the soil vapour samples.

The recommendations of the program were as follows:

- Monitor groundwater elevations and soil vapour data bi-annually for one hydrogeological cycle.
- Determine if surface water sampling should be included with groundwater sampling to determine exposure from leachate contaminants in Waskasoo Creek.
- 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.

[5] Currently Alberta Environment and Protected Areas (AEPA).

- Develop a risk management plan (RMP) to consider future land uses and address environmental concerns.
- Review all data to update the RMP with new information.

The RMP conducted by Tiamat in 2014 stated "the outcome of the RMP confirm the identified chemicals of concern and relevant risk are manageable to facilitate future developments which may lie within the regulated setback distance to the historic waste disposal site"[4].

The following recommendations were made:

- 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.

2.1 2021 Vapour Well Installation

On May 4, 2021, a new vapour well (VW-04) was installed using a tracked drill rig and solid stem augers along the east site boundary near monitoring wells MW-02 and MW-03 to monitor LFG vapour along the east site boundary. While drilling the vapour well, waste was encountered 1 m below ground (mbg). The vapour well was installed with 19 mm diameter polyvinyl chloride (PVC) pipe to a depth of 4.0 mbg and screened with 19 mm slotted PVC pipe from 2.5 mbg to 4.0 mbg. Free water was not observed in the borehole during the installation of the vapour well; materials were noted as dry to a depth of 3.0 mbg and damp between 3.0 mbg and 4.0 mbg. This well was reinstalled in 2022 as described in the main report.

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 the site are located within the Red Deer River drainage basin with principal drainage via the Red Deer River located northwest of the site. The river has incised the uplands with gentle slopes to the east and west of the river, south of the site, aligned with Waskasoo Creek. 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[3]:

"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.

The Tertiary bedrock consists of sequences of alternating shales and sandstones of the Paskapoo Formation. This non-marine bedrock is composed of mudstone, siltstone and sandstone."

3.1.2 Local Geology

Based on borehole logs from the Phase II ESA conducted by Tiamat, the site is underlain by sand, loam and clay fill, underlain by clay till and/or native sands. Within the waste footprint, waste was encountered immediately below surface and was mixed with sand fill material. Fill material extended to maximum depths of approximately 7.6 m below grade (mbg) and waste was identified to a maximum depth of approximately 4.3 mbg. Bedrock was not encountered during the Phase II ESA.

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 buried channel 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[3]:

"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."

There are two significant buried valleys and aquifer resources beneath the city, Mapping by the Alberta Geological Survey[6] indicates that a north-northeast trending valley is situated east of the site, and a northeast trending valley (which connects to the first) is situated south of the site. The valleys could influence the geology and hydrogeology beneath the site, however the width of the valleys are not defined.

Waskasoo Creek is the primary surface water feature near the site. The creek historically meandered in the area of the site, but since the construction of Taylor Drive, circa late 1980s, follows a constructed drainage channel in a northerly direction. The regional groundwater flow is expected to follow the bedrock topography and may be influenced by the buried channels in the area that are trending in a northeasterly direction."

3.2.2 Local Hydrogeology

Waskasoo Creek is located on the west side of the site and extends to the north beneath 32 Street. It flows along the east side of Taylor Drive past the site, and discharges into the Red Deer River. Waskasoo Creek is located adjacent to the west of the site, and the Red Deer River is located approximately 1.8 km north of the site. The site

[6] Andriashek, L. comp. 2018. Thalwegs of Bedrock Valleys, Alberta (GIS data, line features); Alberta Energy Regulator, AER/AGS Digital Data 2018-0001.

is within a groundwater recharge zone and has a downward flow component. Shallow groundwater flow is assumed to flow towards the creek.

3.3 Groundwater Resource Usage

A search of the Alberta Water Well Database conducted in January 2020 for groundwater users within a 1 km radius of the Red Deer Motors site identified 13 groundwater wells; 6 of the wells are listed as domestic use, 2 are listed as domestic and stock use, 2 are listed as industrial use, 2 as "other" use, and 1 as observation use[7].

The nearest water well to site is located approximately 650 m east of the site. The proposed well use is domestic and stock. The water wells within a 1 km radius of the site range from 5.8 m to 120 m depths. The status and use of the surrounding groundwater wells were not confirmed and they were not field verified.

4.0 REVIEW OF THE 2014 HAZARD QUOTIENTS FROM THE RISK MANAGEMENT PLAN AND MITIGATIVE MEASURES FOR THE SITE

The following section is a review of the 2014 RMP for the site that was completed by Tiamat. The review of the 2014 RMP was completed for the 2019 groundwater and soil vapour monitoring report[1].

The 2014 RMP presented a proposed site-specific environmental RMP 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 chemicals of potential concern (COPCs) with a hazard quotient (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[4]. Further, underground utility workers and subsurface utility infrastructure were considered relevant to potential exposure.

The RMP applied a 10x factor of safety to the HQs to address uncertainties. HQs from the RMP ranged up to 588,280 (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"[8], 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 6. HQs were calculated using estimated dose (based on concentrations measured at the site) and divided by screening criteria. 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, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene) identified that the 2013 concentrations for soil vapour wells VW-02 and VW-03 would not have unacceptable HQs using the updated CCME methodology. Soil vapour well VW-01 would have unacceptable HQs using the updated CCME methodology for cis-1,2-dichloroethene, hexane, and vinyl chloride.

[7] Alberta Environment and Parks. 2019b. Water Well Database. Information obtained included in Appendix C. http://www.telusgeomatics.com/tgpub/ag_water/.

[8] Canadian Council of Ministers of the Environment. 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Exposure Protection of Human Exposures via Inhalation of Vapours. Available online: http://ceqg-rcqe.ccme.ca/en/index.html#void.

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 of Red Deer 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[9]. 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 Pa 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.

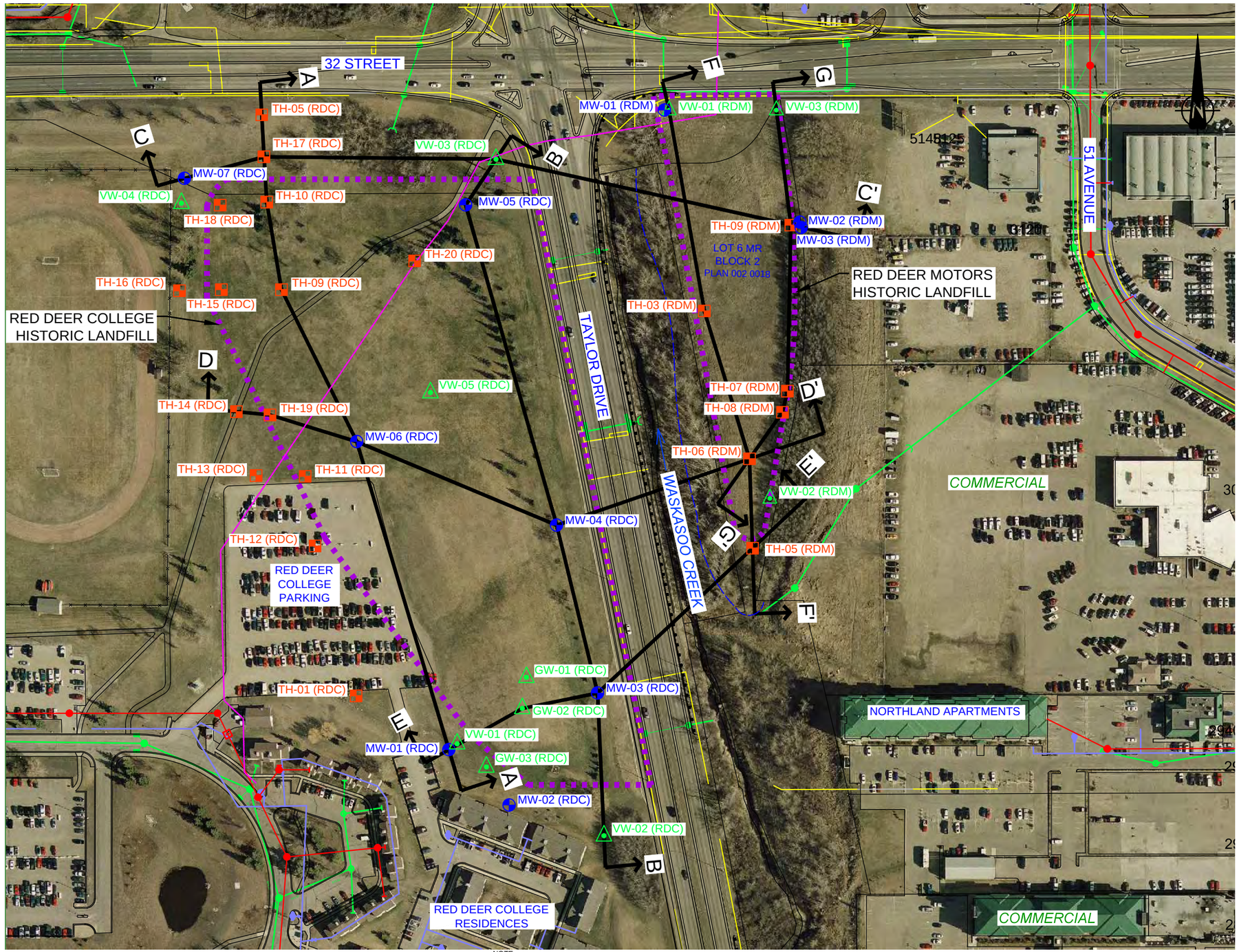
2. Active Measures - Level E: for Cancer Risk of >$2E^{-3}$ and/or HQ values >100.

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

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

APPENDIX C

CROSS-SECTIONS (TIAMAT 2014)



SOURCE
2010 ORTHOGRAPHIC IMAGE © COPYRIGHT WITH PERMISSION FROM THE CITY OF RED DEER.

0 20 50 100m
Scale 1:2000

PHASE II TEST LOCATIONS
MW-## GROUNDWATER MONITORING WELL INSTALLED BY TIAMAT
TH-## TESTHOLE
VW-## SOIL VAPOUR MONITORING WELL
MW-## GROUNDWATER MONITORING WELL INSTALLED BY OTHERS
REFER TO TABLE 1 FOR TESTHOLE INFORMATION

LEGEND
HISTORIC WASTE DISPOSAL
LOT BOUNDARY
100 YEAR FLOOD LINE
CROSS SECTION LOCATION
ELECTRICAL
SANITARY
STORM
WATER
PRIVATE COMMUNICATIONS CABLE INSTALLED JULY 2011

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.

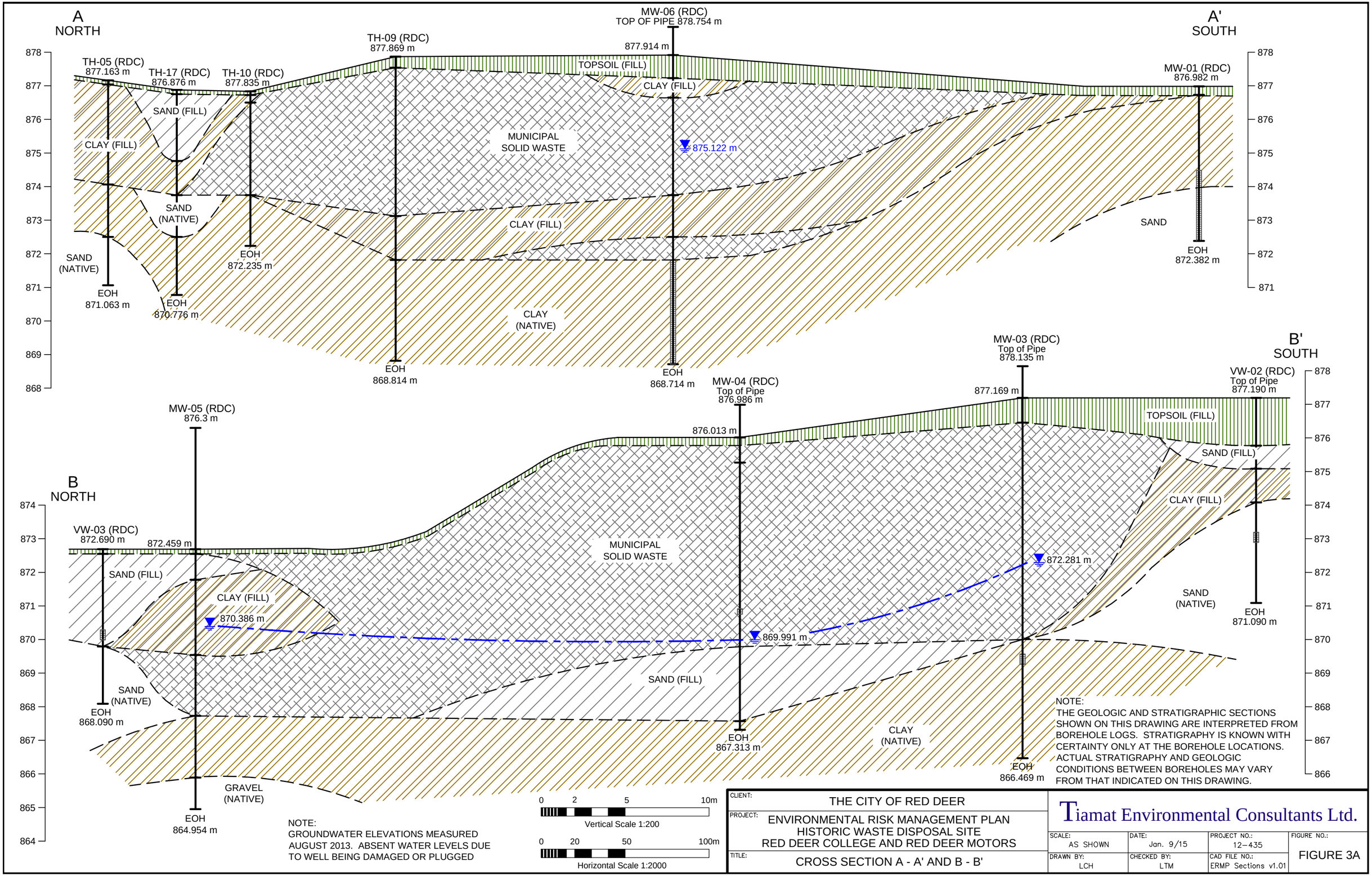
CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: INTERPRETED EXTENT OF WASTE

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 2000	JAN. 18/15	12-435	FIGURE 2
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP v1.03	



NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

0 2 5 10m
Vertical Scale 1:200

0 20 50 100m
Horizontal Scale 1:2000

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.

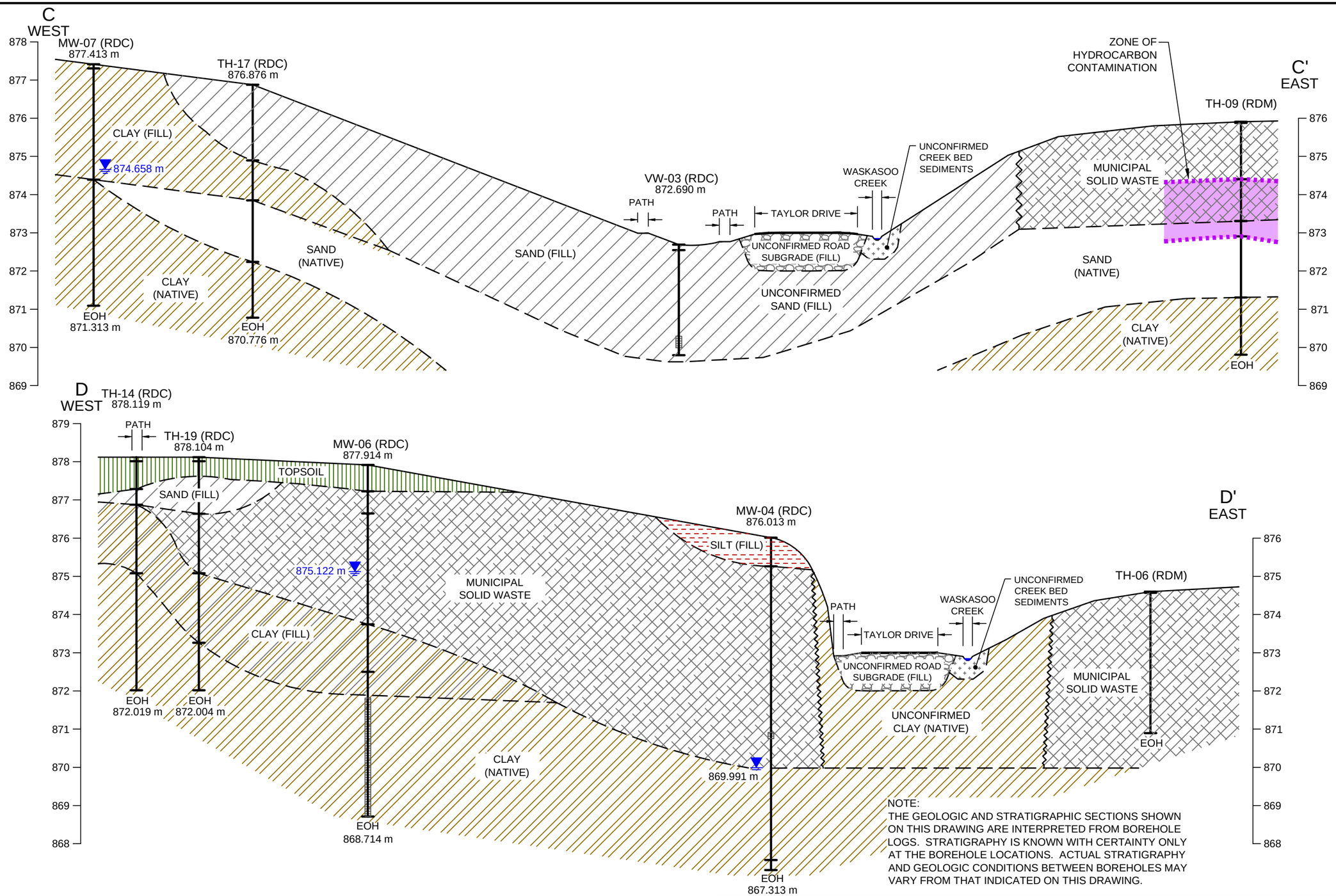
CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

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

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	Jan. 9/15	12-435	FIGURE 3A
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.01	



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.

0 2 5 10m
Vertical Scale 1:200

0 20 50 100m
Horizontal Scale 1:2000

NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

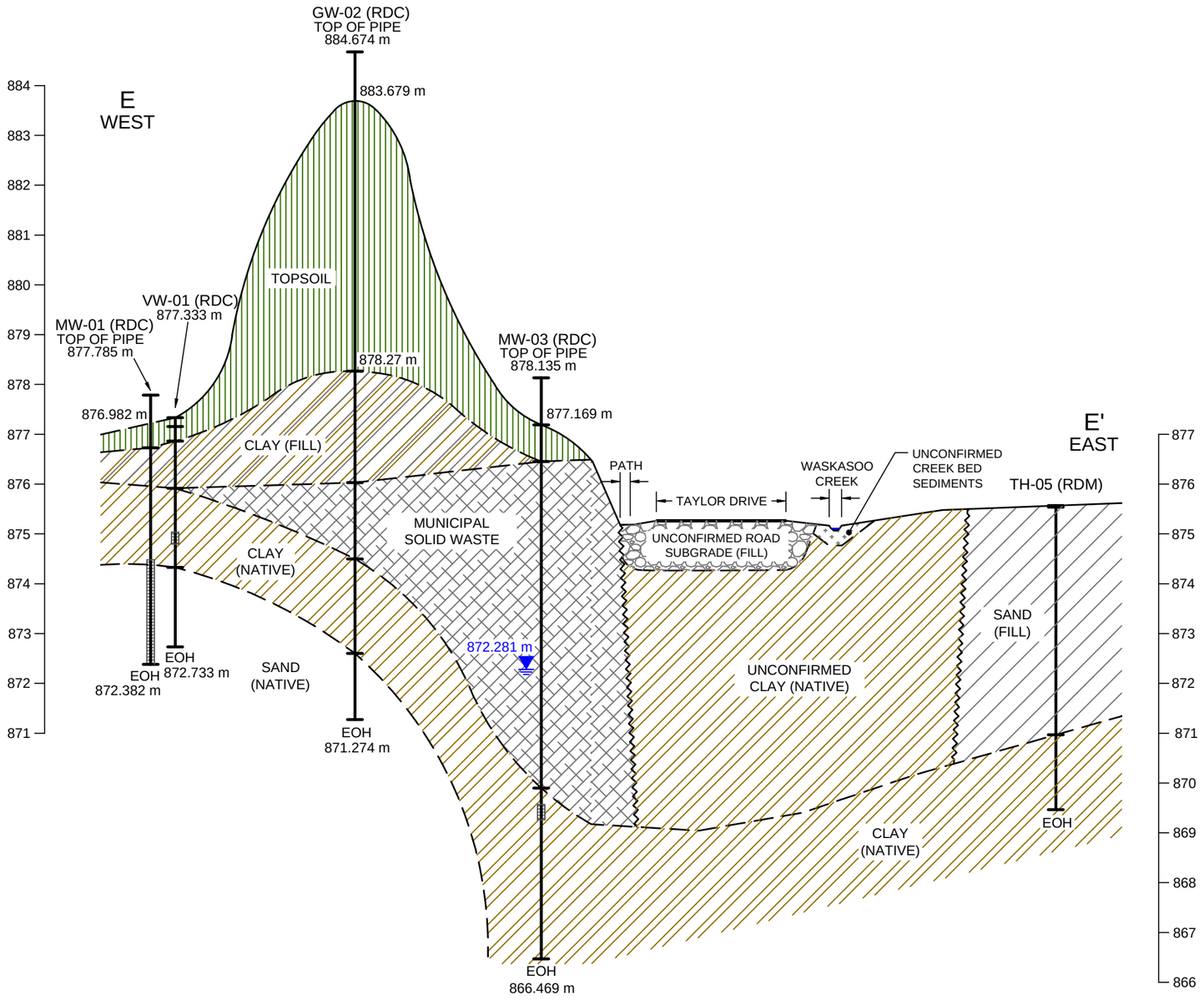
CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: CROSS SECTION C - C' AND D - D'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	June 27/14	12-435	FIGURE 3B
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.00	



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.

0 2 5 10m
Vertical Scale 1:200

0 20 50 100m
Horizontal Scale 1:2000

NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

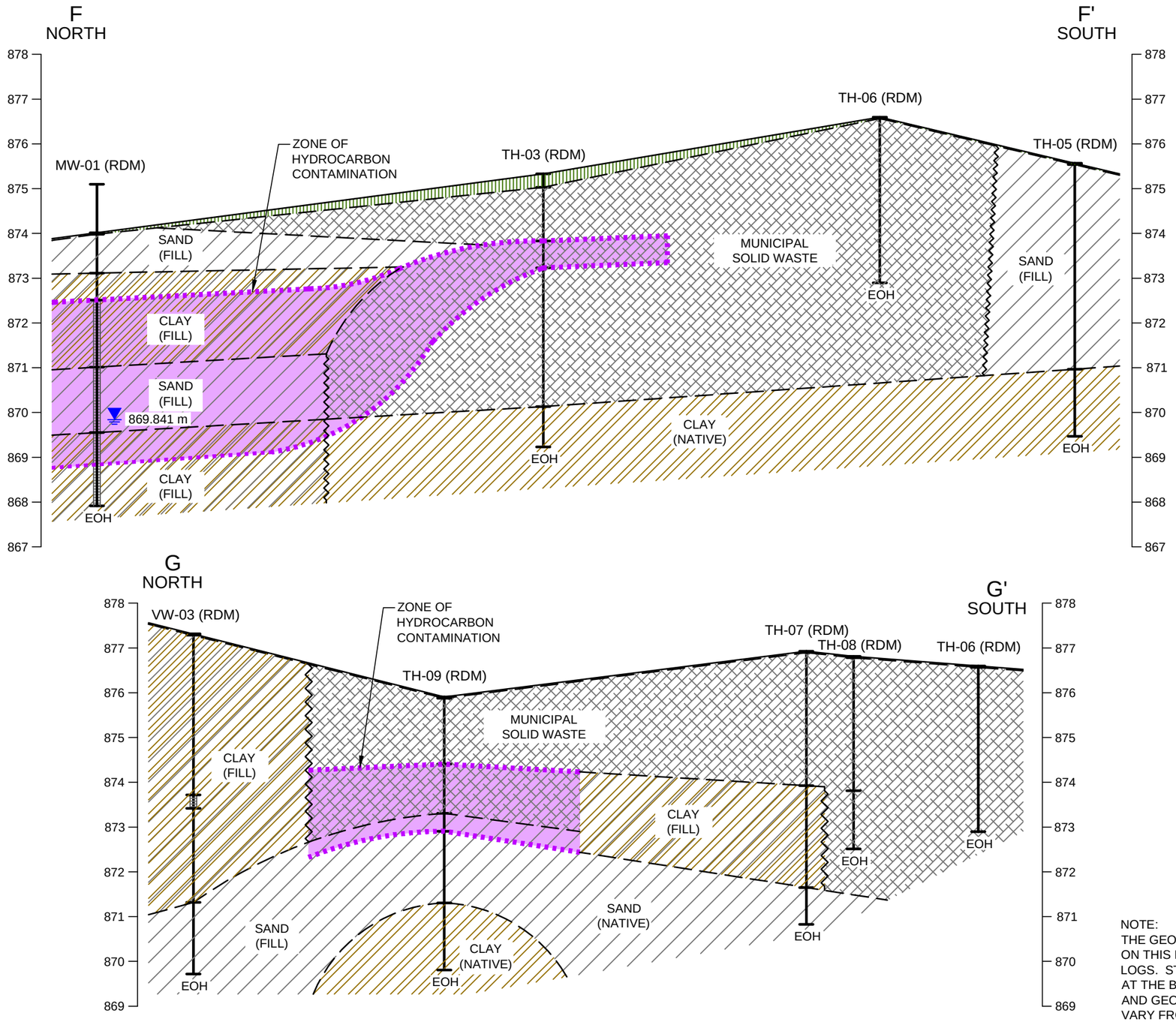
CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: CROSS SECTION E - E'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	June 27/14	12-435	FIGURE 3C
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.00	



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.

0 2 5 10m
Vertical Scale 1:200

0 20 50 100m
Horizontal Scale 1:2000

NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: CROSS SECTION F - F' AND G - G'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	June 27/14	12-435	FIGURE 3D
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.00	

APPENDIX D

LABORATORY ANALYTICAL REPORTS

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **CG2215748**	Page	: 1 of 7
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.005	Date Samples Received	: 11-Nov-2022 08:00
PO	: SWM.SWOP04071-03.005	Date Analysis Commenced	: 14-Nov-2022
C-O-C number	: CORD RED DEER COLLEGE	Issue Date	: 20-Nov-2022 12:11
Sampler	: , Ryan Miller		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Cynthia Bauer	Organic Supervisor	Organics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Maqsood UlHassan	Laboratory Analyst	Organics, Calgary, Alberta
Summie Lo	Lab Assistant	Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

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

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

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

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

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

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

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	SW-01 (DOWNSTREAM)	SW-02 (UPSTREAM)	----	----	----
					Client sampling date / time	10-Nov-2022 17:35	10-Nov-2022 17:15	----	----	----
						CG2215748-001	CG2215748-002	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		552	550	----	----	----
conductivity	----	E100	2.0	µS/cm		1210	1200	----	----	----
pH	----	E108	0.10	pH units		8.15	8.17	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L		561	563	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L		<1.0	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L		<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	2.0	mg/L		460	462	----	----	----
solids, total dissolved [TDS], calculated	----	EC103	1.0	mg/L		793	786	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0874	0.0792	----	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		139	136	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.201	0.197	----	----	----
nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L		1.41	1.36	----	----	----
nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L		<0.050 DLDS	<0.050 DLDS	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		75.0	70.9	----	----	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0500	mg/L		1.41	1.36	----	----	----
Ion Balance										
anion sum	----	EC101	0.10	meq/L		14.8	14.6	----	----	----
cation sum	----	EC101	0.10	meq/L		15.0	15.0	----	----	----
ion balance (APHA)	----	EC101	0.01	%		0.67	1.35	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%		101	103	----	----	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0284	0.0590	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L		0.00023	0.00021	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00121	0.00176	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.196	0.200	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L		0.078	0.082	----	----	----
cadmium, total	7440-43-9	E420	0.0000050	mg/L		<0.0000050	0.0000130	----	----	----

Analytical Results

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

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	SW-01 (DOWNSTREAM)	SW-02 (UPSTREAM)	----	----	----
					Client sampling date / time	10-Nov-2022 17:35	10-Nov-2022 17:15	----	----	----
						CG2215748-001	CG2215748-002	--------	--------	--------
						Result	Result	----	----	----
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		119	117	----	----	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00122	0.00119	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L		0.362	0.551	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L		0.000054	0.000090	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L		64.3	63.5	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.0428	0.0897	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L		<0.0000050	<0.0000050	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L		0.00306	0.00309	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L		8.62	8.54	----	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000326	0.000382	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L		89.9	87.8	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.00593	0.00587	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L		0.0082	0.0111	----	----	----
Dissolved Metals										
calcium, dissolved	7440-70-2	E421	0.050	mg/L		120	119	----	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		0.080	0.077	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L		61.2	61.4	----	----	----
manganese, dissolved	7439-96-5	E421	0.00500	mg/L		0.0143	0.0328	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		8.83	8.84	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		86.7	86.5	----	----	----
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	----	----	----
Volatile Organic Compounds										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	----	----	----
benzene	71-43-2	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
bromobenzene	108-86-1	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
bromochloromethane	74-97-5	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
bromodichloromethane	75-27-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

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

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	SW-01 (DOWNSTREAM)	SW-02 (UPSTREAM)	----	----	----
					Client sampling date / time	10-Nov-2022 17:35	10-Nov-2022 17:15	----	----	----
						CG2215748-001	CG2215748-002	--------	--------	--------
						Result	Result	----	----	----
Volatile Organic Compounds										
bromoform	75-25-2	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
bromomethane	74-83-9	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
butylbenzene, n-	104-51-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
butylbenzene, sec-	135-98-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
butylbenzene, tert-	98-06-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
carbon tetrachloride	56-23-5	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
chlorobenzene	108-90-7	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
chloroethane	75-00-3	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
chloroform	67-66-3	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
chloromethane	74-87-3	E611E	5.0	µg/L		<5.0	<5.0	----	----	----
chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
cymene, p-	99-87-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dibromochloromethane	124-48-1	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dibromomethane	74-95-3	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloromethane	75-09-2	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

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

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	SW-01 (DOWNSTREAM)	SW-02 (UPSTREAM)	----	----	----
					Client sampling date / time	10-Nov-2022 17:35	10-Nov-2022 17:15	----	----	----
						CG2215748-001	CG2215748-002	--------	--------	--------
						Result	Result	----	----	----
Volatile Organic Compounds										
dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloropropylene, cis+trans-1,3-	542-75-6	E611E	1.5	µg/L		<1.5	<1.5	----	----	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	----	----	----
ethylbenzene	100-41-4	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
hexachlorobutadiene	87-68-3	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
isopropylbenzene	98-82-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
propylbenzene, n-	103-65-1	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
styrene	100-42-5	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
tetrachloroethylene	127-18-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	----	----	----
toluene	108-88-3	E611E	0.50	µg/L		<0.50	<0.50	----	----	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trichloroethylene	79-01-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trichlorofluoromethane	75-69-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
vinyl chloride	75-01-4	E611E	1.0	µg/L		<1.0	<1.0	----	----	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	----	----	----
xylene, m+p-	179601-23-1	E611E	0.40	µg/L		<0.40	<0.40	----	----	----

Analytical Results

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

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: SW-01 (DOWNSTREAM)	SW-02 (UPSTREAM)	----	----	----
Client sampling date / time					10-Nov-2022 17:35	10-Nov-2022 17:15	----	----	----
					CG2215748-001	CG2215748-002	--------	--------	--------
					Result	Result	----	----	----
Volatile Organic Compounds									
xylene, o-	95-47-6	E611A	0.30	µg/L	<0.30	<0.30	----	----	----
xylene, o-	95-47-6	E611E	0.30	µg/L	<0.30	<0.30	----	----	----
xylenes, total	1330-20-7	E611A	0.50	µg/L	<0.50	<0.50	----	----	----
xylenes, total	1330-20-7	E611E	0.50	µg/L	<0.50	<0.50	----	----	----
BTEX, total	----	E611E	1.0	µg/L	<1.0	<1.0	----	----	----
trihalomethanes [THMs], total	----	E611E	2.0	µg/L	<2.0	<2.0	----	----	----
Hydrocarbons									
F1 (C6-C10)	----	E581.F1	100	µg/L	<100	<100	----	----	----
F1-BTEX	----	EC580	25	µg/L	<100	<100	----	----	----
F2 (C10-C16)	----	E601	100	µg/L	<100	<100	----	----	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%	85.5	88.0	----	----	----
dichlorotoluene, 3,4-	97-75-0	E581.F1	1.0	%	76.8	75.6	----	----	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%	78.3	82.1	----	----	----
bromofluorobenzene, 4-	460-00-4	E611E	1.0	%	78.3	82.1	----	----	----
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%	101	103	----	----	----
difluorobenzene, 1,4-	540-36-3	E611E	1.0	%	101	103	----	----	----

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

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2215748**	Page	: 1 of 11
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.005	Date Samples Received	: 11-Nov-2022 08:00
PO	: SWM.SWOP04071-03.005	Issue Date	: 20-Nov-2022 12:11
C-O-C number	: CORD RED DEER COLLEGE		
Sampler	: , Ryan Miller		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

Key

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

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

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

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SW-01 (DOWNSTREAM)	E298	10-Nov-2022	15-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SW-02 (UPSTREAM)	E298	10-Nov-2022	15-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE SW-01 (DOWNSTREAM)	E235.Cl	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE SW-02 (UPSTREAM)	E235.Cl	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE SW-01 (DOWNSTREAM)	E235.F	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE SW-02 (UPSTREAM)	E235.F	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE SW-01 (DOWNSTREAM)	E235.NO3	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	3 days	5 days	× EHT

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC										
HDPE SW-02 (UPSTREAM)	E235.NO3	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	3 days	5 days	✖ EHT
Anions and Nutrients : Nitrite in Water by IC										
HDPE SW-01 (DOWNSTREAM)	E235.NO2	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	3 days	5 days	✖ EHT
Anions and Nutrients : Nitrite in Water by IC										
HDPE SW-02 (UPSTREAM)	E235.NO2	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	3 days	5 days	✖ EHT
Anions and Nutrients : Sulfate in Water by IC										
HDPE SW-01 (DOWNSTREAM)	E235.SO4	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE SW-02 (UPSTREAM)	E235.SO4	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) SW-01 (DOWNSTREAM)	E421	10-Nov-2022	17-Nov-2022	----	----		18-Nov-2022	180 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) SW-02 (UPSTREAM)	E421	10-Nov-2022	17-Nov-2022	----	----		18-Nov-2022	180 days	8 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) SW-01 (DOWNSTREAM)	E581.F1	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	14 days	5 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) SW-02 (UPSTREAM)	E581.F1	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	14 days	5 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) SW-01 (DOWNSTREAM)	E601	10-Nov-2022	18-Nov-2022	14 days	8 days	✓	18-Nov-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) SW-02 (UPSTREAM)	E601	10-Nov-2022	18-Nov-2022	14 days	8 days	✓	18-Nov-2022	40 days	0 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE SW-01 (DOWNSTREAM)	E290	10-Nov-2022	17-Nov-2022	----	----		17-Nov-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE SW-02 (UPSTREAM)	E290	10-Nov-2022	17-Nov-2022	----	----		17-Nov-2022	14 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE SW-01 (DOWNSTREAM)	E100	10-Nov-2022	17-Nov-2022	----	----		17-Nov-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE SW-02 (UPSTREAM)	E100	10-Nov-2022	17-Nov-2022	----	----		17-Nov-2022	28 days	7 days	✓
Physical Tests : pH by Meter										
HDPE SW-01 (DOWNSTREAM)	E108	10-Nov-2022	17-Nov-2022	----	----		17-Nov-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE SW-02 (UPSTREAM)	E108	10-Nov-2022	17-Nov-2022	----	----		17-Nov-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) SW-01 (DOWNSTREAM)	E508	10-Nov-2022	18-Nov-2022	----	----		18-Nov-2022	28 days	8 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) SW-02 (UPSTREAM)	E508	10-Nov-2022	18-Nov-2022	----	----		18-Nov-2022	28 days	8 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE total (nitric acid) SW-01 (DOWNSTREAM)	E420	10-Nov-2022	18-Nov-2022	----	----		18-Nov-2022	180 days	8 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE total (nitric acid) SW-02 (UPSTREAM)	E420	10-Nov-2022	18-Nov-2022	----	----		18-Nov-2022	180 days	8 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) SW-01 (DOWNSTREAM)	E611A	10-Nov-2022	14-Nov-2022	----	----		14-Nov-2022	14 days	4 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) SW-02 (UPSTREAM)	E611A	10-Nov-2022	14-Nov-2022	----	----		14-Nov-2022	14 days	4 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) SW-01 (DOWNSTREAM)	E611E	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	14 days	5 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) SW-02 (UPSTREAM)	E611E	10-Nov-2022	14-Nov-2022	----	----		15-Nov-2022	14 days	5 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	747357	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	743797	1	5	20.0	5.0	✓
BTEX by Headspace GC-MS	E611A	742430	1	15	6.6	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	742431	1	15	6.6	5.0	✓
Chloride in Water by IC	E235.Cl	742806	1	3	33.3	5.0	✓
Conductivity in Water	E100	747358	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	747186	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	742803	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	742804	1	3	33.3	5.0	✓
Nitrite in Water by IC	E235.NO2	742807	1	3	33.3	5.0	✓
pH by Meter	E108	747356	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	742805	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	748807	1	20	5.0	5.0	✓
Total metals in Water by CRC ICPMS	E420	747704	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	742433	1	2	50.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	747357	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	743797	1	5	20.0	5.0	✓
BTEX by Headspace GC-MS	E611A	742430	1	15	6.6	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	742431	1	15	6.6	5.0	✓
CCME PHCs - F2-F4 by GC-FID	E601	746126	1	18	5.5	5.0	✓
Chloride in Water by IC	E235.Cl	742806	1	3	33.3	5.0	✓
Conductivity in Water	E100	747358	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	747186	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	742803	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	742804	1	3	33.3	5.0	✓
Nitrite in Water by IC	E235.NO2	742807	1	3	33.3	5.0	✓
pH by Meter	E108	747356	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	742805	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	748807	1	20	5.0	5.0	✓
Total metals in Water by CRC ICPMS	E420	747704	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	742433	1	2	50.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	747357	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	743797	1	5	20.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
BTEX by Headspace GC-MS	E611A	742430	1	15	6.6	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	742431	1	15	6.6	5.0	✓
CCME PHCs - F2-F4 by GC-FID	E601	746126	1	18	5.5	5.0	✓
Chloride in Water by IC	E235.Cl	742806	1	3	33.3	5.0	✓
Conductivity in Water	E100	747358	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	747186	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	742803	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	742804	1	3	33.3	5.0	✓
Nitrite in Water by IC	E235.NO2	742807	1	3	33.3	5.0	✓
Sulfate in Water by IC	E235.SO4	742805	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	748807	1	20	5.0	5.0	✓
Total metals in Water by CRC ICPMS	E420	747704	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	742433	1	2	50.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	743797	1	5	20.0	5.0	✓
BTEX by Headspace GC-MS	E611A	742430	1	15	6.6	5.0	✓
Chloride in Water by IC	E235.Cl	742806	1	3	33.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	747186	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	742803	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	742804	1	3	33.3	5.0	✓
Nitrite in Water by IC	E235.NO2	742807	1	3	33.3	5.0	✓
Sulfate in Water by IC	E235.SO4	742805	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	748807	1	20	5.0	5.0	✓
Total metals in Water by CRC ICPMS	E420	747704	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	742433	1	2	50.0	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Chloride in Water by IC	E235.Cl Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC	E235.NO2 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
CCME PHC - F1 by Headspace GC-FID	E581.F1 Calgary - Environmental	Water	CCME PHC in Soil - Tier 1	CCME Fraction 1 (F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
CCME PHCs - F2-F4 by GC-FID	E601 Calgary - Environmental	Water	CCME PHC in Soil - Tier 1	Sample extracts are analyzed by GC-FID for CCME hydrocarbon fractions (F2-F4).
BTEX by Headspace GC-MS	E611A Calgary - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs (Prairies List) by Headspace GC-MS	E611E Calgary - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
TDS in Water (Calculation)	EC103 Calgary - Environmental	Water	APHA 1030E (mod)	Total Dissolved Solids is calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Calgary - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).
F1-BTEX	EC580 Calgary - Environmental	Water	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
VOCs Preparation for Headspace Analysis	EP581 Calgary - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
PHCs and PAHs Hexane Extraction	EP601 Calgary - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **CG2215748**	Page	: 1 of 18
Client	: Tetra Tech Canada Inc.	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	:	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.005	Date Samples Received	: 11-Nov-2022 08:00
PO	: SWM.SWOP04071-03.005	Date Analysis Commenced	: 14-Nov-2022
C-O-C number	: CORD RED DEER COLLEGE	Issue Date	: 20-Nov-2022 12:11
Sampler	: , Ryan Miller 403 203 3355		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Cynthia Bauer	Organic Supervisor	Calgary Organics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Maqsood UlHassan	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Summie Lo	Lab Assistant	Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 747356)											
CG2215747-001	Anonymous	pH	----	E108	0.10	pH units	8.24	8.16	0.976%	4%	----
Physical Tests (QC Lot: 747357)											
CG2215747-001	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	478	483	0.915%	20%	----
Physical Tests (QC Lot: 747358)											
CG2215747-001	Anonymous	conductivity	----	E100	2.0	µS/cm	1690	1680	0.296%	10%	----
Anions and Nutrients (QC Lot: 742803)											
CG2215722-008	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.062	0.061	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 742804)											
CG2215722-008	Anonymous	nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L	0.118	0.116	0.002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 742805)											
CG2215722-008	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	39.9	40.1	0.612%	20%	----
Anions and Nutrients (QC Lot: 742806)											
CG2215722-008	Anonymous	chloride	16887-00-6	E235.Cl	0.50	mg/L	0.87	0.86	0.008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 742807)											
CG2215722-008	Anonymous	nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 743797)											
CG2215688-008	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.230	0.226	1.54%	20%	----
Total Metals (QC Lot: 747704)											
CG2215745-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0189	0.0173	0.0016	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00041	0.00041	0.000004	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0462	0.0472	1.99%	20%	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	35.3	35.7	1.08%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.016	0.017	0.0006	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	10.8	11.0	1.94%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 747704) - continued											
CG2215745-001	Anonymous	manganese, total	7439-96-5	E420	0.00010	mg/L	0.00173	0.00169	2.11%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.534	0.538	0.732%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	1.27 µg/L	0.00134	5.60%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	3.10	3.16	1.92%	20%	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000671	0.000682	1.66%	20%	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 748807)											
CG2215732-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 747186)											
CG2215751-001	Anonymous	calcium, dissolved	7440-70-2	E421	0.050	mg/L	37.1	37.1	0.0320%	20%	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	11.8	11.5	2.79%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00021	0.00024	0.00003	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.583	0.576	1.22%	20%	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	3.94	3.87	1.97%	20%	----
Volatile Organic Compounds (QC Lot: 742430)											
CG2215722-001	Anonymous	benzene	71-43-2	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 742433)											
CG2215748-001	SW-01 (DOWNSTREAM)	benzene	71-43-2	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromobenzene	108-86-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromochloromethane	74-97-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromoform	75-25-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromomethane	74-83-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, n-	104-51-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, sec-	135-98-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, tert-	98-06-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 742433) - continued											
CG2215748-001	SW-01 (DOWNSTREAM)	chlorobenzene	108-90-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloroethane	75-00-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloroform	67-66-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloromethane	74-87-3	E611E	5.0	µg/L	<5.0	<5.0	0	Diff <2x LOR	----
		chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		cymene, p-	99-87-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromomethane	74-95-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloromethane	75-09-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		hexachlorobutadiene	87-68-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		isopropylbenzene	98-82-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		propylbenzene, n-	103-65-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		styrene	100-42-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 742433) - continued											
CG2215748-001	SW-01 (DOWNSTREAM)	tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		toluene	108-88-3	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611E	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611E	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 742431)											
CG2215722-001	Anonymous	F1 (C6-C10)	----	E581.F1	100	µg/L	<100	<100	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 747357)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 747358)						
conductivity	----	E100	1	µS/cm	1.3	----
Anions and Nutrients (QCLot: 742803)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 742804)						
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 742805)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 742806)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 742807)						
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 743797)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Total Metals (QCLot: 747704)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 747704) - continued						
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 748807)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 747186)						
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
Volatile Organic Compounds (QCLot: 742430)						
benzene	71-43-2	E611A	0.5	µg/L	<0.50	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	<0.50	----
toluene	108-88-3	E611A	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611A	0.3	µg/L	<0.30	----
Volatile Organic Compounds (QCLot: 742433)						
benzene	71-43-2	E611E	0.5	µg/L	<0.50	----
bromobenzene	108-86-1	E611E	1	µg/L	<1.0	----
bromochloromethane	74-97-5	E611E	1	µg/L	<1.0	----
bromodichloromethane	75-27-4	E611E	1	µg/L	<1.0	----
bromoform	75-25-2	E611E	1	µg/L	<1.0	----
bromomethane	74-83-9	E611E	1	µg/L	<1.0	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	<1.0	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	<1.0	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	<1.0	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	<0.50	----
chlorobenzene	108-90-7	E611E	1	µg/L	<1.0	----
chloroethane	75-00-3	E611E	1	µg/L	<1.0	----
chloroform	67-66-3	E611E	1	µg/L	<1.0	----
chloromethane	74-87-3	E611E	5	µg/L	<5.0	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 742433) - continued						
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	<1.0	----
cymene, p-	99-87-6	E611E	1	µg/L	<1.0	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	<1.0	----
dibromochloromethane	124-48-1	E611E	1	µg/L	<1.0	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	<1.0	----
dibromomethane	74-95-3	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	<1.0	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	<1.0	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	<1.0	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	<1.0	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	<1.0	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	<1.0	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	<1.0	----
dichloromethane	75-09-2	E611E	1	µg/L	<1.0	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	<1.0	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	<1.0	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	<1.0	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	<1.0	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	<1.0	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	<1.0	----
ethylbenzene	100-41-4	E611E	0.5	µg/L	<0.50	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	<1.0	----
isopropylbenzene	98-82-8	E611E	1	µg/L	<1.0	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	<0.50	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	<1.0	----
styrene	100-42-5	E611E	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	<1.0	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	<1.0	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	<1.0	----
toluene	108-88-3	E611E	0.5	µg/L	<0.50	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	<1.0	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 742433) - continued						
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	<1.0	----
trichloroethylene	79-01-6	E611E	1	µg/L	<1.0	----
trichlorofluoromethane	75-69-4	E611E	1	µg/L	<1.0	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	<1.0	----
vinyl chloride	75-01-4	E611E	1	µg/L	<1.0	----
xylene, m+p-	179601-23-1	E611E	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611E	0.3	µg/L	<0.30	----
Hydrocarbons (QCLot: 742431)						
F1 (C6-C10)	----	E581.F1	100	µg/L	<100	----
Hydrocarbons (QCLot: 746126)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 747356)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 747357)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	102	85.0	115	----
Physical Tests (QCLot: 747358)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	98.6	90.0	110	----
Anions and Nutrients (QCLot: 742803)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	98.2	90.0	110	----
Anions and Nutrients (QCLot: 742804)									
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	98.6	90.0	110	----
Anions and Nutrients (QCLot: 742805)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	99.3	90.0	110	----
Anions and Nutrients (QCLot: 742806)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	98.2	90.0	110	----
Anions and Nutrients (QCLot: 742807)									
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	96.7	90.0	110	----
Anions and Nutrients (QCLot: 743797)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	103	85.0	115	----
Total Metals (QCLot: 747704)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	96.7	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	105	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	97.2	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	95.7	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	95.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	96.2	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	95.7	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	95.4	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	97.8	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	96.3	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 747704) - continued									
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	95.7	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	97.9	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	96.0	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	93.1	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	92.3	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	96.2	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	95.4	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	96.7	80.0	120	----
Total Metals (QCLot: 748807)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	102	80.0	120	----
Dissolved Metals (QCLot: 747186)									
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	96.1	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	105	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	90.6	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	95.2	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	95.4	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	92.4	80.0	120	----
Volatile Organic Compounds (QCLot: 742430)									
benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	98.3	70.0	130	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	80.8	70.0	130	----
toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	80.5	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	82.4	70.0	130	----
xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	88.1	70.0	130	----
Volatile Organic Compounds (QCLot: 742433)									
benzene	71-43-2	E611E	0.5	µg/L	100 µg/L	98.3	70.0	130	----
bromobenzene	108-86-1	E611E	1	µg/L	100 µg/L	90.8	70.0	130	----
bromochloromethane	74-97-5	E611E	1	µg/L	100 µg/L	117	70.0	130	----
bromodichloromethane	75-27-4	E611E	1	µg/L	100 µg/L	120	70.0	130	----
bromoform	75-25-2	E611E	1	µg/L	100 µg/L	96.3	70.0	130	----
bromomethane	74-83-9	E611E	1	µg/L	100 µg/L	111	60.0	140	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	100 µg/L	75.7	70.0	130	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	100 µg/L	77.5	70.0	130	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	100 µg/L	75.8	70.0	130	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	100 µg/L	112	70.0	130	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 742433) - continued									
chlorobenzene	108-90-7	E611E	1	µg/L	100 µg/L	98.5	70.0	130	----
chloroethane	75-00-3	E611E	1	µg/L	100 µg/L	112	60.0	140	----
chloroform	67-66-3	E611E	1	µg/L	100 µg/L	119	70.0	130	----
chloromethane	74-87-3	E611E	5	µg/L	100 µg/L	107	60.0	140	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	100 µg/L	89.9	70.0	130	----
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	100 µg/L	83.6	70.0	130	----
cymene, p-	99-87-6	E611E	1	µg/L	100 µg/L	76.9	70.0	130	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	100 µg/L	122	70.0	130	----
dibromochloromethane	124-48-1	E611E	1	µg/L	100 µg/L	118	70.0	130	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	100 µg/L	114	70.0	130	----
dibromomethane	74-95-3	E611E	1	µg/L	100 µg/L	122	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	100 µg/L	101	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	100 µg/L	92.7	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	100 µg/L	94.5	70.0	130	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	100 µg/L	120	60.0	140	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	100 µg/L	115	70.0	130	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	100 µg/L	116	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	100 µg/L	104	70.0	130	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	100 µg/L	111	70.0	130	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	100 µg/L	103	70.0	130	----
dichloromethane	75-09-2	E611E	1	µg/L	100 µg/L	108	70.0	130	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	100 µg/L	107	70.0	130	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	100 µg/L	108	70.0	130	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	100 µg/L	107	70.0	130	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	100 µg/L	97.9	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	100 µg/L	99.0	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	100 µg/L	113	70.0	130	----
ethylbenzene	100-41-4	E611E	0.5	µg/L	100 µg/L	80.8	70.0	130	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	100 µg/L	126	70.0	130	----
isopropylbenzene	98-82-8	E611E	1	µg/L	100 µg/L	86.5	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	100 µg/L	102	70.0	130	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	100 µg/L	86.7	70.0	130	----
styrene	100-42-5	E611E	0.5	µg/L	100 µg/L	82.7	70.0	130	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	100 µg/L	124	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	100 µg/L	109	70.0	130	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	100 µg/L	102	70.0	130	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 742433) - continued									
toluene	108-88-3	E611E	0.5	µg/L	100 µg/L	80.5	70.0	130	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	100 µg/L	114	70.0	130	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	100 µg/L	123	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	100 µg/L	118	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	100 µg/L	120	70.0	130	----
trichloroethylene	79-01-6	E611E	1	µg/L	100 µg/L	107	70.0	130	----
trichlorofluoromethane	75-69-4	E611E	1	µg/L	100 µg/L	116	60.0	140	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	100 µg/L	106	70.0	130	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	100 µg/L	76.8	70.0	130	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	100 µg/L	82.9	70.0	130	----
vinyl chloride	75-01-4	E611E	1	µg/L	100 µg/L	94.0	60.0	140	----
xylene, m+p-	179601-23-1	E611E	0.4	µg/L	200 µg/L	82.4	70.0	130	----
xylene, o-	95-47-6	E611E	0.3	µg/L	100 µg/L	88.1	70.0	130	----
Hydrocarbons (QCLot: 742431)									
F1 (C6-C10)	----	E581.F1	100	µg/L	100 µg/L	76.2	70.0	130	----
Hydrocarbons (QCLot: 746126)									
F2 (C10-C16)	----	E601	100	µg/L	3669.135 µg/L	92.2	70.0	130	----

Matrix Spike (MS) Report

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

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 742803)										
CG2215748-001	SW-01 (DOWNSTREAM)	fluoride	16984-48-8	E235.F	0.948 mg/L	1 mg/L	94.8	75.0	125	----
Anions and Nutrients (QCLot: 742804)										
CG2215748-001	SW-01 (DOWNSTREAM)	nitrate (as N)	14797-55-8	E235.NO3	2.22 mg/L	2.5 mg/L	88.6	75.0	125	----
Anions and Nutrients (QCLot: 742805)										
CG2215748-001	SW-01 (DOWNSTREAM)	sulfate (as SO4)	14808-79-8	E235.SO4	89.5 mg/L	100 mg/L	89.5	75.0	125	----
Anions and Nutrients (QCLot: 742806)										
CG2215748-001	SW-01 (DOWNSTREAM)	chloride	16887-00-6	E235.Cl	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 742807)										
CG2215748-001	SW-01 (DOWNSTREAM)	nitrite (as N)	14797-65-0	E235.NO2	0.473 mg/L	0.5 mg/L	94.6	75.0	125	----
Anions and Nutrients (QCLot: 743797)										
CG2215748-001	SW-01 (DOWNSTREAM)	ammonia, total (as N)	7664-41-7	E298	0.0962 mg/L	0.1 mg/L	96.2	75.0	125	----
Total Metals (QCLot: 747704)										
CG2215745-002	Anonymous	aluminum, total	7429-90-5	E420	1.92 mg/L	2 mg/L	96.3	70.0	130	----
		antimony, total	7440-36-0	E420	0.199 mg/L	0.2 mg/L	99.6	70.0	130	----
		arsenic, total	7440-38-2	E420	0.190 mg/L	0.2 mg/L	94.8	70.0	130	----
		barium, total	7440-39-3	E420	0.193 mg/L	0.2 mg/L	96.5	70.0	130	----
		boron, total	7440-42-8	E420	0.967 mg/L	1 mg/L	96.7	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0383 mg/L	0.04 mg/L	95.7	70.0	130	----
		calcium, total	7440-70-2	E420	40.7 mg/L	40 mg/L	102	70.0	130	----
		chromium, total	7440-47-3	E420	0.376 mg/L	0.4 mg/L	94.1	70.0	130	----
		copper, total	7440-50-8	E420	0.195 mg/L	0.2 mg/L	97.6	70.0	130	----
		iron, total	7439-89-6	E420	19.3 mg/L	20 mg/L	96.5	70.0	130	----
		lead, total	7439-92-1	E420	0.191 mg/L	0.2 mg/L	95.4	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.192 mg/L	0.2 mg/L	95.9	70.0	130	----
		nickel, total	7440-02-0	E420	0.398 mg/L	0.4 mg/L	99.6	70.0	130	----
		potassium, total	7440-09-7	E420	38.2 mg/L	40 mg/L	95.6	70.0	130	----
		selenium, total	7782-49-2	E420	0.373 mg/L	0.4 mg/L	93.2	70.0	130	----
		silver, total	7440-22-4	E420	0.0424 mg/L	0.04 mg/L	106	70.0	130	----
		sodium, total	7440-23-5	E420	19.5 mg/L	20 mg/L	97.3	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 747704) - continued										
CG2215745-002	Anonymous	uranium, total	7440-61-1	E420	0.0375 mg/L	0.04 mg/L	93.9	70.0	130	----
		zinc, total	7440-66-6	E420	3.94 mg/L	4 mg/L	98.6	70.0	130	----
Total Metals (QCLot: 748807)										
CG2215732-002	Anonymous	mercury, total	7439-97-6	E508	0.000110 mg/L	0.0001 mg/L	110	70.0	130	----
Dissolved Metals (QCLot: 747186)										
CG2215751-002	Anonymous	calcium, dissolved	7440-70-2	E421	40.1 mg/L	40 mg/L	100	70.0	130	----
		iron, dissolved	7439-89-6	E421	19.7 mg/L	20 mg/L	98.5	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.196 mg/L	0.2 mg/L	98.0	70.0	130	----
		potassium, dissolved	7440-09-7	E421	39.6 mg/L	40 mg/L	99.0	70.0	130	----
		sodium, dissolved	7440-23-5	E421	19.8 mg/L	20 mg/L	99.0	70.0	130	----
Volatile Organic Compounds (QCLot: 742430)										
CG2215722-001	Anonymous	benzene	71-43-2	E611A	99.4 µg/L	100 µg/L	99.4	70.0	130	----
		ethylbenzene	100-41-4	E611A	86.0 µg/L	100 µg/L	86.0	70.0	130	----
		toluene	108-88-3	E611A	86.0 µg/L	100 µg/L	86.0	70.0	130	----
		xylene, m+p-	179601-23-1	E611A	167 µg/L	200 µg/L	83.4	70.0	130	----
		xylene, o-	95-47-6	E611A	92.6 µg/L	100 µg/L	92.6	70.0	130	----
Volatile Organic Compounds (QCLot: 742433)										
CG2215748-001	SW-01 (DOWNSTREAM)	benzene	71-43-2	E611E	95.8 µg/L	100 µg/L	95.8	70.0	130	----
		bromobenzene	108-86-1	E611E	88.5 µg/L	100 µg/L	88.5	70.0	130	----
		bromochloromethane	74-97-5	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		bromodichloromethane	75-27-4	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		bromoform	75-25-2	E611E	86.9 µg/L	100 µg/L	86.9	70.0	130	----
		bromomethane	74-83-9	E611E	104 µg/L	100 µg/L	104	60.0	140	----
		butylbenzene, n-	104-51-8	E611E	75.6 µg/L	100 µg/L	75.6	70.0	130	----
		butylbenzene, sec-	135-98-8	E611E	78.3 µg/L	100 µg/L	78.3	70.0	130	----
		butylbenzene, tert-	98-06-6	E611E	76.5 µg/L	100 µg/L	76.5	70.0	130	----
		carbon tetrachloride	56-23-5	E611E	108 µg/L	100 µg/L	108	70.0	130	----
		chlorobenzene	108-90-7	E611E	100 µg/L	100 µg/L	100	70.0	130	----
		chloroethane	75-00-3	E611E	107 µg/L	100 µg/L	107	60.0	140	----
		chloroform	67-66-3	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		chloromethane	74-87-3	E611E	101 µg/L	100 µg/L	101	60.0	140	----
		chlorotoluene, 2-	95-49-8	E611E	79.4 µg/L	100 µg/L	79.4	70.0	130	----
		chlorotoluene, 4-	106-43-4	E611E	82.8 µg/L	100 µg/L	82.8	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 742433) - continued										
CG2215748-001	SW-01 (DOWNSTREAM)	cymene, p-	99-87-6	E611E	77.7 µg/L	100 µg/L	77.7	70.0	130	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	117 µg/L	100 µg/L	117	70.0	130	----
		dibromochloromethane	124-48-1	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		dibromoethane, 1,2-	106-93-4	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		dibromomethane	74-95-3	E611E	108 µg/L	100 µg/L	108	70.0	130	----
		dichlorobenzene, 1,2-	95-50-1	E611E	97.1 µg/L	100 µg/L	97.1	70.0	130	----
		dichlorobenzene, 1,3-	541-73-1	E611E	92.4 µg/L	100 µg/L	92.4	70.0	130	----
		dichlorobenzene, 1,4-	106-46-7	E611E	91.6 µg/L	100 µg/L	91.6	70.0	130	----
		dichlorodifluoromethane	75-71-8	E611E	113 µg/L	100 µg/L	113	60.0	140	----
		dichloroethane, 1,1-	75-34-3	E611E	108 µg/L	100 µg/L	108	70.0	130	----
		dichloroethane, 1,2-	107-06-2	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		dichloroethylene, 1,1-	75-35-4	E611E	99.8 µg/L	100 µg/L	99.8	70.0	130	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	99.8 µg/L	100 µg/L	99.8	70.0	130	----
		dichloromethane	75-09-2	E611E	97.5 µg/L	100 µg/L	97.5	70.0	130	----
		dichloropropane, 1,2-	78-87-5	E611E	102 µg/L	100 µg/L	102	70.0	130	----
		dichloropropane, 1,3-	142-28-9	E611E	104 µg/L	100 µg/L	104	70.0	130	----
		dichloropropane, 2,2-	594-20-7	E611E	123 µg/L	100 µg/L	123	70.0	130	----
		dichloropropylene, 1,1-	563-58-6	E611E	95.9 µg/L	100 µg/L	95.9	70.0	130	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	102 µg/L	100 µg/L	102	70.0	130	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	108 µg/L	100 µg/L	108	70.0	130	----
		ethylbenzene	100-41-4	E611E	88.3 µg/L	100 µg/L	88.3	70.0	130	----
		hexachlorobutadiene	87-68-3	E611E	116 µg/L	100 µg/L	116	70.0	130	----
		isopropylbenzene	98-82-8	E611E	90.2 µg/L	100 µg/L	90.2	70.0	130	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	98.8 µg/L	100 µg/L	98.8	70.0	130	----
		propylbenzene, n-	103-65-1	E611E	89.9 µg/L	100 µg/L	89.9	70.0	130	----
		styrene	100-42-5	E611E	81.6 µg/L	100 µg/L	81.6	70.0	130	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	96.3 µg/L	100 µg/L	96.3	70.0	130	----
		tetrachloroethylene	127-18-4	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		toluene	108-88-3	E611E	86.9 µg/L	100 µg/L	86.9	70.0	130	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	123 µg/L	100 µg/L	123	70.0	130	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	113 µg/L	100 µg/L	113	70.0	130	----
		trichloroethane, 1,1,1-	71-55-6	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		trichloroethane, 1,1,2-	79-00-5	E611E	115 µg/L	100 µg/L	115	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 742433) - continued										
CG2215748-001	SW-01 (DOWNSTREAM)	trichloroethylene	79-01-6	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		trichlorofluoromethane	75-69-4	E611E	111 µg/L	100 µg/L	111	60.0	140	----
		trichloropropane, 1,2,3-	96-18-4	E611E	94.7 µg/L	100 µg/L	94.7	70.0	130	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	76.2 µg/L	100 µg/L	76.2	70.0	130	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	70.6 µg/L	100 µg/L	70.6	70.0	130	----
		vinyl chloride	75-01-4	E611E	92.5 µg/L	100 µg/L	92.5	60.0	140	----
		xylene, m+p-	179601-23-1	E611E	162 µg/L	200 µg/L	81.2	70.0	130	----
		xylene, o-	95-47-6	E611E	91.2 µg/L	100 µg/L	91.2	70.0	130	----

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

Page 1 of 1

Environmental Division Calgary
Work Order Reference
CG2215748

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 #:	SWM.SWOP04071-03.005		
Address:		PO/AFE:	SWM.SWOP04071-03.005		
Sample		Legal Site Description:			
Phone:	Fax:	Quote #:	CG22-EBAE100-C		
Lab Work Order # (lab use only)		ALS Contact:	Milica Papic	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)	S542 - Total Metals+ Hg	E611E - VOCs	PR01 - Routine	E298 - NH3	S665A.F - BTEX/F1-F2	Hazardous?	Highly Contaminated?	Number of Containers
	SW-01 (Downstream)	10-11-22	17:35	Water	X	X	X	X	X			8
	SW-02 (Upstream)	↓	17:15	Water	X	X	X	X	X			8

Guidelines / Regulations

Special Instructions / Hazardous Details

Total Metals Preserved

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.

						Sample Condition (lab use only)	
Date & Time:	NOV 10/22	Received By:		Date & Time:	11/11 8:10	Temperature	Samples Received in Good Condition? Y / N (if no provided details)
Date & Time:	14:30	Received By:		Date & Time:		4	

Environmental Division
Calgary
Work Order Reference
CG2215748

Telephone : +1 403 407 1800

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **CG2217083**	Page	: 1 of 8
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.004	Date Samples Received	: 12-Dec-2022 08:00
PO	: SWM.SWOP04071-03.004	Date Analysis Commenced	: 13-Dec-2022
C-O-C number	: CORD RDM VWs	Issue Date	: 22-Dec-2022 12:47
Sampler	: Ryan Miller		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
David Tremblett	VOC Section Supervisor	Air Quality, Waterloo, Ontario

General Comments

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

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

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

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

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
%	percent
µg/m³	micrograms per cubic metre
Inches Hg	inches of mercury
ppbv	parts per billion (volume/volume)

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
AI	*Analytical interferences may be present. Result may be biased high.*
DLB	*Detection Limit Raised. Analyte detected at comparable level in Method Blank.*
DLHC	*Detection Limit Raised: Dilution required due to high concentration of test analyte(s).*
DLQ	*Detection Limit raised due to co-eluting interference. Mass Spectrometry qualifier ion ratio did not meet acceptance criteria.*

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: VW-04	----	----	----	----
					Client sampling date / time: 09-Dec-2022 11:43	----	----	----	----
					CG2217083-001	--------	--------	--------	--------
					Result	----	----	----	----
Field Tests									
ID, batch proof	----	EF001	-	-	221106.106	----	----	----	----
ID, canister	----	EF001	-	-	01400-0435	----	----	----	----
ID, regulator	----	EF001	-	-	G316	----	----	----	----
pressure, on receipt	----	EF001	0.10	Inches Hg	-10.2	----	----	----	----
Permanent Gases									
carbon dioxide	124-38-9	E629B-H	0.050	%	16.6	----	----	----	----
carbon monoxide	630-08-0	E629B-H	0.050	%	0.072	----	----	----	----
methane	74-82-8	E629B-H	0.050	%	33.8	----	----	----	----
oxygen	7782-44-7	E629B-H	0.10	%	3.63	----	----	----	----
Volatile Organic Compounds									
Acetone	67-64-1	EC621B	2.4	µg/m³	323	----	----	----	----
Acetone	67-64-1	E621B	1.0	ppbv	136 DLHC	----	----	----	----
allyl chloride	107-05-1	EC621B	0.63	µg/m³	<30.2	----	----	----	----
allyl chloride	107-05-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----
benzene	71-43-2	EC621B	0.32	µg/m³	<65.5	----	----	----	----
benzene	71-43-2	E621B	0.10	ppbv	<20.5 DLB, DLHC	----	----	----	----
benzyl chloride	100-44-7	EC621B	1.0	µg/m³	<50.0	----	----	----	----
benzyl chloride	100-44-7	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----
bromodichloromethane	75-27-4	EC621B	1.3	µg/m³	<64.7	----	----	----	----
bromodichloromethane	75-27-4	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----
bromoform	75-25-2	EC621B	2.1	µg/m³	<99.8	----	----	----	----
bromoform	75-25-2	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----
bromomethane	74-83-9	EC621B	0.78	µg/m³	<37.5	----	----	----	----
bromomethane	74-83-9	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----
butadiene, 1,3-	106-99-0	EC621B	0.44	µg/m³	<23.7	----	----	----	----
butadiene, 1,3-	106-99-0	E621B	0.20	ppbv	<10.7 DLHC, DLQ	----	----	----	----
carbon disulfide	75-15-0	EC621B	1.6	µg/m³	<75.4	----	----	----	----
carbon disulfide	75-15-0	E621B	0.50	ppbv	<24.2 DLHC	----	----	----	----
carbon tetrachloride	56-23-5	EC621B	1.30	µg/m³	<60.8	----	----	----	----

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	VW-04	----	----	----	----
					Client sampling date / time	09-Dec-2022 11:43	----	----	----	----
					CG2217083-001	--------	--------	--------	--------	--------
					Result	----	----	----	----	----
Volatile Organic Compounds										
carbon tetrachloride	56-23-5	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
chlorobenzene	108-90-7	EC621B	0.92	µg/m³	<44.5	----	----	----	----	----
chlorobenzene	108-90-7	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
chloroethane	75-00-3	EC621B	0.53	µg/m³	<25.5	----	----	----	----	----
chloroethane	75-00-3	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
chloroform	67-66-3	EC621B	0.98	µg/m³	<47.2	----	----	----	----	----
chloroform	67-66-3	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
chloromethane	74-87-3	EC621B	0.41	µg/m³	<19.9	----	----	----	----	----
chloromethane	74-87-3	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
cyclohexane	110-82-7	EC621B	0.69	µg/m³	699	----	----	----	----	----
cyclohexane	110-82-7	E621B	0.20	ppbv	203 DLHC	----	----	----	----	----
dibromochloromethane	124-48-1	EC621B	1.7	µg/m³	<82.3	----	----	----	----	----
dibromochloromethane	124-48-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dibromoethane, 1,2-	106-93-4	EC621B	1.5	µg/m³	<74.2	----	----	----	----	----
dibromoethane, 1,2-	106-93-4	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichlorobenzene, 1,2-	95-50-1	EC621B	1.2	µg/m³	<58.1	----	----	----	----	----
dichlorobenzene, 1,2-	95-50-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichlorobenzene, 1,3-	541-73-1	EC621B	1.2	µg/m³	<58.1	----	----	----	----	----
dichlorobenzene, 1,3-	541-73-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichlorobenzene, 1,4-	106-46-7	EC621B	1.2	µg/m³	<58.1	----	----	----	----	----
dichlorobenzene, 1,4-	106-46-7	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichlorodifluoromethane	75-71-8	EC621B	1.0	µg/m³	3920	----	----	----	----	----
dichlorodifluoromethane	75-71-8	E621B	0.20	ppbv	793	----	----	----	----	----
dichloroethane, 1,1-	75-34-3	EC621B	0.81	µg/m³	<39.1	----	----	----	----	----
dichloroethane, 1,1-	75-34-3	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichloroethane, 1,2-	107-06-2	EC621B	0.81	µg/m³	<39.1	----	----	----	----	----
dichloroethane, 1,2-	107-06-2	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichloroethylene, 1,1-	75-35-4	EC621B	0.79	µg/m³	<38.3	----	----	----	----	----
dichloroethylene, 1,1-	75-35-4	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
dichloroethylene, cis-1,2-	156-59-2	EC621B	0.79	µg/m³	50.0	----	----	----	----	----

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	VW-04	----	----	----	----
					Client sampling date / time	09-Dec-2022 11:43	----	----	----	----
					CG2217083-001	--------	--------	--------	--------	--------
					Result	----	----	----	----	----
Volatile Organic Compounds										
dichloroethylene, cis-1,2-	156-59-2	E621B	0.20	ppbv	12.6 DLHC	----	----	----	----	
dichloroethylene, trans-1,2-	156-60-5	EC621B	0.79	µg/m³	50.0	----	----	----	----	
dichloroethylene, trans-1,2-	156-60-5	E621B	0.20	ppbv	12.6 DLHC	----	----	----	----	
dichloromethane	75-09-2	EC621B	0.69	µg/m³	<33.6	----	----	----	----	
dichloromethane	75-09-2	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
dichloropropane, 1,2-	78-87-5	EC621B	0.9	µg/m³	<44.6	----	----	----	----	
dichloropropane, 1,2-	78-87-5	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
dichloropropylene, cis+trans-1,3-	542-75-6	EC621B	1.3	µg/m³	<87.7	----	----	----	----	
dichloropropylene, cis+trans-1,3-	542-75-6	E621B	0.30	ppbv	<13.7 DLHC	----	----	----	----	
dichloropropylene, cis-1,3-	10061-01-5	EC621B	0.9	µg/m³	<43.8	----	----	----	----	
dichloropropylene, cis-1,3-	10061-01-5	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
dichloropropylene, trans-1,3-	10061-02-6	EC621B	0.9	µg/m³	<43.8	----	----	----	----	
dichloropropylene, trans-1,3-	10061-02-6	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	EC621B	1.4	µg/m³	669	----	----	----	----	
dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B	0.20	ppbv	95.7 DLHC	----	----	----	----	
dioxane, 1,4-	123-91-1	EC621B	0.72	µg/m³	<34.8	----	----	----	----	
dioxane, 1,4-	123-91-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
ethyl acetate	141-78-6	EC621B	0.72	µg/m³	<34.8	----	----	----	----	
ethyl acetate	141-78-6	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
ethylbenzene	100-41-4	EC621B	0.43	µg/m³	<21.0	----	----	----	----	
ethylbenzene	100-41-4	E621B	0.10	ppbv	<4.83 DLHC	----	----	----	----	
ethyltoluene, 4-	622-96-8	EC621B	1.0	µg/m³	<47.5	----	----	----	----	
ethyltoluene, 4-	622-96-8	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
heptane, n-	142-82-5	EC621B	0.82	µg/m³	672	----	----	----	----	
heptane, n-	142-82-5	E621B	0.20	ppbv	164 DLHC	----	----	----	----	
hexachlorobutadiene	87-68-3	EC621B	2.1	µg/m³	<103	----	----	----	----	
hexachlorobutadiene	87-68-3	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
hexane, n-	110-54-3	EC621B	0.70	µg/m³	3980	----	----	----	----	
hexane, n-	110-54-3	E621B	0.20	ppbv	1130	----	----	----	----	
hexanone, 2-	591-78-6	EC621B	4.10	µg/m³	<198	----	----	----	----	

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	VW-04	----	----	----	----
					Client sampling date / time	09-Dec-2022 11:43	----	----	----	----
					CG2217083-001	--------	--------	--------	--------	--------
					Result	----	----	----	----	----
Volatile Organic Compounds										
hexanone, 2-	591-78-6	E621B	1.0	ppbv	<48.3 DLHC	----	----	----	----	
isopropylbenzene	98-82-8	EC621B	1.0	µg/m³	<47.5	----	----	----	----	
isopropylbenzene	98-82-8	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
methyl ethyl ketone [MEK]	78-93-3	EC621B	0.59	µg/m³	245	----	----	----	----	
methyl ethyl ketone [MEK]	78-93-3	E621B	0.20	ppbv	83.1 DLHC	----	----	----	----	
methyl isobutyl ketone [MIBK]	108-10-1	EC621B	0.82	µg/m³	<39.6	----	----	----	----	
methyl isobutyl ketone [MIBK]	108-10-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
methyl-tert-butyl ether [MTBE]	1634-04-4	EC621B	0.72	µg/m³	<34.8	----	----	----	----	
methyl-tert-butyl ether [MTBE]	1634-04-4	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
naphthalene	91-20-3	EC621B	0.52	µg/m³	<25.3	----	----	----	----	
naphthalene	91-20-3	E621B	0.10	ppbv	<4.83 DLHC	----	----	----	----	
propylene	115-07-1	EC621B	0.34	µg/m³	1010	----	----	----	----	
propylene	115-07-1	E621B	0.20	ppbv	589 AI	----	----	----	----	
styrene	100-42-5	EC621B	0.85	µg/m³	<41.2	----	----	----	----	
styrene	100-42-5	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
tetrachloroethane, 1,1,2,2-	79-34-5	EC621B	1.4	µg/m³	<66.3	----	----	----	----	
tetrachloroethane, 1,1,2,2-	79-34-5	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
tetrachloroethylene	127-18-4	EC621B	1.4	µg/m³	<65.5	----	----	----	----	
tetrachloroethylene	127-18-4	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
tetrahydrofuran	109-99-9	EC621B	0.59	µg/m³	1800	----	----	----	----	
tetrahydrofuran	109-99-9	E621B	0.20	ppbv	612	----	----	----	----	
toluene	108-88-3	EC621B	0.38	µg/m³	<21.9	----	----	----	----	
toluene	108-88-3	E621B	0.10	ppbv	<5.80 DLB, DLHC	----	----	----	----	
trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	EC621B	1.5	µg/m³	<74.0	----	----	----	----	
trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
trichlorobenzene, 1,2,4-	120-82-1	EC621B	1.5	µg/m³	<71.7	----	----	----	----	
trichlorobenzene, 1,2,4-	120-82-1	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
trichloroethane, 1,1,1-	71-55-6	EC621B	1.1	µg/m³	<52.7	----	----	----	----	
trichloroethane, 1,1,1-	71-55-6	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	
trichloroethane, 1,1,2-	79-00-5	EC621B	1.1	µg/m³	<52.7	----	----	----	----	

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	VW-04	----	----	----	----
					Client sampling date / time	09-Dec-2022 11:43	----	----	----	----
					CG2217083-001	--------	--------	--------	--------	--------
					Result	----	----	----	----	----
Volatile Organic Compounds										
trichloroethane, 1,1,2-	79-00-5	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
trichloroethylene	79-01-6	EC621B	1.1	µg/m³	<51.9	----	----	----	----	----
trichloroethylene	79-01-6	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
trichlorofluoromethane	75-69-4	EC621B	1.1	µg/m³	<54.3	----	----	----	----	----
trichlorofluoromethane	75-69-4	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
trimethylbenzene, 1,2,4-	95-63-6	EC621B	1.0	µg/m³	<47.5	----	----	----	----	----
trimethylbenzene, 1,2,4-	95-63-6	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
trimethylbenzene, 1,3,5-	108-67-8	EC621B	1.0	µg/m³	<47.5	----	----	----	----	----
trimethylbenzene, 1,3,5-	108-67-8	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
trimethylpentane, 2,2,4-	540-84-1	EC621B	0.9	µg/m³	58.9	----	----	----	----	----
trimethylpentane, 2,2,4-	540-84-1	E621B	0.20	ppbv	12.6 AI, DLHC	----	----	----	----	----
vinyl acetate	108-05-4	EC621B	1.8	µg/m³	<268	----	----	----	----	----
vinyl acetate	108-05-4	E621B	0.50	ppbv	<76.0 DLHC, DLQ	----	----	----	----	----
vinyl bromide	593-60-2	EC621B	0.9	µg/m³	<42.2	----	----	----	----	----
vinyl bromide	593-60-2	E621B	0.20	ppbv	<9.66 DLHC	----	----	----	----	----
vinyl chloride	75-01-4	EC621B	0.51	µg/m³	1130	----	----	----	----	----
vinyl chloride	75-01-4	E621B	0.20	ppbv	442	----	----	----	----	----
xylene, m+p-	179601-23-1	EC621B	0.87	µg/m³	92.0	----	----	----	----	----
xylene, m+p-	179601-23-1	E621B	0.20	ppbv	21.2 DLHC	----	----	----	----	----
xylene, o-	95-47-6	EC621B	0.43	µg/m³	21.0	----	----	----	----	----
xylene, o-	95-47-6	E621B	0.10	ppbv	4.83 DLHC	----	----	----	----	----
xylenes, total	1330-20-7	EC621B	1.3	µg/m³	113	----	----	----	----	----
xylenes, total	1330-20-7	E621B	0.30	ppbv	26.0 DLHC	----	----	----	----	----
BTEX, total	----	EC621B	1.2	µg/m³	<171	----	----	----	----	----
BTEX, total	----	E621B	0.30	ppbv	26.0 DLHC	----	----	----	----	----
Hydrocarbons										
aliphatic (C10-C12)	----	E593C	15	µg/m³	135	----	----	----	----	----
aliphatic (C12-C16)	----	E593C	30	µg/m³	<30	----	----	----	----	----
aliphatic (C6-C8)	----	E593C	15	µg/m³	447000	----	----	----	----	----
aliphatic (C8-C10)	----	E593C	15	µg/m³	931	----	----	----	----	----

Analytical Results

Sub-Matrix: Air (Matrix: Air)					Client sample ID	VW-04	----	----	----	----
					Client sampling date / time	09-Dec-2022 11:43	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		CG2217083-001	--------	--------	--------	--------
						Result	----	----	----	----
Hydrocarbons										
aromatic (C10-C12)	----	E593C	15	µg/m³		41	----	----	----	----
aromatic (C12-C16)	----	E593C	30	µg/m³		<30	----	----	----	----
aromatic (C6-C8)	----	E593C	15	µg/m³		2340	----	----	----	----
aromatic (C8-C10)	----	E593C	15	µg/m³		189	----	----	----	----
F1 (C6-C10)	----	E593A	15	µg/m³		404000	----	----	----	----
F1-BTEX	----	EC592A	15	µg/m³		404000	----	----	----	----
F2 (C10-C16)	----	E593A	15	µg/m³		303	----	----	----	----
F2-naphthalene	----	EC593D	15	µg/m³		303	----	----	----	----
TVOC (C10-C12)	----	E593C	15	µg/m³		176	----	----	----	----
TVOC (C12-C16)	----	E593C	30	µg/m³		<30	----	----	----	----
TVOC (C6-C8)	----	E593C	15	µg/m³		449000	----	----	----	----
TVOC (C8-C10)	----	E593C	15	µg/m³		1120	----	----	----	----
Hydrocarbons Surrogates										
bromofluorobenzene, 4-	460-00-4	E593C	1	%		106	----	----	----	----
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E621B	0.20	%		114	----	----	----	----

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

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2217083**	Page	: 1 of 6
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.004	Date Samples Received	: 12-Dec-2022 08:00
PO	: SWM.SWOP04071-03.004	Issue Date	: 22-Dec-2022 12:48
C-O-C number	: CORD RDM VWs		
Sampler	: Ryan Miller		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

Key

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

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Air**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Volatile Organic Compounds	QC-781492-001	----	benzene	71-43-2	E621B	0.26 ppbv MB-LOR	0.2 ppbv	Blank result exceeds permitted value
Volatile Organic Compounds	QC-781492-001	----	cyclohexane	110-82-7	E621B	0.26 ppbv MB-LOR	0.2 ppbv	Blank result exceeds permitted value
Volatile Organic Compounds	QC-781492-001	----	heptane, n-	142-82-5	E621B	0.50 ppbv MB-LOR	0.2 ppbv	Blank result exceeds permitted value
Volatile Organic Compounds	QC-781492-001	----	hexane, n-	110-54-3	E621B	0.54 ppbv MB-LOR	0.2 ppbv	Blank result exceeds permitted value
Volatile Organic Compounds	QC-781492-001	----	toluene	108-88-3	E621B	0.29 ppbv MB-LOR	0.2 ppbv	Blank result exceeds permitted value

Result Qualifiers

Qualifier	*Description*
MB-LOR	*Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.*

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Air**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Air Canister Information										
Canister VW-04	EF001	09-Dec-2022	----	----	----		13-Dec-2022	----	----	
Hydrocarbons : TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)										
Canister VW-04	E593C	09-Dec-2022	----	----	----		16-Dec-2022	30 days	7 days	✓
Hydrocarbons : TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)										
Canister VW-04	E593A	09-Dec-2022	----	----	----		16-Dec-2022	30 days	7 days	✓
Permanent Gases : Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)										
Canister VW-04	E629B-H	09-Dec-2022	----	----	----		15-Dec-2022	30 days	6 days	✓
Volatile Organic Compounds : VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)										
Canister VW-04	E621B	09-Dec-2022	----	----	----		16-Dec-2022	30 days	7 days	✓

Legend & Qualifier Definitions

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Air**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)	E629B-H	779253	1	12	8.3	5.0	✓
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C	781496	1	1	100.0	5.0	✓
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A	781495	1	1	100.0	5.0	✓
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B	781492	1	1	100.0	5.0	✓
Laboratory Control Samples (LCS)							
Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)	E629B-H	779253	1	12	8.3	5.0	✓
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C	781496	1	1	100.0	5.0	✓
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A	781495	1	1	100.0	5.0	✓
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B	781492	1	1	100.0	5.0	✓
Method Blanks (MB)							
Air Canister Information	EF001	777117	1	16	6.2	5.0	✓
Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)	E629B-H	779253	1	12	8.3	5.0	✓
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C	781496	1	1	100.0	5.0	✓
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A	781495	1	1	100.0	5.0	✓
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B	781492	1	1	100.0	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A Waterloo - Environmental	Air	EPA TO-15 (mod)	Total Volatile Organic Compounds (TVOC) in canisters (or bags) are transferred to a preconcentrator system and then thermally desorbed prior to injection into a GC-MS system for analysis.
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C Waterloo - Environmental	Air	EPA TO-15 (mod)	Total Volatile Organic Compounds (TVOC) in canisters (or bags) are transferred to a preconcentrator system and then thermally desorbed prior to injection into a GC-MS system for analysis.
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B Waterloo - Environmental	Air	EPA TO-15 (mod)	Volatile Organic Compounds (VOC) in canisters (or bags) are transferred to a preconcentrator system and then thermally desorbed prior to injection into a GC-MS system for analysis.
Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)	E629B-H Waterloo - Environmental	Air	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.
F1-BTEX in Canisters or Bags GC-MS (µg/m3)	EC592A Waterloo - Environmental	Air	unit conversion	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).
F2-Naphthalene in Canisters by GC-MS (ug/m3)	EC593D Waterloo - Environmental	Air	CCME PHC	F2-PAH = CCME Fraction 2 (C10-C16) minus Naphthalene
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ug/m3)	EC621B Waterloo - Environmental	Air	unit conversion	Convert ppbV to ug/m3
Air Canister Information	EF001 Waterloo - Environmental	Air	In-house	Air canister information provided by client and recorded on ALS report may affect the validity of results.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **CG2217083**	Page	: 1 of 11
Client	: Tetra Tech Canada Inc.	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	:	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.004	Date Samples Received	: 12-Dec-2022 08:00
PO	: SWM.SWOP04071-03.004	Date Analysis Commenced	: 13-Dec-2022
C-O-C number	: CORD RDM VWs	Issue Date	: 22-Dec-2022 12:48
Sampler	: Ryan Miller 403 203 3355		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
David Tremblett	VOC Section Supervisor	Waterloo Air Quality, Waterloo, Ontario

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Air**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Permanent Gases (QC Lot: 779253)											
WT2224382-001	Anonymous	carbon dioxide	124-38-9	E629B-H	0.050	%	4.85	4.98	2.70%	30%	----
		carbon monoxide	630-08-0	E629B-H	0.050	%	<0.050	<0.050	0	Diff <2x LOR	----
		methane	74-82-8	E629B-H	0.050	%	<0.050	<0.050	0	Diff <2x LOR	----
		oxygen	7782-44-7	E629B-H	0.20	%	18.0	18.2	1.35%	30%	----
Volatile Organic Compounds (QC Lot: 781492)											
CG2217083-001	VW-04	Acetone	67-64-1	E621B	48.3	ppbv	136	139	2.9	Diff <2x LOR	----
		allyl chloride	107-05-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		benzene	71-43-2	E621B	22.5	ppbv	<20.5	<22.5	2.00	Diff <2x LOR	----
		benzyl chloride	100-44-7	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		bromoform	75-25-2	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		bromomethane	74-83-9	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		butadiene, 1,3-	106-99-0	E621B	12.6	ppbv	<10.7	<12.6	1.90	Diff <2x LOR	----
		carbon disulfide	75-15-0	E621B	24.2	ppbv	<24.2	<24.2	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		chloroethane	75-00-3	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		chloroform	67-66-3	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		chloromethane	74-87-3	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		cyclohexane	110-82-7	E621B	9.66	ppbv	203	210	3.28%	30%	----
		dibromochloromethane	124-48-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dibromoethane, 1,2-	106-93-4	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichlorodifluoromethane	75-71-8	E621B	48.1	ppbv	793	848	6.71%	30%	----
		dichloroethane, 1,1-	75-34-3	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-2	E621B	9.66	ppbv	12.6	13.5	0.97	Diff <2x LOR	----

Sub-Matrix: **Air**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 781492) - continued											
CG2217083-001	VW-04	dichloroethylene, trans-1,2-	156-60-5	E621B	9.66	ppbv	12.6	13.5	0.97	Diff <2x LOR	----
		dichloromethane	75-09-2	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichloropropylene, cis+trans-1,3-	542-75-6	E621B	13.7	ppbv	<13.7	<13.7	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B	9.66	ppbv	95.7	100	4.93%	30%	----
		dioxane, 1,4-	123-91-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		ethyl acetate	141-78-6	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E621B	4.83	ppbv	<4.83	<4.83	0	Diff <2x LOR	----
		ethyltoluene, 4-	622-96-8	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		heptane, n-	142-82-5	E621B	9.66	ppbv	164	176	6.82%	30%	----
		hexachlorobutadiene	87-68-3	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		hexane, n-	110-54-3	E621B	48.1	ppbv	1130	1160	3.29%	30%	----
		hexanone, 2-	591-78-6	E621B	48.3	ppbv	<48.3	<48.3	0	Diff <2x LOR	----
		isopropylbenzene	98-82-8	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		methyl ethyl ketone [MEK]	78-93-3	E621B	9.66	ppbv	83.1	77.3	7.23%	30%	----
		methyl isobutyl ketone [MIBK]	108-10-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		naphthalene	91-20-3	E621B	4.83	ppbv	<4.83	<4.83	0	Diff <2x LOR	----
		propylene	115-07-1	E621B	48.1	ppbv	589	609	3.22%	30%	----
		styrene	100-42-5	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		tetrahydrofuran	109-99-9	E621B	48.1	ppbv	612	667	8.62%	30%	----
		toluene	108-88-3	E621B	5.80	ppbv	<5.80	<5.80	0	Diff <2x LOR	----
		trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,4-	120-82-1	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trimethylbenzene, 1,2,4-	95-63-6	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----

Sub-Matrix: **Air**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 781492) - continued											
CG2217083-001	VW-04	trimethylbenzene, 1,3,5-	108-67-8	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		trimethylpentane, 2,2,4-	540-84-1	E621B	9.66	ppbv	12.6	14.5	1.93	Diff <2x LOR	----
		vinyl acetate	108-05-4	E621B	76.0	ppbv	<76.0	<76.0	0	Diff <2x LOR	----
		vinyl bromide	593-60-2	E621B	9.66	ppbv	<9.66	<9.66	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E621B	48.1	ppbv	442	470	5.93%	30%	----
		xylene, m+p-	179601-23-1	E621B	9.66	ppbv	21.2	20.3	0.97	Diff <2x LOR	----
		xylene, o-	95-47-6	E621B	4.83	ppbv	4.83	5.80	0.97	Diff <2x LOR	----
Hydrocarbons (QC Lot: 781495)											
CG2217083-001	VW-04	F1 (C6-C10)	----	E593A	721	µg/m³	404000	418000	3.28%	30%	----
		F2 (C10-C16)	----	E593A	15	µg/m³	303	322	6.15%	30%	----
Hydrocarbons (QC Lot: 781496)											
CG2217083-001	VW-04	aromatic (C10-C12)	----	E593C	15	µg/m³	41	43	2	Diff <2x LOR	----
		aromatic (C12-C16)	----	E593C	30	µg/m³	<30	<30	0	Diff <2x LOR	----
		aromatic (C6-C8)	----	E593C	721	µg/m³	2340	2440	93	Diff <2x LOR	----
		aromatic (C8-C10)	----	E593C	15	µg/m³	189	196	3.87%	50%	----
		TVOC (C10-C12)	----	E593C	15	µg/m³	176	186	5.52%	50%	----
		TVOC (C12-C16)	----	E593C	30	µg/m³	<30	<30	0	Diff <2x LOR	----
		TVOC (C6-C8)	----	E593C	721	µg/m³	449000	465000	3.47%	50%	----
		TVOC (C8-C10)	----	E593C	15	µg/m³	1120	1160	3.06%	50%	----

Method Blank (MB) Report

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

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Field Tests (QCLot: 777117)						
pressure, on receipt	----	EF001	0.1	Inches Hg	-29.8	----
Permanent Gases (QCLot: 779253)						
carbon dioxide	124-38-9	E629B-H	0.05	%	<0.050	----
carbon monoxide	630-08-0	E629B-H	0.05	%	<0.050	----
methane	74-82-8	E629B-H	0.05	%	<0.050	----
oxygen	7782-44-7	E629B-H	0.1	%	<0.10	----
Volatile Organic Compounds (QCLot: 781492)						
Acetone	67-64-1	E621B	1	ppbv	<1.0	----
allyl chloride	107-05-1	E621B	0.2	ppbv	<0.20	----
benzene	71-43-2	E621B	0.1	ppbv	# 0.26	MB-LOR
benzyl chloride	100-44-7	E621B	0.2	ppbv	<0.20	----
bromodichloromethane	75-27-4	E621B	0.2	ppbv	<0.20	----
bromoform	75-25-2	E621B	0.2	ppbv	<0.20	----
bromomethane	74-83-9	E621B	0.2	ppbv	<0.20	----
butadiene, 1,3-	106-99-0	E621B	0.2	ppbv	<0.20	----
carbon disulfide	75-15-0	E621B	0.5	ppbv	<0.50	----
carbon tetrachloride	56-23-5	E621B	0.2	ppbv	<0.20	----
chlorobenzene	108-90-7	E621B	0.2	ppbv	<0.20	----
chloroethane	75-00-3	E621B	0.2	ppbv	<0.20	----
chloroform	67-66-3	E621B	0.2	ppbv	<0.20	----
chloromethane	74-87-3	E621B	0.2	ppbv	<0.20	----
cyclohexane	110-82-7	E621B	0.2	ppbv	# 0.26	MB-LOR
dibromochloromethane	124-48-1	E621B	0.2	ppbv	<0.20	----
dibromoethane, 1,2-	106-93-4	E621B	0.2	ppbv	<0.20	----
dichlorobenzene, 1,2-	95-50-1	E621B	0.2	ppbv	<0.20	----
dichlorobenzene, 1,3-	541-73-1	E621B	0.2	ppbv	<0.20	----
dichlorobenzene, 1,4-	106-46-7	E621B	0.2	ppbv	<0.20	----
dichlorodifluoromethane	75-71-8	E621B	0.2	ppbv	<0.20	----
dichloroethane, 1,1-	75-34-3	E621B	0.2	ppbv	<0.20	----
dichloroethane, 1,2-	107-06-2	E621B	0.2	ppbv	<0.20	----
dichloroethylene, 1,1-	75-35-4	E621B	0.2	ppbv	<0.20	----
dichloroethylene, cis-1,2-	156-59-2	E621B	0.2	ppbv	<0.20	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 781492) - continued						
dichloroethylene, trans-1,2-	156-60-5	E621B	0.2	ppbv	<0.20	----
dichloromethane	75-09-2	E621B	0.2	ppbv	<0.20	----
dichloropropane, 1,2-	78-87-5	E621B	0.2	ppbv	<0.20	----
dichloropropylene, cis-1,3-	10061-01-5	E621B	0.2	ppbv	<0.20	----
dichloropropylene, trans-1,3-	10061-02-6	E621B	0.2	ppbv	<0.20	----
dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B	0.2	ppbv	<0.20	----
dioxane, 1,4-	123-91-1	E621B	0.2	ppbv	<0.20	----
ethyl acetate	141-78-6	E621B	0.2	ppbv	<0.20	----
ethylbenzene	100-41-4	E621B	0.1	ppbv	<0.10	----
ethyltoluene, 4-	622-96-8	E621B	0.2	ppbv	<0.20	----
heptane, n-	142-82-5	E621B	0.2	ppbv	# 0.50	MB-LOR
hexachlorobutadiene	87-68-3	E621B	0.2	ppbv	<0.20	----
hexane, n-	110-54-3	E621B	0.2	ppbv	# 0.54	MB-LOR
hexanone, 2-	591-78-6	E621B	1	ppbv	<1.0	----
isopropylbenzene	98-82-8	E621B	0.2	ppbv	<0.20	----
methyl ethyl ketone [MEK]	78-93-3	E621B	0.2	ppbv	<0.20	----
methyl isobutyl ketone [MIBK]	108-10-1	E621B	0.2	ppbv	<0.20	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E621B	0.2	ppbv	<0.20	----
naphthalene	91-20-3	E621B	0.1	ppbv	<0.10	----
propylene	115-07-1	E621B	0.2	ppbv	<0.20	----
styrene	100-42-5	E621B	0.2	ppbv	<0.20	----
tetrachloroethane, 1,1,2,2-	79-34-5	E621B	0.2	ppbv	<0.20	----
tetrachloroethylene	127-18-4	E621B	0.2	ppbv	<0.20	----
tetrahydrofuran	109-99-9	E621B	0.2	ppbv	<0.20	----
toluene	108-88-3	E621B	0.1	ppbv	# 0.29	MB-LOR
trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B	0.2	ppbv	<0.20	----
trichlorobenzene, 1,2,4-	120-82-1	E621B	0.2	ppbv	<0.20	----
trichloroethane, 1,1,1-	71-55-6	E621B	0.2	ppbv	<0.20	----
trichloroethane, 1,1,2-	79-00-5	E621B	0.2	ppbv	<0.20	----
trichloroethylene	79-01-6	E621B	0.2	ppbv	<0.20	----
trichlorofluoromethane	75-69-4	E621B	0.2	ppbv	<0.20	----
trimethylbenzene, 1,2,4-	95-63-6	E621B	0.2	ppbv	<0.20	----
trimethylbenzene, 1,3,5-	108-67-8	E621B	0.2	ppbv	<0.20	----
trimethylpentane, 2,2,4-	540-84-1	E621B	0.2	ppbv	<0.20	----
vinyl acetate	108-05-4	E621B	0.5	ppbv	<0.50	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 781492) - continued						
vinyl bromide	593-60-2	E621B	0.2	ppbv	<0.20	----
vinyl chloride	75-01-4	E621B	0.2	ppbv	<0.20	----
xylene, m+p-	179601-23-1	E621B	0.2	ppbv	<0.20	----
xylene, o-	95-47-6	E621B	0.1	ppbv	<0.10	----
Hydrocarbons (QCLot: 781495)						
F1 (C6-C10)	----	E593A	15	µg/m³	<15	----
F2 (C10-C16)	----	E593A	15	µg/m³	<15	----
Hydrocarbons (QCLot: 781496)						
aromatic (C10-C12)	----	E593C	15	µg/m³	<15	----
aromatic (C12-C16)	----	E593C	30	µg/m³	<30	----
aromatic (C6-C8)	----	E593C	15	µg/m³	<15	----
aromatic (C8-C10)	----	E593C	15	µg/m³	<15	----
TVOC (C10-C12)	----	E593C	15	µg/m³	<15	----
TVOC (C12-C16)	----	E593C	30	µg/m³	<30	----
TVOC (C6-C8)	----	E593C	15	µg/m³	<15	----
TVOC (C8-C10)	----	E593C	15	µg/m³	<15	----

Qualifiers

Qualifier	Description
MB-LOR	*Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.*

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Air**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Permanent Gases (QCLot: 779253)									
carbon dioxide	124-38-9	E629B-H	0.05	%	4.982 %	101	70.0	130	----
carbon monoxide	630-08-0	E629B-H	0.05	%	0.747 %	104	70.0	130	----
methane	74-82-8	E629B-H	0.05	%	14.95 %	103	70.0	130	----
oxygen	7782-44-7	E629B-H	0.1	%	7.407 %	100	70.0	130	----
Volatile Organic Compounds (QCLot: 781492)									
Acetone	67-64-1	E621B	1	ppbv	1.02 ppbv	100	70.0	130	----
allyl chloride	107-05-1	E621B	0.2	ppbv	1 ppbv	105	70.0	130	----
benzene	71-43-2	E621B	0.1	ppbv	1.06 ppbv	90.6	70.0	130	----
benzyl chloride	100-44-7	E621B	0.2	ppbv	1.04 ppbv	105	70.0	130	----
bromodichloromethane	75-27-4	E621B	0.2	ppbv	1.06 ppbv	90.6	70.0	130	----
bromoform	75-25-2	E621B	0.2	ppbv	1.06 ppbv	84.9	70.0	130	----
bromomethane	74-83-9	E621B	0.2	ppbv	1.01 ppbv	100	70.0	130	----
butadiene, 1,3-	106-99-0	E621B	0.2	ppbv	1.06 ppbv	92.4	70.0	130	----
carbon disulfide	75-15-0	E621B	0.5	ppbv	1.03 ppbv	97.1	70.0	130	----
carbon tetrachloride	56-23-5	E621B	0.2	ppbv	1.07 ppbv	94.4	70.0	130	----
chlorobenzene	108-90-7	E621B	0.2	ppbv	1.06 ppbv	94.3	70.0	130	----
chloroethane	75-00-3	E621B	0.2	ppbv	1.02 ppbv	90.2	70.0	130	----
chloroform	67-66-3	E621B	0.2	ppbv	1.05 ppbv	89.5	70.0	130	----
chloromethane	74-87-3	E621B	0.2	ppbv	1.02 ppbv	72.5	70.0	130	----
cyclohexane	110-82-7	E621B	0.2	ppbv	1.06 ppbv	86.8	70.0	130	----
dibromochloromethane	124-48-1	E621B	0.2	ppbv	1.08 ppbv	86.1	70.0	130	----
dibromoethane, 1,2-	106-93-4	E621B	0.2	ppbv	1.08 ppbv	88.0	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E621B	0.2	ppbv	1.04 ppbv	96.2	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E621B	0.2	ppbv	1.05 ppbv	99.0	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E621B	0.2	ppbv	1.04 ppbv	98.1	70.0	130	----
dichlorodifluoromethane	75-71-8	E621B	0.2	ppbv	1.01 ppbv	91.1	70.0	130	----
dichloroethane, 1,1-	75-34-3	E621B	0.2	ppbv	1.02 ppbv	96.1	70.0	130	----
dichloroethane, 1,2-	107-06-2	E621B	0.2	ppbv	1.04 ppbv	90.4	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E621B	0.2	ppbv	1.02 ppbv	103	70.0	130	----
dichloroethylene, cis-1,2-	156-59-2	E621B	0.2	ppbv	1.06 ppbv	85.8	70.0	130	----
dichloroethylene, trans-1,2-	156-60-5	E621B	0.2	ppbv	1.01 ppbv	100	70.0	130	----
dichloromethane	75-09-2	E621B	0.2	ppbv	1 ppbv	103	70.0	130	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 781492) - continued									
dichloropropane, 1,2-	78-87-5	E621B	0.2	ppbv	1.05 ppbv	84.8	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E621B	0.2	ppbv	1.05 ppbv	92.4	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E621B	0.2	ppbv	1.07 ppbv	87.8	70.0	130	----
dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B	0.2	ppbv	0.95 ppbv	95.8	70.0	130	----
dioxane, 1,4-	123-91-1	E621B	0.2	ppbv	1.06 ppbv	99.0	70.0	130	----
ethyl acetate	141-78-6	E621B	0.2	ppbv	1.05 ppbv	88.6	70.0	130	----
ethylbenzene	100-41-4	E621B	0.1	ppbv	1.09 ppbv	95.4	70.0	130	----
ethyltoluene, 4-	622-96-8	E621B	0.2	ppbv	1.06 ppbv	93.4	70.0	130	----
heptane, n-	142-82-5	E621B	0.2	ppbv	1.06 ppbv	86.8	70.0	130	----
hexachlorobutadiene	87-68-3	E621B	0.2	ppbv	1.05 ppbv	103	70.0	130	----
hexane, n-	110-54-3	E621B	0.2	ppbv	1.06 ppbv	90.6	70.0	130	----
hexanone, 2-	591-78-6	E621B	1	ppbv	1.09 ppbv	90.8	70.0	130	----
isopropylbenzene	98-82-8	E621B	0.2	ppbv	1.03 ppbv	98.0	70.0	130	----
methyl ethyl ketone [MEK]	78-93-3	E621B	0.2	ppbv	1.08 ppbv	92.6	70.0	130	----
methyl isobutyl ketone [MIBK]	108-10-1	E621B	0.2	ppbv	1.06 ppbv	84.9	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E621B	0.2	ppbv	1.07 ppbv	98.1	70.0	130	----
naphthalene	91-20-3	E621B	0.1	ppbv	1.05 ppbv	105	70.0	130	----
propylene	115-07-1	E621B	0.2	ppbv	1.07 ppbv	92.5	70.0	130	----
styrene	100-42-5	E621B	0.2	ppbv	1.04 ppbv	92.3	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E621B	0.2	ppbv	1.07 ppbv	87.8	70.0	130	----
tetrachloroethylene	127-18-4	E621B	0.2	ppbv	1.04 ppbv	101	70.0	130	----
tetrahydrofuran	109-99-9	E621B	0.2	ppbv	1.04 ppbv	83.6	70.0	130	----
toluene	108-88-3	E621B	0.1	ppbv	1.08 ppbv	96.3	70.0	130	----
trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B	0.2	ppbv	0.98 ppbv	107	70.0	130	----
trichlorobenzene, 1,2,4-	120-82-1	E621B	0.2	ppbv	1.05 ppbv	100	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E621B	0.2	ppbv	1.05 ppbv	94.3	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E621B	0.2	ppbv	1.08 ppbv	90.7	70.0	130	----
trichloroethylene	79-01-6	E621B	0.2	ppbv	1.06 ppbv	96.2	70.0	130	----
trichlorofluoromethane	75-69-4	E621B	0.2	ppbv	1.03 ppbv	99.0	70.0	130	----
trimethylbenzene, 1,2,4-	95-63-6	E621B	0.2	ppbv	1.06 ppbv	100	70.0	130	----
trimethylbenzene, 1,3,5-	108-67-8	E621B	0.2	ppbv	1.06 ppbv	95.3	70.0	130	----
trimethylpentane, 2,2,4-	540-84-1	E621B	0.2	ppbv	1.05 ppbv	89.5	70.0	130	----
vinyl acetate	108-05-4	E621B	0.5	ppbv	1.09 ppbv	94.5	70.0	130	----
vinyl bromide	593-60-2	E621B	0.2	ppbv	1.04 ppbv	103	70.0	130	----
vinyl chloride	75-01-4	E621B	0.2	ppbv	1.01 ppbv	94.0	70.0	130	----
xylene, m+p-	179601-23-1	E621B	0.2	ppbv	2.12 ppbv	95.3	70.0	130	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 781492) - continued									
xylene, o-	95-47-6	E621B	0.1	ppbv	1.07 ppbv	95.3	70.0	130	----
Hydrocarbons (QCLot: 781495)									
F1 (C6-C10)	----	E593A	15	µg/m³	981.96 µg/m³	118	50.0	150	----
Hydrocarbons (QCLot: 781496)									
aromatic (C10-C12)	----	E593C	15	µg/m³	60.75 µg/m³	80.0	50.0	150	----
aromatic (C12-C16)	----	E593C	30	µg/m³	60.07 µg/m³	89.2	50.0	150	----
aromatic (C6-C8)	----	E593C	15	µg/m³	60.06 µg/m³	76.2	50.0	150	----
aromatic (C8-C10)	----	E593C	15	µg/m³	59.58 µg/m³	79.2	50.0	150	----
TVOC (C10-C12)	----	E593C	15	µg/m³	121.28 µg/m³	85.4	50.0	150	----
TVOC (C12-C16)	----	E593C	30	µg/m³	120.29 µg/m³	111	50.0	150	----
TVOC (C6-C8)	----	E593C	15	µg/m³	119.87 µg/m³	84.3	50.0	150	----
TVOC (C8-C10)	----	E593C	15	µg/m³	119 µg/m³	87.6	50.0	150	----

Batch Proof Report

Batch Proof ID: 221106.116
Canister ID: 01400-0048
Analysis Date: 17-Nov-22

right solutions.
right partner.

1,1,1-Trichloroethane	<0.02	ppb(V)	cis-1,3-Dichloropropene	<0.02	ppb(V)
1,1,1,2-Tetrachloroethane	<0.02	ppb(V)	Cyclohexane	<0.20	ppb(V)
1,1,2,2-Tetrachloroethane	<0.02	ppb(V)	Dibromochloromethane	<0.20	ppb(V)
1,1,2-Trichloroethane	<0.02	ppb(V)	Dichlorodifluoromethane	<0.20	ppb(V)
1,1-Dichloroethane	<0.02	ppb(V)	Ethyl Acetate	<0.20	ppb(V)
1,1-Dichloroethene	<0.02	ppb(V)	Ethyl Benzene	<0.02	ppb(V)
1,2,4-Trichlorobenzene	<0.20	ppb(V)	Freon 113	<0.20	ppb(V)
1,2,4-Trimethylbenzene	<0.20	ppb(V)	Freon 114	<0.20	ppb(V)
1,2-Dibromoethane	<0.01	ppb(V)	Hexachlorobutadiene	<0.02	ppb(V)
1,2-Dichlorobenzene	<0.02	ppb(V)	Isooctane	<0.20	ppb(V)
1,2-Dichloroethane	<0.01	ppb(V)	Isopropyl Alcohol	N/A	ppb(V)
1,2-Dichloropropane	<0.02	ppb(V)	Isopropylbenzene	<0.20	ppb(V)
1,3,5-Trimethylbenzene	<0.20	ppb(V)	m&p-Xylene	<0.04	ppb(V)
1,3-Butadiene	<0.20	ppb(V)	Methyl Ethyl Ketone	<0.20	ppb(V)
1,3-Dichlorobenzene	<0.02	ppb(V)	Methylcyclohexane	<0.20	ppb(V)
1,4-Dichlorobenzene	<0.02	ppb(V)	Methyl Isobutyl Ketone	<0.20	ppb(V)
1,4-Dioxane	<0.20	ppb(V)	Methylene Chloride	<0.02	ppb(V)
2-Chlorophenol	<0.20	ppb(V)	MTBE	<0.20	ppb(V)
2-Hexanone	<1.0	ppb(V)	Naphthalene	<0.05	ppb(V)
4-Ethyltoluene	<0.20	ppb(V)	n-Decane	<0.20	ppb(V)
Acetone	<1.0	ppb(V)	n-Heptane	<0.20	ppb(V)
Acrolein	<0.10	ppb(V)	n-Hexane	<0.02	ppb(V)
Allyl Chloride	<0.20	ppb(V)	o-Xylene	<0.02	ppb(V)
Benzene	<0.02	ppb(V)	Propylene	<0.20	ppb(V)
Benzyl Chloride	<0.20	ppb(V)	Styrene	<0.02	ppb(V)
Bromodichloromethane	<0.20	ppb(V)	Tetrachloroethylene	<0.02	ppb(V)
Bromobenzene	<0.20	ppb(V)	Tetrahydrofuran	<0.20	ppb(V)
Bromoform	<0.02	ppb(V)	Toluene	<0.02	ppb(V)
Bromomethane	<0.20	ppb(V)	trans-1,2-Dichloroethene	<0.02	ppb(V)
Carbon Disulfide	<0.50	ppb(V)	trans-1,3-Dichloropropene	<0.02	ppb(V)
Carbon Tetrachloride	<0.02	ppb(V)	Trichloroethylene	<0.02	ppb(V)
Chlorobenzene	<0.20	ppb(V)	Trichlorofluoromethane	<0.20	ppb(V)
Chloroethane	<0.02	ppb(V)	Vinyl Acetate	<0.50	ppb(V)
Chloroform	<0.02	ppb(V)	Vinyl Bromide	<0.20	ppb(V)
Chloromethane	<0.20	ppb(V)	Vinyl Chloride	<0.02	ppb(V)
cis-1,2-Dichloroethene	<0.02	ppb(V)	4-Bromofluorobenzene	96.00	%

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 # CORD RDM VWs

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 Servi
		Email 2: ryan.miller@tetratech.com	☐ Emergency
Phone: 403-723-6867 Fax: 403-203-3301		ALS Digital Crosstab results	
Invoice To: ☑ Same as Report		Indicate Bottles: Filtered / Preserved (F/P) →	
Company: SAME AS REPORT		**Client / Project Information:**	
Contact:		Job #: SWM.SWOP04071-03.004	
Address:		PO/AFE: SWM.SWOP04071-03.004	
Sample		Legal Site Description:	
Phone: Fax:		Quote #: CG22-EBAE100-0021	
Lab Work Order # (lab use only)		ALS Contact: Patryk Wojciak	Sampler (Initials): Ryan Miller

Environmental Division Calgary
Work Order Reference
CG2217083

Telephone : +1 403 407 1800

Sample #	Sample Identification (This description will appear on the report)	Date dd-mmm-yy	Time hh:mm	Sample Type (Select from drop-down list)	EP592	S621E - Aliphatic and Aromatic	S629B - Methane, CO2, CO, N	
	~~VW-01~~			~~Air~~	~~X~~	~~X~~	~~X~~	
	VW-04	09-12-22	11:43	Air	X	X	X	1
	~~Duplicate~~			~~Air~~	~~X~~	~~X~~	~~X~~	

Guidelines / Regulations	**Special Instructions / Hazardous Details**

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.

								Sample Condition (lab use only)	
Relinquished By:		Date & Time:	Dec 11/22	Received By:	RL	Date & Time:	12/12 8:00	Temperature	Samples Received in Good Condition? Y / N (if no provided details)
Relinquished By:		Date & Time:	15:15	Received By:		Date & Time:		16C	

Did not sample VW-01 or Dup, well was frozen

ALS Canada Ltd.

CERTIFICATE OF ANALYSIS

Work Order	: **CG2217087**	Page	: 1 of 8
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.004	Date Samples Received	: 12-Dec-2022 08:00
PO	: SWM.SWOP04071-03.004	Date Analysis Commenced	: 12-Dec-2022
C-O-C number	: CORD RED DEER MOTORS	Issue Date	: 16-Dec-2022 14:19
Sampler	: ----		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Cynthia Bauer	Organic Supervisor	Organics, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Jyotsnarani Devi	Laboratory Analyst	Organics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Metals, Calgary, Alberta
Sorina Motea	Laboratory Analyst	Organics, Calgary, Alberta
Summie Lo	Lab Assistant	Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

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

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

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

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

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

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

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW-01	MW-04A	MW-05	DUPLICATE	----
					Client sampling date / time	09-Dec-2022 15:20	09-Dec-2022 16:00	09-Dec-2022 15:40	09-Dec-2022	----
						CG2217087-001	CG2217087-002	CG2217087-003	CG2217087-004	--------
						Result	Result	Result	Result	----
Physical Tests										
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L		941	899	1180	940	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		772	737	970	770	----
conductivity	----	E100	1.0	µS/cm		2470	2740	2060	2470	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		877	1010	908	865	----
pH	----	E108	0.10	pH units		7.17	7.78	7.76	7.19	----
solids, total dissolved [TDS], calculated	----	EC103	1.0	mg/L		1560	1840	1340	1560	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		2.82	0.103	5.59	2.80	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		381	349	179	393	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.253	0.266	0.235	0.231	----
nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L		<0.100 DLDS	<0.100 DLDS	<0.100 DLDS	<0.100 DLDS	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0032	mg/L		<0.112	<0.112	<0.112	<0.112	----
nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L		<0.050 DLDS	<0.050 DLDS	<0.050 DLDS	<0.050 DLDS	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		118	416	68.9	120	----
Ion Balance										
anion sum	----	EC101	0.10	meq/L		28.6	33.2	25.9	29.0	----
cation sum	----	EC101	0.10	meq/L		29.3	32.9	26.7	28.7	----
ion balance (APHA)	----	EC101	0.01	%		1.21	-0.45	1.52	-0.52	----
ion balance (cations/anions)	----	EC101	0.010	%		102	99.1	103	99.0	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L		0.0064	0.0084	<0.0050 DLDS	0.0081	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00050 DLDS	0.00183	<0.00050 DLDS	<0.00050 DLDS	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.0202	0.00356	0.00591	0.0195	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.540	0.0452	0.665	0.534	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.075	0.156	0.210	0.074	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		<0.0000250 DLDS	<0.0000250 DLDS	0.0000365	<0.0000250 DLDS	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		170	206	169	170	----

Analytical Results

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

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW-01	MW-04A	MW-05	DUPLICATE	----
					Client sampling date / time	09-Dec-2022 15:20	09-Dec-2022 16:00	09-Dec-2022 15:40	09-Dec-2022	----
						CG2217087-001	CG2217087-002	CG2217087-003	CG2217087-004	--------
						Result	Result	Result	Result	----
Dissolved Metals										
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L		<0.00100 DLDS	0.00231	<0.00100 DLDS	<0.00100 DLDS	----
iron, dissolved	7439-89-6	E421	0.010	mg/L		24.8	0.315	6.58	24.1	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000250 DLDS	<0.000250 DLDS	<0.000250 DLDS	<0.000250 DLDS	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L		110	120	118	107	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		2.11	0.399	1.51	2.08	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.0103	0.0212	0.0260	0.0103	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		8.61	4.62	8.52	8.43	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		<0.000250 DLDS	0.000324	<0.000250 DLDS	<0.000250 DLDS	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000050 DLDS	<0.000050 DLDS	<0.000050 DLDS	<0.000050 DLDS	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		238	289	177	232	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.00384	0.0919	0.0122	0.00399	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L		<0.0050 DLDS	<0.0050 DLDS	<0.0050 DLDS	<0.0050 DLDS	----
dissolved mercury filtration location	----	EP509	-	-		Field	Field	Field	Field	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	----
Volatile Organic Compounds										
benzene	71-43-2	E611A	0.50	µg/L		1.16	<0.50	1.32	1.10	----
bromobenzene	108-86-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
bromochloromethane	74-97-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
bromodichloromethane	75-27-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
bromoform	75-25-2	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
bromomethane	74-83-9	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
butylbenzene, n-	104-51-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
butylbenzene, sec-	135-98-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
butylbenzene, tert-	98-06-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
carbon tetrachloride	56-23-5	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
chlorobenzene	108-90-7	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
chloroethane	75-00-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
chloroform	67-66-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----

Analytical Results

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

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: MW-01	MW-04A	MW-05	DUPLICATE	----
					Client sampling date / time: 09-Dec-2022 15:20	09-Dec-2022 16:00	09-Dec-2022 15:40	09-Dec-2022	----
					CG2217087-001	CG2217087-002	CG2217087-003	CG2217087-004	--------
					Result	Result	Result	Result	----
Volatile Organic Compounds									
chloromethane	74-87-3	E611E	5.0	µg/L	<5.0	<5.0	<5.0	<5.0	----
chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
cymene, p-	99-87-6	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dibromochloromethane	124-48-1	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dibromomethane	74-95-3	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L	14.7	1.3	184	14.0	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L	2.3	<1.0	13.4	2.2	----
dichloromethane	75-09-2	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloropropylene, cis+trans-1,3-	542-75-6	E611E	1.5	µg/L	<1.5	<1.5	<1.5	<1.5	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
hexachlorobutadiene	87-68-3	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
isopropylbenzene	98-82-8	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
propylbenzene, n-	103-65-1	E611E	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	MW-01	MW-04A	MW-05	DUPLICATE	----
					Client sampling date / time	09-Dec-2022 15:20	09-Dec-2022 16:00	09-Dec-2022 15:40	09-Dec-2022	----
Analyte	CAS Number	Method	LOR	Unit		CG2217087-001	CG2217087-002	CG2217087-003	CG2217087-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
styrene	100-42-5	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
tetrachloroethylene	127-18-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trichloroethylene	79-01-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trichlorofluoromethane	75-69-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
vinyl chloride	75-01-4	E611E	1.0	µg/L		8.7	<1.0	7.4	8.2	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	----
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	----
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
trihalomethanes [THMs], total	----	E611E	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Hydrocarbons										
F1 (C6-C10)	----	E581.F1	100	µg/L		<100	<100	<100	<100	----
F1-BTEX	----	EC580	25	µg/L		<100	<100	<100	<100	----
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	----
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%		97.2	89.0	88.6	95.3	----
dichlorotoluene, 3,4-	97-75-0	E581.F1	1.0	%		101	97.6	92.7	100	----
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%		76.5	73.4	74.4	77.1	----
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%		100	101	102	100	----

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

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2217087**	Page	: 1 of 14
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.004	Date Samples Received	: 12-Dec-2022 08:00
PO	: SWM.SWOP04071-03.004	Issue Date	: 16-Dec-2022 14:20
C-O-C number	: CORD RED DEER MOTORS		
Sampler	: ----		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

Key

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

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

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

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) DUPLICATE	E298	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) MW-01	E298	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) MW-04A	E298	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) MW-05	E298	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE DUPLICATE	E235.Cl	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-01	E235.Cl	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-04A	E235.Cl	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-05	E235.Cl	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE DUPLICATE	E235.F	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW-01	E235.F	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW-04A	E235.F	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW-05	E235.F	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE DUPLICATE	E235.NO3	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW-01	E235.NO3	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW-04A	E235.NO3	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW-05	E235.NO3	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC										
HDPE DUPLICATE	E235.NO2	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-01	E235.NO2	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-04A	E235.NO2	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-05	E235.NO2	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE DUPLICATE	E235.SO4	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW-01	E235.SO4	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW-04A	E235.SO4	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW-05	E235.SO4	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) DUPLICATE	E509	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW-01	E509	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW-04A	E509	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW-05	E509	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	28 days	3 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) DUPLICATE	E421	09-Dec-2022	14-Dec-2022	----	----		15-Dec-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW-01	E421	09-Dec-2022	14-Dec-2022	----	----		15-Dec-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW-04A	E421	09-Dec-2022	14-Dec-2022	----	----		15-Dec-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW-05	E421	09-Dec-2022	14-Dec-2022	----	----		15-Dec-2022	180 days	6 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) DUPLICATE	E581.F1	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW-01	E581.F1	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW-04A	E581.F1	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW-05	E581.F1	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) DUPLICATE	E601	09-Dec-2022	15-Dec-2022	14 days	6 days	✓	15-Dec-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW-01	E601	09-Dec-2022	15-Dec-2022	14 days	6 days	✓	15-Dec-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW-04A	E601	09-Dec-2022	15-Dec-2022	14 days	6 days	✓	15-Dec-2022	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW-05	E601	09-Dec-2022	15-Dec-2022	14 days	6 days	✓	15-Dec-2022	40 days	0 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE DUPLICATE	E290	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	14 days	5 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW-01	E290	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	14 days	5 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW-04A	E290	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	14 days	5 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE MW-05	E290	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	14 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE DUPLICATE	E100	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	28 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-01	E100	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	28 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-04A	E100	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	28 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-05	E100	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	28 days	5 days	✓
Physical Tests : pH by Meter										
HDPE DUPLICATE	E108	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-01	E108	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-04A	E108	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-05	E108	09-Dec-2022	14-Dec-2022	----	----		14-Dec-2022	0.25 hrs	0.25 hrs	× EHTR-FM

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) DUPLICATE	E611A	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-01	E611A	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-04A	E611A	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-05	E611A	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUPLICATE	E611E	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-01	E611E	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-04A	E611E	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-05	E611E	09-Dec-2022	12-Dec-2022	----	----		12-Dec-2022	14 days	3 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	778185	2	38	5.2	5.0	✓
Ammonia by Fluorescence	E298	775577	1	8	12.5	5.0	✓
BTEX by Headspace GC-MS	E611A	775456	1	4	25.0	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	775457	1	4	25.0	5.0	✓
Chloride in Water by IC	E235.Cl	775886	1	11	9.0	5.0	✓
Conductivity in Water	E100	778184	2	38	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	775718	1	14	7.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	777893	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	775883	1	11	9.0	5.0	✓
Nitrate in Water by IC	E235.NO3	775884	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	775885	1	11	9.0	5.0	✓
pH by Meter	E108	778183	2	38	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	775887	1	11	9.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	775458	1	8	12.5	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	778185	2	38	5.2	5.0	✓
Ammonia by Fluorescence	E298	775577	1	8	12.5	5.0	✓
BTEX by Headspace GC-MS	E611A	775456	1	4	25.0	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	775457	1	4	25.0	5.0	✓
CCME PHCs - F2-F4 by GC-FID	E601	779295	1	16	6.2	5.0	✓
Chloride in Water by IC	E235.Cl	775886	1	11	9.0	5.0	✓
Conductivity in Water	E100	778184	2	38	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	775718	1	14	7.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	777893	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	775883	1	11	9.0	5.0	✓
Nitrate in Water by IC	E235.NO3	775884	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	775885	1	11	9.0	5.0	✓
pH by Meter	E108	778183	2	38	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	775887	1	11	9.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	775458	1	8	12.5	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	778185	2	38	5.2	5.0	✓
Ammonia by Fluorescence	E298	775577	1	8	12.5	5.0	✓
BTEX by Headspace GC-MS	E611A	775456	1	4	25.0	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	775457	1	4	25.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
CCME PHCs - F2-F4 by GC-FID	E601	779295	1	16	6.2	5.0	✓
Chloride in Water by IC	E235.Cl	775886	1	11	9.0	5.0	✓
Conductivity in Water	E100	778184	2	38	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	775718	1	14	7.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	777893	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	775883	1	11	9.0	5.0	✓
Nitrate in Water by IC	E235.NO3	775884	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	775885	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	775887	1	11	9.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	775458	1	8	12.5	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	775577	1	8	12.5	5.0	✓
BTEX by Headspace GC-MS	E611A	775456	1	4	25.0	5.0	✓
Chloride in Water by IC	E235.Cl	775886	1	11	9.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	775718	1	14	7.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	777893	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	775883	1	11	9.0	5.0	✓
Nitrate in Water by IC	E235.NO3	775884	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	775885	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	775887	1	11	9.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	775458	1	8	12.5	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Chloride in Water by IC	E235.Cl Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC	E235.NO2 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
CCME PHC - F1 by Headspace GC-FID	E581.F1 Calgary - Environmental	Water	CCME PHC in Soil - Tier 1	CCME Fraction 1 (F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
CCME PHCs - F2-F4 by GC-FID	E601 Calgary - Environmental	Water	CCME PHC in Soil - Tier 1	Sample extracts are analyzed by GC-FID for CCME hydrocarbon fractions (F2-F4).
BTEX by Headspace GC-MS	E611A Calgary - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs (Prairies List) by Headspace GC-MS	E611E Calgary - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
TDS in Water (Calculation)	EC103 Calgary - Environmental	Water	APHA 1030E (mod)	Total Dissolved Solids is calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Calgary - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).
F1-BTEX	EC580 Calgary - Environmental	Water	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
VOCs Preparation for Headspace Analysis	EP581 Calgary - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
PHCs and PAHs Hexane Extraction	EP601 Calgary - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **CG2217087**	Page	: 1 of 18
Client	: Tetra Tech Canada Inc.	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	:	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.004	Date Samples Received	: 12-Dec-2022 08:00
PO	: SWM.SWOP04071-03.004	Date Analysis Commenced	: 12-Dec-2022
C-O-C number	: CORD RED DEER MOTORS	Issue Date	: 16-Dec-2022 14:20
Sampler	: ---- 403 203 3355		
Site	: ----		
Quote number	: CG22-EBAE100-0021 City of Red Deer (CORD) Pre-1972 Landfill Sites		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Cynthia Bauer	Organic Supervisor	Calgary Organics, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Jyotsnarani Devi	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Sorina Motea	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Summie Lo	Lab Assistant	Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 778183)											
CG2217073-005	Anonymous	pH	----	E108	0.10	pH units	7.49	7.47	0.267%	4%	----
Physical Tests (QC Lot: 778184)											
CG2217073-005	Anonymous	conductivity	----	E100	2.0	µS/cm	3180	3170	0.315%	10%	----
Physical Tests (QC Lot: 778185)											
CG2217073-005	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	804	816	1.48%	20%	----
Physical Tests (QC Lot: 778186)											
CG2217087-004	DUPLICATE	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	770	759	1.48%	20%	----
Physical Tests (QC Lot: 778187)											
CG2217087-004	DUPLICATE	pH	----	E108	0.10	pH units	7.19	7.25	0.831%	4%	----
Physical Tests (QC Lot: 778188)											
CG2217087-004	DUPLICATE	conductivity	----	E100	1.0	µS/cm	2470	2490	0.806%	10%	----
Anions and Nutrients (QC Lot: 775577)											
CG2217087-001	MW-01	ammonia, total (as N)	7664-41-7	E298	0.125	mg/L	2.82	2.85	1.13%	20%	----
Anions and Nutrients (QC Lot: 775883)											
CG2217087-001	MW-01	fluoride	16984-48-8	E235.F	0.100	mg/L	0.253	0.250	0.003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 775884)											
CG2217087-001	MW-01	nitrate (as N)	14797-55-8	E235.NO3	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 775885)											
CG2217087-001	MW-01	nitrite (as N)	14797-65-0	E235.NO2	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 775886)											
CG2217087-001	MW-01	chloride	16887-00-6	E235.Cl	2.50	mg/L	381	387	1.56%	20%	----
Anions and Nutrients (QC Lot: 775887)											
CG2217087-001	MW-01	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	118	119	1.35%	20%	----
Dissolved Metals (QC Lot: 775718)											
CG2216879-008	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 777893)											
CG2217082-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0200	mg/L	0.0215	<0.0200	0.0015	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00200	mg/L	0.00280	<0.00200	0.00080	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00200	mg/L	<0.00200	<0.00200	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00200	mg/L	0.0228	0.0213	7.12%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 777893) - continued											
CG2217082-001	Anonymous	boron, dissolved	7440-42-8	E421	0.200	mg/L	0.256	0.243	0.012	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	1.00	mg/L	203	201	1.04%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00200	mg/L	<0.00200	<0.00200	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00400	mg/L	0.00792	0.00760	0.00031	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.200	mg/L	<0.200	<0.200	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.100	mg/L	194	194	0.442%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00500	mg/L	0.0770	0.0760	1.39%	20%	----
		nickel, dissolved	7440-02-0	E421	0.0100	mg/L	0.0723	0.0702	0.00210	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	1.00	mg/L	16.0	15.9	0.695%	20%	----
		selenium, dissolved	7782-49-2	E421	0.00100	mg/L	0.0516	0.0497	3.64%	20%	----
		silver, dissolved	7440-22-4	E421	0.000200	mg/L	<0.000200	<0.000200	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	1.00	mg/L	3430	3350	2.58%	20%	----
		uranium, dissolved	7440-61-1	E421	0.000200	mg/L	0.0544	0.0526	3.38%	20%	----
		zinc, dissolved	7440-66-6	E421	0.0200	mg/L	<0.0200	<0.0200	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 775456)											
CG2217087-001	MW-01	benzene	71-43-2	E611A	0.50	µg/L	1.16	1.27	0.11	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 775458)											
CG2217087-001	MW-01	bromobenzene	108-86-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromochloromethane	74-97-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromoform	75-25-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromomethane	74-83-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, n-	104-51-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, sec-	135-98-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, tert-	98-06-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloroethane	75-00-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 775458) - continued											
CG2217087-001	MW-01	chloroform	67-66-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloromethane	74-87-3	E611E	5.0	µg/L	<5.0	<5.0	0	Diff <2x LOR	----
		chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		cymene, p-	99-87-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromomethane	74-95-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L	14.7	15.9	7.87%	30%	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L	2.3	2.7	0.3	Diff <2x LOR	----
		dichloromethane	75-09-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		hexachlorobutadiene	87-68-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		isopropylbenzene	98-82-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		propylbenzene, n-	103-65-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		styrene	100-42-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 775458) - continued											
CG2217087-001	MW-01	trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611E	1.0	µg/L	8.7	9.4	8.09%	50%	----
Hydrocarbons (QC Lot: 775457)											
CG2217087-001	MW-01	F1 (C6-C10)	----	E581.F1	100	µg/L	<100	<100	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 778184)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 778185)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 778186)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 778188)						
conductivity	----	E100	1	µS/cm	<1.0	----
Anions and Nutrients (QCLot: 775577)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 775883)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 775884)						
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 775885)						
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 775886)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 775887)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Dissolved Metals (QCLot: 775718)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 777893)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 777893) - continued						
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Volatile Organic Compounds (QCLot: 775456)						
benzene	71-43-2	E611A	0.5	µg/L	<0.50	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	<0.50	----
toluene	108-88-3	E611A	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611A	0.3	µg/L	<0.30	----
Volatile Organic Compounds (QCLot: 775458)						
bromobenzene	108-86-1	E611E	1	µg/L	<1.0	----
bromochloromethane	74-97-5	E611E	1	µg/L	<1.0	----
bromodichloromethane	75-27-4	E611E	1	µg/L	<1.0	----
bromoform	75-25-2	E611E	1	µg/L	<1.0	----
bromomethane	74-83-9	E611E	1	µg/L	<1.0	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	<1.0	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	<1.0	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	<1.0	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	<0.50	----
chlorobenzene	108-90-7	E611E	1	µg/L	<1.0	----
chloroethane	75-00-3	E611E	1	µg/L	<1.0	----
chloroform	67-66-3	E611E	1	µg/L	<1.0	----
chloromethane	74-87-3	E611E	5	µg/L	<5.0	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	<1.0	----
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	<1.0	----
cymene, p-	99-87-6	E611E	1	µg/L	<1.0	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	<1.0	----
dibromochloromethane	124-48-1	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 775458) - continued						
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	<1.0	----
dibromomethane	74-95-3	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	<1.0	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	<1.0	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	<1.0	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	<1.0	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	<1.0	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	<1.0	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	<1.0	----
dichloromethane	75-09-2	E611E	1	µg/L	<1.0	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	<1.0	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	<1.0	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	<1.0	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	<1.0	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	<1.0	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	<1.0	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	<1.0	----
isopropylbenzene	98-82-8	E611E	1	µg/L	<1.0	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	<0.50	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	<1.0	----
styrene	100-42-5	E611E	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	<1.0	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	<1.0	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	<1.0	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	<1.0	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	<1.0	----
trichloroethylene	79-01-6	E611E	1	µg/L	<1.0	----
trichlorofluoromethane	75-69-4	E611E	1	µg/L	<1.0	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 775458) - continued						
vinyl chloride	75-01-4	E611E	1	µg/L	<1.0	----
Hydrocarbons (QCLot: 775457)						
F1 (C6-C10)	----	E581.F1	100	µg/L	<100	----
Hydrocarbons (QCLot: 779295)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 778183)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 778184)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	104	90.0	110	----
Physical Tests (QCLot: 778185)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	108	85.0	115	----
Physical Tests (QCLot: 778186)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	112	85.0	115	----
Physical Tests (QCLot: 778187)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 778188)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	100	90.0	110	----
Anions and Nutrients (QCLot: 775577)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	96.6	85.0	115	----
Anions and Nutrients (QCLot: 775883)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 775884)									
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	98.6	90.0	110	----
Anions and Nutrients (QCLot: 775885)									
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	98.1	90.0	110	----
Anions and Nutrients (QCLot: 775886)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	99.6	90.0	110	----
Anions and Nutrients (QCLot: 775887)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	101	90.0	110	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	108	80.0	120	----
Dissolved Metals (QCLot: 777893)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	104	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	92.0	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	90.3	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 777893) - continued									
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	101	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	92.1	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	98.9	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.3	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	99.6	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	94.8	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	105	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	99.3	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	98.1	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	94.9	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	88.9	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	97.2	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	95.4	80.0	120	----
Volatile Organic Compounds (QCLot: 775456)									
benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	106	70.0	130	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	95.0	70.0	130	----
toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	102	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	110	70.0	130	----
xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	93.9	70.0	130	----
Volatile Organic Compounds (QCLot: 775458)									
bromobenzene	108-86-1	E611E	1	µg/L	100 µg/L	120	70.0	130	----
bromochloromethane	74-97-5	E611E	1	µg/L	100 µg/L	107	70.0	130	----
bromodichloromethane	75-27-4	E611E	1	µg/L	100 µg/L	105	70.0	130	----
bromoform	75-25-2	E611E	1	µg/L	100 µg/L	111	70.0	130	----
bromomethane	74-83-9	E611E	1	µg/L	100 µg/L	106	60.0	140	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	100 µg/L	80.8	70.0	130	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	100 µg/L	116	70.0	130	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	100 µg/L	122	70.0	130	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	100 µg/L	123	70.0	130	----
chlorobenzene	108-90-7	E611E	1	µg/L	100 µg/L	105	70.0	130	----
chloroethane	75-00-3	E611E	1	µg/L	100 µg/L	128	60.0	140	----
chloroform	67-66-3	E611E	1	µg/L	100 µg/L	111	70.0	130	----
chloromethane	74-87-3	E611E	5	µg/L	100 µg/L	116	60.0	140	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 775458) - continued									
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	100 µg/L	116	70.0	130	----
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	100 µg/L	118	70.0	130	----
cymene, p-	99-87-6	E611E	1	µg/L	100 µg/L	98.2	70.0	130	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	100 µg/L	93.9	70.0	130	----
dibromochloromethane	124-48-1	E611E	1	µg/L	100 µg/L	113	70.0	130	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	100 µg/L	99.4	70.0	130	----
dibromomethane	74-95-3	E611E	1	µg/L	100 µg/L	105	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	100 µg/L	108	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	100 µg/L	108	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	100 µg/L	108	70.0	130	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	100 µg/L	118	60.0	140	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	100 µg/L	118	70.0	130	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	100 µg/L	104	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	100 µg/L	122	70.0	130	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	100 µg/L	106	70.0	130	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	100 µg/L	104	70.0	130	----
dichloromethane	75-09-2	E611E	1	µg/L	100 µg/L	111	70.0	130	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	100 µg/L	106	70.0	130	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	100 µg/L	106	70.0	130	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	100 µg/L	93.9	70.0	130	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	100 µg/L	102	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	100 µg/L	88.6	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	100 µg/L	75.8	70.0	130	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	100 µg/L	75.5	70.0	130	----
isopropylbenzene	98-82-8	E611E	1	µg/L	100 µg/L	108	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	100 µg/L	111	70.0	130	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	100 µg/L	88.6	70.0	130	----
styrene	100-42-5	E611E	0.5	µg/L	100 µg/L	88.1	70.0	130	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	100 µg/L	97.9	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	100 µg/L	127	70.0	130	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	100 µg/L	102	70.0	130	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	100 µg/L	83.2	70.0	130	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	100 µg/L	80.0	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	100 µg/L	127	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	100 µg/L	112	70.0	130	----
trichloroethylene	79-01-6	E611E	1	µg/L	100 µg/L	104	70.0	130	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 775458) - continued									
trichlorofluoromethane	75-69-4	E611E	1	µg/L	100 µg/L	121	60.0	140	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	100 µg/L	122	70.0	130	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	100 µg/L	102	70.0	130	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	100 µg/L	117	70.0	130	----
vinyl chloride	75-01-4	E611E	1	µg/L	100 µg/L	114	60.0	140	----
Hydrocarbons (QCLot: 775457)									
F1 (C6-C10)	----	E581.F1	100	µg/L	100 µg/L	108	70.0	130	----
Hydrocarbons (QCLot: 779295)									
F2 (C10-C16)	----	E601	100	µg/L	3669.135 µg/L	94.9	70.0	130	----

Matrix Spike (MS) Report

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

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 775577)										
CG2217087-002	MW-04A	ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 775883)										
CG2217087-002	MW-04A	fluoride	16984-48-8	E235.F	0.911 mg/L	1 mg/L	91.1	75.0	125	----
Anions and Nutrients (QCLot: 775884)										
CG2217087-002	MW-04A	nitrate (as N)	14797-55-8	E235.NO3	2.42 mg/L	2.5 mg/L	96.9	75.0	125	----
Anions and Nutrients (QCLot: 775885)										
CG2217087-002	MW-04A	nitrite (as N)	14797-65-0	E235.NO2	0.497 mg/L	0.5 mg/L	99.4	75.0	125	----
Anions and Nutrients (QCLot: 775886)										
CG2217087-002	MW-04A	chloride	16887-00-6	E235.Cl	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 775887)										
CG2217087-002	MW-04A	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Dissolved Metals (QCLot: 775718)										
CG2216972-012	Anonymous	mercury, dissolved	7439-97-6	E509	0.000108 mg/L	0.0001 mg/L	108	70.0	130	----
Dissolved Metals (QCLot: 777893)										
CG2217082-002	Anonymous	aluminum, dissolved	7429-90-5	E421	2.18 mg/L	2 mg/L	109	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.206 mg/L	0.2 mg/L	103	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.206 mg/L	0.2 mg/L	103	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.209 mg/L	0.2 mg/L	104	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.955 mg/L	1 mg/L	95.5	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0413 mg/L	0.04 mg/L	103	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.416 mg/L	0.4 mg/L	104	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.200 mg/L	0.2 mg/L	100	70.0	130	----
		iron, dissolved	7439-89-6	E421	20.6 mg/L	20 mg/L	103	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.196 mg/L	0.2 mg/L	98.0	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.211 mg/L	0.2 mg/L	105	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.405 mg/L	0.4 mg/L	101	70.0	130	----
		potassium, dissolved	7440-09-7	E421	41.3 mg/L	40 mg/L	103	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 777893) - continued										
CG2217082-002	Anonymous	selenium, dissolved	7782-49-2	E421	0.422 mg/L	0.4 mg/L	106	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	20 mg/L	ND	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.77 mg/L	4 mg/L	94.3	70.0	130	----
Volatile Organic Compounds (QCLot: 775456)										
CG2217087-001	MW-01	benzene	71-43-2	E611A	94.9 µg/L	100 µg/L	94.9	70.0	130	----
		ethylbenzene	100-41-4	E611A	95.8 µg/L	100 µg/L	95.8	70.0	130	----
		toluene	108-88-3	E611A	104 µg/L	100 µg/L	104	70.0	130	----
		xylene, m+p-	179601-23-1	E611A	221 µg/L	200 µg/L	110	70.0	130	----
		xylene, o-	95-47-6	E611A	95.6 µg/L	100 µg/L	95.6	70.0	130	----
Volatile Organic Compounds (QCLot: 775458)										
CG2217087-001	MW-01	bromobenzene	108-86-1	E611E	128 µg/L	100 µg/L	128	70.0	130	----
		bromochloromethane	74-97-5	E611E	88.8 µg/L	100 µg/L	88.8	70.0	130	----
		bromodichloromethane	75-27-4	E611E	90.2 µg/L	100 µg/L	90.2	70.0	130	----
		bromoform	75-25-2	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		bromomethane	74-83-9	E611E	93.6 µg/L	100 µg/L	93.6	60.0	140	----
		butylbenzene, n-	104-51-8	E611E	84.3 µg/L	100 µg/L	84.3	70.0	130	----
		butylbenzene, sec-	135-98-8	E611E	128 µg/L	100 µg/L	128	70.0	130	----
		butylbenzene, tert-	98-06-6	E611E	128 µg/L	100 µg/L	128	70.0	130	----
		carbon tetrachloride	56-23-5	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		chlorobenzene	108-90-7	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		chloroethane	75-00-3	E611E	117 µg/L	100 µg/L	117	60.0	140	----
		chloroform	67-66-3	E611E	99.2 µg/L	100 µg/L	99.2	70.0	130	----
		chloromethane	74-87-3	E611E	104 µg/L	100 µg/L	104	60.0	140	----
		chlorotoluene, 2-	95-49-8	E611E	128 µg/L	100 µg/L	128	70.0	130	----
		chlorotoluene, 4-	106-43-4	E611E	130 µg/L	100 µg/L	130	70.0	130	----
		cymene, p-	99-87-6	E611E	107 µg/L	100 µg/L	107	70.0	130	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	76.3 µg/L	100 µg/L	76.3	70.0	130	----
		dibromochloromethane	124-48-1	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		dibromoethane, 1,2-	106-93-4	E611E	92.4 µg/L	100 µg/L	92.4	70.0	130	----
		dibromomethane	74-95-3	E611E	84.1 µg/L	100 µg/L	84.1	70.0	130	----
		dichlorobenzene, 1,2-	95-50-1	E611E	111 µg/L	100 µg/L	111	70.0	130	----
		dichlorobenzene, 1,3-	541-73-1	E611E	119 µg/L	100 µg/L	119	70.0	130	----
		dichlorobenzene, 1,4-	106-46-7	E611E	115 µg/L	100 µg/L	115	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 775458) - continued										
CG2217087-001	MW-01	dichlorodifluoromethane	75-71-8	E611E	123 µg/L	100 µg/L	123	60.0	140	----
		dichloroethane, 1,1-	75-34-3	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		dichloroethane, 1,2-	107-06-2	E611E	85.5 µg/L	100 µg/L	85.5	70.0	130	----
		dichloroethylene, 1,1-	75-35-4	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	88.7 µg/L	100 µg/L	88.7	70.0	130	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	96.0 µg/L	100 µg/L	96.0	70.0	130	----
		dichloromethane	75-09-2	E611E	93.0 µg/L	100 µg/L	93.0	70.0	130	----
		dichloropropane, 1,2-	78-87-5	E611E	91.7 µg/L	100 µg/L	91.7	70.0	130	----
		dichloropropane, 1,3-	142-28-9	E611E	100 µg/L	100 µg/L	100	70.0	130	----
		dichloropropane, 2,2-	594-20-7	E611E	81.2 µg/L	100 µg/L	81.2	70.0	130	----
		dichloropropylene, 1,1-	563-58-6	E611E	95.7 µg/L	100 µg/L	95.7	70.0	130	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	80.0 µg/L	100 µg/L	80.0	70.0	130	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	71.8 µg/L	100 µg/L	71.8	70.0	130	----
		hexachlorobutadiene	87-68-3	E611E	71.9 µg/L	100 µg/L	71.9	70.0	130	----
		isopropylbenzene	98-82-8	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	115 µg/L	100 µg/L	115	70.0	130	----
		propylbenzene, n-	103-65-1	E611E	91.5 µg/L	100 µg/L	91.5	70.0	130	----
		styrene	100-42-5	E611E	83.5 µg/L	100 µg/L	83.5	70.0	130	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	104 µg/L	100 µg/L	104	70.0	130	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		tetrachloroethylene	127-18-4	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	79.8 µg/L	100 µg/L	79.8	70.0	130	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	83.0 µg/L	100 µg/L	83.0	70.0	130	----
		trichloroethane, 1,1,1-	71-55-6	E611E	117 µg/L	100 µg/L	117	70.0	130	----
		trichloroethane, 1,1,2-	79-00-5	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		trichloroethylene	79-01-6	E611E	95.8 µg/L	100 µg/L	95.8	70.0	130	----
		trichlorofluoromethane	75-69-4	E611E	109 µg/L	100 µg/L	109	60.0	140	----
		trichloropropane, 1,2,3-	96-18-4	E611E	111 µg/L	100 µg/L	111	70.0	130	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	123 µg/L	100 µg/L	123	70.0	130	----
		vinyl chloride	75-01-4	E611E	105 µg/L	100 µg/L	105	60.0	140	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
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COC # CORD Red Deer Motors

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:	ryan.miller@tetratech.com	☐	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 #:	SWM.SWOP04071-03.004		
Address:		PO/AFE:	SWM.SWOP04071-03.004		
Sample		Legal Site Description:			
Phone:	Fax:	Quote #:	CG22-EBAE100-0021		
Lab Work Order # (lab use only)		ALS Contact:	Patryk Wojciak	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)	S5421B - Routine + Metals	S665A F - BTEX/F1-F2	E611E - VOC	E298 - Ammonia	Hazardous?	Highly Contaminated?	Number of Containers
	MW-01	09-12-22	15:20	Water	X	X	X	X			3
	MW-04A	↓	16:00	Water	X	X	X	X			3
	MW-05		15:40	Water	X	X	X	X			3
	Duplicate	↓	—	Water	X	X	X	X			

Guidelines / Regulations

Special Instructions / Hazardous Details

Diss Metals & Hg filtered & preserved

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 11/22	Received By:	R	Date & Time:	12/12 8:00	Sample Condition (la	
Relinquished By:		Date & Time:	15:15	Received By:		Date & Time:		Temperature 5C	Samples Received Condition? Y / N provided deta

Environmental Division
Calgary
Work Order Reference
CG2217087

Telephone : +1 403 407 1800

APPENDIX E

HISTORICAL ANALYTICAL REPORTS

Table 1
Elevations for Soil Vapour and Groundwater Monitoring Wells

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval		
				Bottom	Top	
MW-01	6.1	874.014	875.099	867.914	872.514	4.6
MW-02	6.6	877.302	878.096	870.702	- -	- -
MW-03	5.1	877.297	877.307	872.197	- -	- -
VW-01	3.5	874.194	874.943	870.694	870.994	0.3
VW-02	4.6	877.321	878.166	872.721	873.021	0.3
VW-03	4.0	877.316	878.017	873.316	873.616	0.3
TH-03	No Well	875.332	- -	- -	- -	- -
TH-05	No Well	875.567	- -	- -	- -	- -
TH-06	No Well	876.597	- -	- -	- -	- -
TH-07	No Well	876.925	- -	- -	- -	- -
TH-08	No Well	876.812	- -	- -	- -	- -
TH-09	No Well	875.907	- -	- -	- -	- -

Notes:

1) Geodetic elevations are referenced to multiple ASCM Nos. 269191, 376673 and 384792.
2) MW - Monitoring Well.
3) VW - Soil Vapour Well.
4) TH - Testhole.
5) Well depth, screen interval derived from borehole logs by others, where avalable.
6) - - No value established.

Table 2
Site Monitoring Results

Test Location	Elevations		Groundwater Elevation (m)		Headspace Vapour			
					03/08/13			
	Ground (m)	Top of Pipe (m)	03/08/13		Combustible	Volatile	Combustible	Volatile
MW-01	874.014	875.099	869.841		230	43		
MW-02	877.302	878.096	874.276		ND	ND		
MW-03	877.297	877.307	NM		NM	NM		
VW-01	874.194	874.943	- -	- -	1,600	64		
VW-02	877.321	878.166	- -	- -	20	2		
VW-03	877.316	878.017	- -	- -	25	ND		
TH-03	875.332	NA	- -	- -	- -	- -	- -	- -
TH-05	875.567	NA	- -	- -	- -	- -	- -	- -
TH-06	876.597	NA	- -	- -	- -	- -	- -	- -
TH-07	876.925	NA	- -	- -	- -	- -	- -	- -
TH-08	876.812	NA	- -	- -	- -	- -	- -	- -
TH-09	875.907	NA	- -	- -	- -	- -	- -	- -

Notes:

1) Geodetic elevations are referenced to multiple ASCM Nos 269191, 376673 and 384792.
2) Measurement of combustible and volatile vapours by RKI Eagle 2. Units ppmv.
   Combustible vapour sensor calibrated to hexane and photoionization detector calibrated to isobutylene.
3) NA - Not Applicable.
4) ND - Not Detected, less than the limit of instrument detection.
5) NM - Not Measured.
6) - - No applicable value.

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	7.71	2-12.5
Flash Point (°C)	30.0	>75	>61
Paint Filter Test	-	PASS	PASS
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) Applicance waste screening process for The City of Red Deer Class II Waste Managment Facility.
2) Class II Landfill Acceptable 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 June 26, 2013.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

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

Parameters	Units	Detection Limit	TH-01 @ 5.2 m 06/26/2013	Tier 1 Guideline
Chloride (Cl)	mg/kg	15	188	- -
Nitrate-N	mg/kg	0.74	ND	- -
Nitrite-N	mg/kg	0.74	ND	- -
Metals				
Antimony (Sb)	mg/kg	0.20	0.44	20
Arsenic (As)	mg/kg	0.20	7.18	17
Barium (Ba)	mg/kg	5.0	242	500
Beryllium (Be)	mg/kg	1.0	ND	5
Cadmium (Cd)	mg/kg	0.50	ND	10
Chromium (Cr)	mg/kg	0.50	35.7	64
Cobalt (Co)	mg/kg	1.0	7.8	20
Copper (Cu)	mg/kg	2.0	18.3	63
Lead (Pb)	mg/kg	5.0	8.0	140
Mercury (Hg)	mg/kg	0.05	ND	6.6
Molybdenum (Mo)	mg/kg	1.0	1.2	4
Nickel (Ni)	mg/kg	2.0	28.6	50
Selenium (Se)	mg/kg	0.50	ND	1.0
Silver (Ag)	mg/kg	1.0	ND	20
Thallium (Tl)	mg/kg	0.5	ND	1.0
Tin (Sn)	mg/kg	2.0	ND	5
Uranium (U)	mg/kg	2.0	ND	23
Vanadium (V)	mg/kg	1.0	38.4	130
Zinc (Zn)	mg/kg	10	63	200
Hexavalent Chromium	mg/kg	0.10	ND	0.4
Boron (B), Hot Water Ext.	mg/kg	0.10	1.26	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 referenced criteria.
4) Bold & Shaded - Exceeds the referenced Alberta Tier 1 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-01 @ 5.2 m 06/26/2013	Tier 1 Guideline
Hydrocarbons				
F1 (C_6-C_{10})	mg/kg	10	ND	24
F2 (C_{10}-C_{16})	mg/kg	25	ND	130
F3 (C_{16}-C_{34})	mg/kg	50	117	300
F4 (C_{34}-C_{50})	mg/kg	50	ND	2,800
Total Hydrocarbons (C_6-C_{50})	mg/kg	50	117	- -
Volatile Organic Compounds				
Benzene	mg/kg	0.0050	ND	0.073
Bromobenzene	mg/kg	0.010	ND	- -
Bromochloromethane	mg/kg	0.010	ND	- -
Bromodichloromethane	mg/kg	0.010	ND	- -
Bromoform	mg/kg	0.010	ND	- -
Bromomethane	mg/kg	0.10	ND	- -
n-Butylbenzene	mg/kg	0.010	ND	- -
sec-Butylbenzene	mg/kg	0.010	ND	- -
tert-Butylbenzene	mg/kg	0.010	ND	- -
Carbon tetrachloride	mg/kg	0.010	ND	0.00056
Chlorobenzene	mg/kg	0.010	ND	0.018
Dibromochloromethane	mg/kg	0.010	ND	0.27
Chloroethane	mg/kg	0.10	ND	- -
Chloroform	mg/kg	0.010	ND	0.0010
Chloromethane	mg/kg	0.10	ND	- -
2-Chlorotoluene	mg/kg	0.010	ND	- -
4-Chlorotoluene	mg/kg	0.010	ND	- -
1,2-Dibromo-3-chloropropane	mg/kg	0.010	ND	- -
1,2-Dibromoethane	mg/kg	0.010	ND	- -
Dibromomethane	mg/kg	0.010	ND	- -
1,2-Dichlorobenzene	mg/kg	0.010	ND	0.18
1,3-Dichlorobenzene	mg/kg	0.010	ND	- -
1,4-Dichlorobenzene	mg/kg	0.010	ND	0.098
Dichlorodifluoromethane	mg/kg	0.010	ND	- -
1,1-Dichloroethane	mg/kg	0.010	ND	- -
1,2-Dichloroethane	mg/kg	0.010	ND	0.0027
1,1-Dichloroethene	mg/kg	0.010	ND	0.021
cis-1,2-Dichloroethene	mg/kg	0.010	ND	- -
trans-1,2-Dichloroethene	mg/kg	0.010	ND	- -
Methylene chloride	mg/kg	0.010	ND	0.095
1,2-Dichloropropane	mg/kg	0.010	ND	- -
1,3-Dichloropropane	mg/kg	0.010	ND	- -
2,2-Dichloropropane	mg/kg	0.010	ND	- -
1,1-Dichloropropene	mg/kg	0.010	ND	- -
cis-1,3-Dichloropropene	mg/kg	0.010	ND	- -
trans-1,3-Dichloropropene	mg/kg	0.010	ND	- -
Ethylbenzene	mg/kg	0.015	ND	0.21
Hexachlorobutadiene	mg/kg	0.010	ND	0.0067
Isopropylbenzene	mg/kg	0.010	ND	- -
p-Isopropyltoluene	mg/kg	0.010	ND	- -
n-Propylbenzene	mg/kg	0.010	ND	- -
Styrene	mg/kg	0.050	ND	0.8
1,1,1,2-Tetrachloroethane	mg/kg	0.010	ND	- -
1,1,2,2-Tetrachloroethane	mg/kg	0.050	ND	- -
Tetrachloroethene	mg/kg	0.010	ND	0.16
Toluene	mg/kg	0.050	ND	0.49
1,2,3-Trichlorobenzene	mg/kg	0.010	ND	0.26
1,2,4-Trichlorobenzene	mg/kg	0.010	ND	0.23
1,1,1-Trichloroethane	mg/kg	0.010	ND	- -
1,1,2-Trichloroethane	mg/kg	0.010	ND	- -
Trichloroethene	mg/kg	0.010	ND	0.012
Trichlorofluoromethane	mg/kg	0.010	ND	- -
1,2,3-Trichloropropane	mg/kg	0.020	ND	- -
1,2,4-Trimethylbenzene	mg/kg	0.010	0.013	- -
1,3,5-Trimethylbenzene	mg/kg	0.010	ND	- -
Vinyl chloride	mg/kg	0.20	ND	0.00034
Xylenes	mg/kg	0.1	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 Guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4A
Groundwater Indices Measured at Time of Sampling

Monitoring Well	pH	Electrical Conductivity (µg/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Total Dissolved Solid (mg/L)	Potential Redox (±mV)
MW-01	8.11	1,437	6.9	0.77	1,404.00	-83.6
MW-02	7.89	641	6.9	1.56	637.00	+42.3
MW-03	- -	- -	- -	- -	- -	- -

Notes:

1) Samples collected on Saturday, August 3, 2013.
2) Groundwater indices are field measured by YSI Pro Plus multi-meter.

Table 4B
Analytical Results - Groundwater - Routine Water Quality

Parameter	Unit	Detection Limit	MW-01	MW-02	Tier 1 Guideline
			08/03/2013		
General Water Quality					
Biochemical Oxygen Demand	mg/L	2.0	11	2	- -
Chemical Oxygen Demand	mg/L	5.0	350	16	- -
Conductivity	µS/cm	1.0	2,400	1,100	- -
pH	Unitless	NA	7.20	7.51	6.5-8.5
Total Organic Carbon (C)	mg/L	0.50	10	3.5	- -
Dissolved Cadmium (Cd)	µg/L	0.0050	0.037	0.025	- -
Total Cadmium (Cd)	µg/L	0.0050	**3.4**	0.025	0.060*
Alkalinity ($CaCO_3$)	mg/L	0.50	570	490	- -
Bicarbonate (HCO_3)	mg/L	0.50	700	600	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	- -
Sulphates (SO_4)	mg/L	1.0	100	48	- -
Chlorides (Cl)	mg/L	1.0 - 5.0	360	36	- -
Total Ammonia (NH_3-N)	mg/L	0.050 - 0.50	**9**	0.1	1.37*
Total Phosphorus (P)	mg/L	0.0030 - 0.0150	4.6	0.015	- -
Total Nitrogen (N)	mg/L	0.050	12	0.26	- -
Nitrate plus Nitrite (N)	mg/L	0.0030 - .015	0.019	ND	- -
Total Kjeldahl Nitrogen (TKN)	mg/L	0.050 - 0.5	12	0.25	- -
Nitrite (NO_2)	mg/L	0.0030 - 0.015	ND	ND	- -
Nitrate (NO_3)	mg/L	0.0030	0.019	0.013	- -
Trace Organics					
Acetic Acid	mg/L	50	ND	ND	- -
Formic Acid	mg/L	50	ND	ND	- -
Propionic Acid	mg/L	50	ND	ND	- -
Adsorbable Organic Halogen	mg/L	0.004 - 0.02	0.29	0.016	- -

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) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) Guidelines as referenced in the Tier 1 Guidelines.
3) ND - Not Detected, less than the limit of method detection.
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guideline.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4C
Analytical Results - Groundwater - Metals

Parameter	Detection Limit	MW-01	MW-02	Tier 1 Guideline
		08/03/2013		
Total Metals				
Aluminum (Al)	0.0030	**34**	**0.29**	0.1*
Antimony (Sb)	0.00060	0.0017	ND	0.006
Arsenic (As)	0.00020	**0.085**	0.00072	0.005
Barium (Ba)	0.010	**1.8**	0.15	1
Beryllium (Be)	0.0010	0.0024	ND	- -
Boron (B)	0.020	0.11	0.065	1.5
Calcium (Ca)	0.30	330	150	- -
Chromium (Cr)	0.0010	**0.11**	ND	0.001*
Cobalt (Co)	0.00030	0.078	0.0022	- -
Copper (Cu)	0.00020	**0.16**	0.0023	0.003*
Iron (Fe)	0.060	**180**	**0.98**	0.3
Lead (Pb)	0.00020	**0.10**	0.00057	0.004*
Lithium (Li)	0.020	0.12	0.051	- -
Magnesium (Mg)	0.20	170	52	- -
Manganese (Mn)	0.0040	**5.6**	**1.8**	0.05
Molybdenum (Mo)	0.00020	0.0071	0.00034	0.073*
Nickel (Ni)	0.00050	**0.20**	0.0034	0.11*
Phosphorus (P)	0.10	3.4	ND	- -
Potassium (K)	0.30	22	6.6	- -
Selenium (Se)	0.00020	**0.0026**	ND	0.001
Silicon (Si)	0.10 - 0.50	100	9.9	- -
Silver (Ag)	0.00010	**0.00058**	ND	0.0001*
Sodium (Na)	0.50	140	16	- -
Strontium (Sr)	0.020	1.8	0.97	- -
Sulphur (S)	0.20	32	15	- -
Thallium (Tl)	0.00020	**0.00097**	ND	0.0008*
Tin (Sn)	0.0010	0.0029	ND	- -
Titanium (Ti)	0.0010	0.71	0.015	- -
Uranium (U)	0.00010	0.006	0.0097	0.02
Vanadium (V)	0.0010	0.17	0.0015	- -
Zinc (Zn)	0.0030	**0.41**	0.0097	0.03
Dissolved Metals				
Aluminum (Al)	0.0030	0.017	0.011	- -
Antimony (Sb)	0.00060	ND	ND	- -
Arsenic (As)	0.00020	0.0230	ND	- -
Barium (Ba)	0.010	0.68	0.13	- -
Beryllium (Be)	0.0010	ND	ND	- -
Boron (B)	0.020	0.074	0.063	- -
Calcium (Ca)	0.30	160	140	- -
Chromium (Cr)	0.0010	ND	ND	- -
Cobalt (Co)	0.00030	0.012	0.0017	- -
Copper (Cu)	0.00020	0.00078	0.002	- -
Iron (Fe)	0.060	27	0.11	- -
Lead (Pb)	0.00020	ND	ND	- -
Lithium (Li)	0.020	0.051	0.049	- -
Magnesium (Mg)	0.20	110	49	- -
Manganese (Mn)	0.0040	1.9	1.8	- -
Molybdenum (Mo)	0.00020	0.0015	0.00026	- -
Nickel (Ni)	0.00050	0.022	0.002	- -
Phosphorus (P)	0.10	ND	ND	- -
Potassium (K)	0.30	14	6.6	- -
Selenium (Se)	0.00020	ND	ND	- -
Silicon (Si)	0.10	15	9.1	- -
Silver (Ag)	0.00010	ND	ND	- -
Sodium (Na)	0.50	140	17	- -
Strontium (Sr)	0.020	1.60	0.98	- -
Sulphur (S)	0.20	32	15	- -
Thallium (Tl)	0.00020	ND	ND	- -
Tin (Sn)	0.0010	ND	ND	- -
Titanium (Ti)	0.0010	ND	ND	- -
Uranium (U)	0.00010	0.0011	0.0092	- -
Vanadium (V)	0.0010	ND	ND	- -
Zinc (Zn)	0.0030	0.0067	0.0062	- -

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) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) Guidelines as referenced in the Tier 1 Guidelines.
3) ND - Not Detected, less than the limit of method detection.
4) Unless specified all units are mg/L.
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guideline.
7) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4D
Analytical Results - Groundwater -VOCs

Parameter	Detection Limit	MW-01	MW-02	Tier 1 Guideline
		08/03/2013		
Volatile Organic Compounds				
Benzene	0.00040	0.0015	ND	0.005
Toluene	0.00040	ND	ND	0.024
Ethylbenzene	0.00040	ND	ND	0.0024
Xylenes (Total)	0.00080	0.0018	ND	0.3
F1 (C_6-C_{10})	0.10	ND	ND	0.81
F2 (C_{10}-C_{16})	0.10	ND	ND	1.1
Total Trihalomethanes	0.0020	ND	ND	0.1
Bromodichloromethane	0.00050	ND	ND	- -
Bromoform	0.00050	ND	ND	- -
Bromomethane	0.0020	ND	ND	- -
Carbon tetrachloride	0.00050	ND	ND	0.00056
Chlorobenzene	0.00050	ND	ND	0.0013
Chlorodibromomethane	0.0010	ND	ND	- -
Chloroethane	0.0010	ND	ND	- -
Chloroform	0.00050	ND	ND	0.0018
Chloromethane	0.0020	ND	ND	- -
1,2-dibromoethane	0.00050	ND	ND	- -
1,2-dichlorobenzene	0.00050	ND	ND	0.0007
1,3-dichlorobenzene	0.00050	ND	ND	- -
1,4-dichlorobenzene	0.00050	ND	ND	0.001
1,1-dichloroethane	0.00050	ND	ND	- -
1,2-dichloroethane	0.00050	ND	ND	0.005
1,1-dichloroethene	0.00050	ND	ND	0.014
cis-1,2-dichloroethene	0.00050	0.033	ND	- -
trans-1,2-dichloroethene	0.00050	0.0034	ND	- -
Dichloromethane	0.0020	ND	ND	0.05
1,2-dichloropropane	0.00050	ND	ND	- -
cis-1,3-dichloropropene	0.00050	ND	ND	- -
trans-1,3-dichloropropene	0.00050	ND	ND	- -
Methyl methacrylate	0.00050	ND	ND	0.47
Methyl-tert-butyl ether (MTBE)	0.00050	ND	ND	0.015
Styrene	0.00050	ND	ND	0.072
1,1,1,2-tetrachloroethane	0.0020	ND	ND	- -
1,1,2,2-tetrachloroethane	0.0020	ND	ND	- -
Tetrachloroethene	0.00050	ND	ND	0.03
1,2,3-trichlorobenzene	0.0010	ND	ND	0.008
1,2,4-trichlorobenzene	0.0010	ND	ND	0.015
1,3,5-trichlorobenzene	0.00050	ND	ND	0.014
1,1,1-trichloroethane	0.00050	ND	ND	- -
1,1,2-trichloroethane	0.00050	ND	ND	- -
Trichloroethene	0.00050	ND	ND	0.005
Trichlorofluoromethane	0.00050	ND	ND	- -
1,2,4-trimethylbenzene	0.00050	0.004	ND	- -
1,3,5-trimethylbenzene	0.00050	0.0018	ND	- -
Vinyl chloride	0.00050	**0.003**	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 (ppm).
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 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 (mm)	Screen Length (cm)	Well Depth (m)	Headspace Volume (cm^3)	Purge Rate (cm^3/min)	Purge Time (min)	Pressure	
							Ambient (psi)	Vapour Well (psi)
VW-01	25	30	3.5	1,718.06	943.3	4	15.00	15.00
VW-02	25	30	4.6	2,258.02	943.3	7	15.10	15.06
VW-03	25	30	4.0	1,963.50	943.3	5	15.14	15.08

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 on Saturday, August 3, 2013.

Table 5B
Analytical Results - Soil Vapour - General Indices

Parameter	Unit	Detection Limit	VW-01	VW-02	VW-03
Gauge Pressure					
Following sampling	psi	- -	-5.0	NA	-5.0
Reported by laboratory	psi	- -	-1.4	-3.6	-3.4
Fixed Gases					
Oxygen	% v/v	0.2 - 0.3	8.4	17.2	19.8
Nitrogen	% v/v	0.2 - 0.3	52.5	77.8	78.3
Carbon monoxide	% v/v	0.2 - 0.3	ND	ND	ND
Methane	% v/v	0.2 - 0.3	26	ND	ND
Carbon dioxide	% v/v	0.2 - 0.3	13.1	4.6	1.9

Notes:

1) Soil vapour sample collected on Saturday, August 3, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) NA - Not Available.
4) - - No value established in the detection limit.
5) 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	VW-03
				08/03/13	
Hydrocarbon Fractions					
Aliphatic >C_5-C_6	µg/m^3	5.0 - 480	53,000	332	6.8
Aliphatic >C_6-C_8	µg/m^3	5.0 - 480	88,300	2,990	34.4
Aliphatic >C_8-C_{10}	µg/m^3	5.0 - 480	ND	577	73.1
Aliphatic >C_{10}-C_{12}	µg/m^3	5.0 - 480	664	345	202
Aliphatic >C_{12}-C_{16}	µg/m^3	5.0 - 480	ND	106	105
Aromatic >C_7-C_8 (TEX excluded)	µg/m^3	5.0 - 480	ND	ND	ND
Aromatic >C_8-C_{10}	µg/m^3	5.0 - 480	ND	44.8	30.9
Aromatic >C_{10}-C_{12}	µg/m^3	5.0 - 480	ND	78.4	58.1
Aromatic >C_{12}-C_{16}	µg/m^3	5.0 - 480	ND	ND	ND
Select Volatile Gases					
Acetylene	ppm	0.19 - 0.34	ND	ND	ND
Ethane	ppm	0.19 - 0.34	1.1	ND	ND
Ethylene	ppm	0.19 - 0.34	0.67	ND	ND
Methane	ppm	5.6 - 6.8	260,000	67	ND
n-Butane	ppm	0.358 - 0.68	2.4	ND	ND
n-Pentane	ppm	0.19 - 0.34	14	ND	ND
Propane	**ppm**	**0.19 - 0.34**	**0.34**	**ND**	**ND**
Propene	ppm	0.19 - 0.34	0.22	ND	ND
Propyne	ppm	0.38 - 0.68	ND	ND	ND
Volatile Organic Compounds					
Dichlorodifluoromethane (FREON 12)	ppbv	0.20 - 58	ND	348	1.60
1,2-Dichlorotetrafluoroethane	ppbv	0.17 - 16	ND	34.4	0.58
Chloromethane	ppbv	0.30 - 29	ND	ND	1.03
Vinyl chloride	ppbv	0.18 - 17	519	0.51	ND
Chloroethane	ppbv	0.30 - 29	ND	ND	ND
1,3-Butadiene	ppbv	0.50 - 48	ND	ND	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.20 - 19	ND	50.6	0.42
Ethanol (ethyl alcohol)	ppbv	23 - 220	322	180	648
Trichlorotrifluoroethane	ppbv	0.15 - 14	ND	ND	ND
2-propanol	ppbv	3.0 - 290	ND	3.6	5.1
2-Propanone	ppbv	0.80 - 76	ND	36.5	18
Methyl ethyl ketone (MEK) (2-Butanone)	ppbv	3.0 - 290	ND	ND	5.8
Methyl isobutyl ketone	ppbv	3.2 - 300	ND	ND	ND
Methyl butyl ketone (MBK) (2-Hexanone)	ppbv	2.0 - 190	ND	ND	ND
Methyl t-butyl ether (MTBE)	ppbv	0.20 - 19	ND	ND	ND
Ethyl acetate	ppbv	2.2 - 210	ND	ND	ND
1,1-Dichloroethylene	ppbv	0.25 - 24	ND	1.41	ND
cis-1,2-Dichloroethylene	ppbv	0.19 - 18	123	13.2	0.42
trans-1,2-Dichloroethylene	ppbv	0.20 - 19	30	ND	ND
Methylene chloride(Dichloromethane)	ppbv	0.80 - 120	ND	1.47	1.06
Chloroform	ppbv	0.15 - 14	ND	18.2	0.52
Carbon tetrachloride	ppbv	0.30 - 29	ND	ND	ND
1,1-Dichloroethane	ppbv	0.20 - 19	ND	ND	ND
1,2-Dichloroethane	ppbv	0.20 - 19	ND	ND	ND
Ethylene dibromide	ppbv	0.17 - 16	ND	ND	ND
1,1,1-Trichloroethane	ppbv	0.30 - 29	ND	3.45	ND
1,1,2-Trichloroethane	ppbv	0.15 - 14	ND	ND	ND
1,1,2,2-Tetrachloroethane	ppbv	0.20 - 19	ND	ND	ND
cis-1,3-Dichloropropene	ppbv	0.18 - 17	ND	ND	ND
trans-1,3-Dichloropropene	ppbv	0.17 - 16	ND	ND	ND
1,2-Dichloropropane	ppbv	0.40 - 38	ND	ND	ND
Bromomethane	ppbv	0.18 - 17	ND	ND	ND
Bromoform	ppbv	0.20 - 19	ND	ND	ND
Bromodichloromethane	ppbv	0.20 - 19	ND	ND	ND
Dibromochloromethane	ppbv	0.20 - 19	ND	ND	ND
Trichloroethylene (TCE)	ppbv	0.30 - 29	ND	81.9	1.32
Tetrachloroethylene (PCE)	ppbv	0.20 - 19	ND	221	ND
Benzene	ppbv	0.18 - 17	ND	5.17	0.79
Toluene	ppbv	0.20 - 81	ND	4.80	3.95
Ethylbenzene	ppbv	0.20 - 27	ND	0.75	0.92
p+m-xylene	ppbv	0.37 - 99	ND	1.89	3.65
o-xylene	ppbv	0.20 - 19	ND	1.22	1.67
Styrene	ppbv	0.20 - 19	42	ND	0.37
4-ethyltoluene	ppbv	2.2 - 210	ND	ND	ND
1,3,5-Trimethylbenzene	ppbv	1.9 - 48	ND	4.05	ND
1,2,4-Trimethylbenzene	ppbv	0.50 - 48	ND	2.31	2.74
Chlorobenzene	ppbv	0.20 - 19	ND	ND	ND
Benzyl chloride	ppbv	1.0 - 95	ND	ND	ND
1,3-Dichlorobenzene	ppbv	0.40 - 38	ND	ND	ND
1,4-Dichlorobenzene	ppbv	0.40 - 38	ND	ND	ND
1,2-Dichlorobenzene	ppbv	0.40 - 38	ND	ND	ND
1,2,4-Trichlorobenzene	ppbv	2.0 - 190	ND	ND	ND
Hexachlorobutadiene	ppbv	3.0 - 290	ND	ND	ND
Hexane	ppbv	1.3 - 29	17,800	142	ND
Heptane	ppbv	0.30 - 29	1,970	181	0.58
Cyclohexane	ppbv	0.20 - 19	4,900	219	0.35
Tetrahydrofuran	ppbv	0.40 - 38	ND	ND	5.14
1,4-Dioxane	ppbv	2.0 - 190	ND	ND	ND
Xylene (Total)	ppbv	0.60 - 99	ND	3.11	5.31
Vinyl bromide	ppbv	0.20 - 19	ND	ND	ND
Propene	ppbv	3.9 - 29	371	ND	ND
2,2,4-Trimethylpentane	ppbv	0.20 - 19	ND	ND	0.64
Carbon disulfide	ppbv	0.50 - 48	ND	40.5	3.21
Vinyl acetate	ppbv	0.20 - 19	ND	ND	ND

Notes:
1) Results are from sampling completed on Saturday, August 03, 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		VW-03	
			08/03/13					
	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm
Trimethylsilyl Fluoride	- -	- -	ND	ND	ND	ND	ND	ND
Tetramethylsilane	0.00010 - 0.0022	0.0001 - 0.0006	ND	ND	ND	ND	ND	ND
Methoxytrimethylsilane	0.0032 - 0.0563	0.0007 - 0.0132	ND	ND	ND	ND	ND	ND
Ethoxytrimethylsilane	0.0031 - 0.0543	0.0006 - 0.0112	ND	ND	ND	ND	ND	ND
Trimethylsilanol	- -	- -	0.0338	0.0092	ND	ND	0.0098	0.0027
Isopropoxytrimethylsilane	0.0013 - 0.0229	0.00020 - 0.0042	ND	ND	ND	ND	ND	ND
Trimethoxymethyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Hexamethyl Disiloxane - L2	0.00010 - 0.0021	0.0001 - 0.0003	ND	ND	ND	ND	ND	ND
Propoxytrimethylsilane	0.0035 - 0.0621	0.0006 - 0.0115	ND	ND	ND	ND	ND	ND
1-Methylbutoxytrimethylsilane *	- -	- -	ND	ND	ND	ND	ND	ND
Butoxytrimethylsilane *	- -	- -	ND	ND	ND	ND	ND	ND
Trimethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	- -	0.1927	0.0212	0.0844	0.0093	0.0146	0.0016
Octamethyl Trisiloxane - L3	0.0002 - 0.0041	0.0001 - 0.0004	ND	ND	ND	ND	ND	ND
Triethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Triethoxyethyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	- -	0.0739	0.0061	0.0299	0.0025	0.0234	0.0019
Decamethyl Tetrasiloxane - L4	0.0003 - 0.0053	0.0001 - 0.0004	ND	ND	ND	ND	ND	ND
Tetraethylsilicate #	- -	- -	ND	ND	ND	ND	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	- -	0.0349	0.0023	0.0321	0.0021	0.0420	0.0028
Dodecamethyl Pentasiloxane - L5	0.0030 - 0.0528	0.0002 - 0.0034	ND	ND	ND	ND	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	0.0531	0.0029	ND	ND	0.1454	0.0080	0.1513	0.0083
Sum	- -	- -	0.6503	0.0870	0.4152	0.0432	0.2559	0.0198

Notes:

1) Soil vapour samples collected on Saturday, August 3, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit.
4) VW-01 V=10.0mL, VW-02 V=25mL, VW-03 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.

APPENDIX F

BOREHOLE LOGS

PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** MW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer Motors Site	**GROUND ELEVATION:** 874.014 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/26/2013

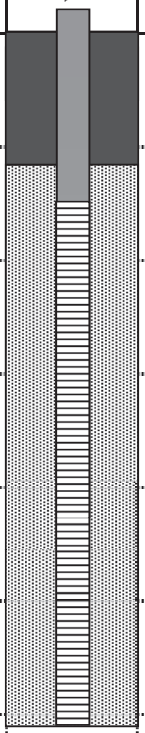
Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Groundwater Monitoring Well is ~ 6 m east of trees along Taylor Drive and ~7 m south of 32 Street, near the northwest corner of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)
0.0	Grass/loam - soft, silty, sandy, moist, olive. (~ 3 cm thick).				
	Sand (fill) - dense to compact, silty, trace clay, damp, yellow.				
1.0	Loam (fill) - compact, silty, sandy, trace clay, damp, dark olive.				
	Clay (fill) - firm, loamy, silty, trace fine rounded gravel, distinctive slough gas odour, moist, dark olive. wood debris at 1.8 m to 2.4 m.				
2.0	No obvious waste material.		J		
3.0	Sand (fill) - compact to loose, silty, trace clay, mild hydrocarbon odour, moist, light olive.				
	becomes wet and trace silt at 3.8 m.				
4.0	some gravel at 4.3 m.				
	Clay (fill) - stiff, trace silt, trace sand, moist, olive. mild hydrocarbon odour at 4.6 m - 5.2 m				
5.0			J		
6.0	End of hole at 6.1 m. 51 mm diameter 4.6 m length 010 PVC screen. Aboveground lockable steel casing set in concrete.				
7.0					
8.0					
9.0					
10.0					
11.0					
12.0					

Well Details



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Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** VW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer Motors Site	**GROUND ELEVATION:** 874.194 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/26/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Soil Vapour Well is ~ 2 m east of MW-01, near the northwest corner of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Grass (~ 3 cm thick). Sand (fill) - compact, silty, clayey, damp, light olive brown.					
1.0	becomes dark olive and loamy at 0.8 m. Silt (fill) - firm, clayey, moist, dark olive.					
2.0	wood fragments at 2.3 m.					
3.0	mild hydrocarbon odour at 3 m. End of hole at 3.5 m. 25 mm diameter 30 cm length 020 PVC screen. Aboveground lockable steel casing set in concrete.					
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 3.5
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

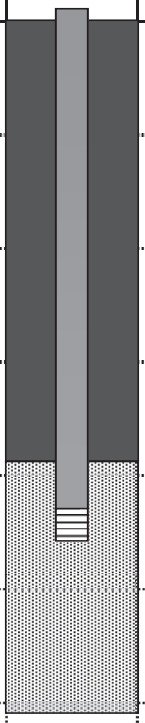
PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** VW-02
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer Motors Site	**GROUND ELEVATION:** 877.321 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/26/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Soil Vapour Well is located on the southeast side of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Grass (~ 3 cm thick).					
	Sand (fill) - loose, trace silt, trace loam, trace clay, damp, light olive brown.					
	trace rootlets to 1.2 m					
	trace plastic bags at 0.9 m to 1.1 m.					
1.0						
	Clay (fill) - stiff, silty, trace sand, moist, light olive.					
2.0						
	No obvious waste material.					
3.0	Sand (fill) - compact, silty, moist, light olive.					
	trace coal at 3 m.					
4.0	trace gravel at 4 m.					
	becomes loose at 4.6 m					
5.0	trace gravel and becomes wet at 5 m.					
6.0	End of hole at 6.1 m.					
	25 mm diameter 30 cm length 020 PVC screen.					
	Aboveground lockable steel casing set in concrete.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						



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Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** VW-03
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer Motors Site	**GROUND ELEVATION:** 877.316 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/27/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Soil Vapour Well is near the northeast corner of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
0.0	Grass. (~ 3 cm thick).							
	Clay (fill) - firm to stiff, silty, moist, olive.							
	trace plastic bags at 0.9 m.							
1.0								
2.0	trace coal at 2.1 m.							
	trace gravel at 2.6 m.							
3.0	No obvious waste material.							
4.0	becomes wet at 4 m.							
5.0								
6.0	Sand (fill) - loose, silty, wet, olive.							
7.0								
	End of hole at 7.6 m.							
	25 mm diameter 30 cm length 020 PVC screen.							
8.0	Flush mount lockable steel casing set in concrete.							
9.0								
10.0								
11.0								
12.0								

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Slough :	Completion Depth (m): 7.6
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

Borehole No: **VW-04**

Project: Red Deer Motors Vapour Probe Installation	Project No: SWM.SWOP04071-02.008
Location: Red Deer Motors	
Red Deer, Alberta	UTM: 307335 E; 5792605 N; Z 12

Depth (m)	Method	Soil Description	Notes and Comments	VW04	Depth (ft)
0					0
	Solid stem auger	TOPSOIL - organics, roots, dry, black			1
1		WASTE - sandy clay, some gravel, dry, wires, bags, plastic, glass, strong odour			2
					3
2					4
					5
					6
					7
					8
					9
3		CLAY - sandy, damp, brown and black			10
					11
					12
4		END OF BOREHOLE (4.0 metres) Vapour well installed to 2.4 metres			13
					14
					15
					16
5					

TETRA TECH

Contractor: CP Drilling	Completion Depth: 4 m
Equipment Type: Truck mounted	Start Date: 2021 May 4
Logged By: MR	Completion Date: 2021 May 4
Reviewed By: FH	Page 1 of 1