2023 Groundwater and Soil Vapour Monitoring Report
Red Deer College
Southeast Corner of Section 08-38-27 W4M

PRESENTED TO
City of Red Deer

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Tetra Tech Canada Inc.
Suite 110, 140 Quarry Park Blvd SE
Calgary, AB T2C 3G3 CANADA
Tel 403.203.3355 Fax 403.203.3301

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EXECUTIVE SUMMARY

The City of Red Deer (The City) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct the 2023 groundwater and vapour monitoring program at the former Red Deer College (RDC) landfill located near Red Deer Polytechnic[1], located at Lot 1 Block 1 Plan 012 0303 within the southeast corner of Section 08-38-27 W4M, hereafter 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 residential receptors from potential risks related to the presence of the historical landfill and to provide recommendations related to risk management activities at the site.

The groundwater monitoring network at the site consists of nine monitoring wells (MW-01 to MW-07, 21MW-08, and 21MW-09). Groundwater monitoring well MW-01 was damaged shortly after installation and is not part of the monitoring program, and 21MW-08 and 21MW-09 were installed in 2021. Monitoring wells 21MW-08 and 21MW-09 were installed as far east as practical, with consideration of underground utilities, immediately west of Taylor Drive. The vapour monitoring network consists of six vapour monitoring wells (VW-01 to VW-05 and 22VW-06). Vapour monitoring well 22VW-06 was installed in December 2022 along the north site boundary outside the waste footprint. Several other vapour and groundwater wells have been installed at the site by others but were not included in the monitoring program. Monitoring wells MW-03 to MW-06, 21MW-08, 21MW-09, and VW-05 are installed within the historical waste disposal area. Monitoring wells MW-01, MW-02, and MW-07 are screened within native materials. Monitoring wells MW-03 and MW-06 are screened below waste. MW-04 and MW-05 are mostly screened below the waste footprint; however, the borehole logs show that the top 10 cm to 20 cm of the screens are in waste. Newly installed monitoring wells 21MW-08 and 21MW-09 are screened within waste. Groundwater samples from monitoring wells MW-05, 21MW-08, and 21MW-09, and soil vapour samples from vapour wells VW-02, VW-03, and 22VW-06, were collected and analyzed in June 2023.

Tetra Tech's scope of work for the 2022 and 2023 monitoring and sampling program at the RDC site included installing an additional soil vapour probe (22VW06) on the north end of the site (outside of the waste footprint and approximately 60 m to 70 m northeast of VW-04), conducting vapour monitoring, conducting site walkovers, a surface emission survey, vapour sampling, groundwater and vapour headspace monitoring, groundwater sampling, surface water sampling, updating the hazard quotients, reviewing and updating previous recommendations for the site, and preparing an annual report.

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 elevations in 2023 indicated that the inferred groundwater flow direction was to the east-northeast, towards Waskasoo Creek, east of Taylor Drive. The average horizontal hydraulic gradient at the site in June 2023 was approximately 0.04 m/m, which is consistent with previous findings. Groundwater elevations in 2023 were stable or marginally increased at most monitoring wells compared to 2021, with the exception of MW-07 which increased by more than 1 m but was within historical ranges.
- Groundwater quality parameters that exceeded the Tier 1 Guidelines at one or more monitoring wells installed within the waste footprint in 2023 included: total dissolved solids (TDS), sodium, sulphate, chloride, ammonia, dissolved metals (arsenic, barium, cadmium, iron, manganese, and nickel), benzene, ethylbenzene, 1,2-dichlorobenzene, and vinyl chloride. The measured concentrations of one or more of these parameters, in addition to the presence of various volatile organic compounds (VOCs) with no established guideline values, suggest leachate has impacted the groundwater quality at MW-05, 21MW-08, and 21MW-09, all situated within the waste footprint. The measured concentrations of these parameters were generally consistent with previous results.

[1] Previously called Red Deer College.

- Surface water analytical results in 2022 along Waskasoo Creek suggest that the surface water quality for most parameters analyzed is similar upstream and downstream of the site. The surface water analytical results in 2022 suggest that the site is not impacting the surface water quality in Waskasoo Creek.
- Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons (PHCs), and VOCs were less than the soil vapour screening criteria in samples VW-02 and 22VW-06, situated southwest and north of the landfill footprint.
- VOCs cis 1,2-dichloroethene (DCE) and vinyl chloride exceeded the soil vapour screening criteria at VW-03, situated immediately adjacent to the waste footprint. Well headspace monitoring also identified methane at this location during the June 2023 event.
- The estimated individual and cumulative risks and hazards associated with the soil vapour samples collected in June 2023 did not exceed the corresponding target risk and hazard levels for samples VW-02 and 22VW-06; however, they exceeded at VW-03.
- A site walkover to survey for methane concentrations in June 2023 identified elevated concentrations up to 22% of the lower explosive limit (LEL) in surface cracks near Taylor Drive; however, above the surface, the readings were not detectable. Additionally, some settlement was noted during the site walkover, however, there is no reason to believe there is more settlement than previously noted or that there are any factors that would increase settlement, such as changes in site use, drainage, or groundwater levels.

Six of the eight groundwater monitoring wells at the site are located within the waste footprint, and either screened within (MW-04, MW-05, 21MW-08, and 21MW-09) or below (MW-03 and MW-06) the waste. Each of these six wells are identified above to contain leachate impacts, and in at least four wells, the measured liquids may represent leachate. Two of the five vapour wells (VW-03 and VW-05) exhibited landfill gas (LFG) impacts, as evidenced by elevated methane and VOCs; the greatest concentrations were measured at VW-05, located centrally in the waste mass, with lower (but elevated) concentrations noted at VW-03, located immediately adjacent to the waste mass at the northeast corner of the site. Elevated methane concentrations indicative of LFG were also measured in the headspace of monitoring wells 21MW-08 and 21MW-09 located along the eastern site perimeter. Elevated chloroform was noted at vapour well 22VW-06, which should be confirmed.

Based on the above, there is a strong correlation between observed impacts and the waste footprint. In the groundwater, the results indicate that impacts may be migrating off site in a hydraulically down-gradient direction (overall easterly towards Waskasoo Creek). However, the surface water results from upstream and downstream Waskasoo Creek in 2021 and 2022 do not suggest that leachate from the former landfill is affecting the water quality in the creek.

Previous soil vapour results from the two wells closest to the residences (VW-01 and VW-02) do not indicate impacts, and the measured concentrations were less than the target cumulative risks and hazard levels for residential land use. The vapours at VW-05 were collected from within the waste mass (and exceed the target risk and hazard levels) and confirm that LFG concentrations typical of a municipal landfill are present, including methane concentrations up to 21.5% in June 2023. The vapours at VW-03, at the northeast end of the site, are also indicative of LFG. This probe is situated immediately adjacent to the waste footprint and is bounded by a road intersection to the north and east. It Is an unlikely location for a building; however, the potential extents of LFG migration off site in this direction are not known. The methane gas concentrations measured to date at VW-03 have been considerably less than within the waste mass (e.g., at VW-05); however, they are still considered elevated. Additionally, elevated surface emissions of methane (up to 22% LEL) were measured in the vicinity of surface cracks along the eastern side of the site, albeit they were non-detectable above the surface.

Based upon the results of the groundwater and vapour monitoring program in 2023 and previous years, there are residual impacts to groundwater, LFG is present, and buried landfill waste remains in place beneath the site.

Furthermore, after drilling the two additional wells in 2021 (21MW-08 and 21MW-09), the limit of wastes and subsurface impacts appear to extend towards Taylor Drive. Drilling additional wells in the median of Taylor Drive may provide additional information; however, the added value of further assessments between existing wells and the creek is questionable. Waskasoo Creek is believed to be a receptor of any leachate impacted groundwater and should continue to be monitored. With respect to any migration of vapours, the depth to groundwater measured to date at the monitoring wells and the elevation of the creek bottom suggest the creek east and south of the site will act as a physical barrier. Monitoring in 2023 suggests surface emissions are occurring in the vicinity of surface cracks along the eastern side of the site; however, emissions were non-detectable in the air above the surface and are not considered to be an immediate threat to outdoor users of the area at this time. Surface emissions should continue to be monitored.

Ongoing risk management is recommended, including the following risk management elements.

Ongoing Monitoring

- Conduct annual groundwater elevation monitoring of all monitoring wells in the summer of 2024 to confirm the groundwater flow pattern.
- Conduct annual sampling in the summer of 2024 at down-gradient monitoring wells MW-05, 21MW-08, and 21MW-09 for routine groundwater chemistry parameters and dissolved metals, VOCs, BTEX, and PHCs to confirm previous concentrations and to monitor trends.
- Conduct annual surface water sampling in the summer of 2024 at upstream and downstream Waskasoo Creek for BTEX, PHC fractions F1 and F2, total metals, routine water chemistry, and VOCs.
- Conduct an additional year (winter 2024) of annual monitoring at VW-01 to 22VW-06 and sampling of the perimeter vapour probes VW-02, VW-03, and 22VW-06.
- Conduct an annual surface emissions survey in the summer of 2024, similar to that undertaken in 2021 and 2023 to further evaluate the nature and extent of emissions. This work should include more detailed (finer-grid) monitoring proximate to areas of greater emissions, and careful mapping of the locations with respect to cracking, holes, evidence of stressed vegetation and other potential observations. This would be followed by an evaluation of potential risk to outdoor users of the area and potential feasibility of, and requirements for mitigative measures.

Additional Assessment and Risk Management

- During the annual monitoring event conduct a site walkover to evaluate for potential erosion, cracking, and/or exposed waste.

Administrative Actions

- 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 The City policies.
- Ensure that the site is clearly identified within The City's utility mapping system. Elevated gas concentrations may be present in the subsurface proximate to the Taylor Drive and 32 Street ROWs. 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. It presently has a grass cover and the status of the cap should be reviewed 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. The recommended further assessment of the cover relative to surface emissions may determine additional requirements for the cover.

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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 the Appendix 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 2023 groundwater and vapour monitoring program at the former Red Deer College (RDC) landfill located near Red Deer Polytechnic[2] (RDP), located at Lot 1 Block 1 Plan 012 0303 within the southeast corner of Section 08-38-27 W4M, hereafter referred to as the site.

The scope of work for 2023 as 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 College (Tetra Tech 2022a). The City submitted the report to Alberta Environment and Protected Areas[3] (AEPA) and on December 21, 2023, AEPA provided a letter requesting additional information to which the City responded on January 26, 2024. On March 21, 2024 AEPA provided a second letter responding to the City's response. Section 1.2 provides a summary of AEPA's comments and the City's response. Copies of the correspondence with AEPA are provided in Appendix B.

The objectives of the monitoring program are to assess the environmental condition of the site and potential impacts on the environment and adjacent residential receptors from potential risks related to the presence of the historical landfill and to provide recommendations related to risk management activities at the site.

The field components of the monitoring program were completed under 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 the proposal titled 2022 and 2023 Work Scope and Cost Estimate dated October 21, 2022 (Tetra Tech 2022b). The work conducted in 2022 and 2023 included the following activities:

- Installing an additional soil vapour probe (22VW-06) on the north end of the site, outside of the waste footprint and approximately 60 m to 70 m northeast of VW-04.
- Conducting an annual vapour monitoring event, including measuring headspace vapours and groundwater levels within each vapour monitoring well, observing monitoring well integrity, and conducting a site walkover.
- Conducting a methane surface emission survey across the site.
- Conducting one annual groundwater monitoring event, 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 June 2023 consisting of:
  - Purging monitoring wells until practically dry or until a minimum of three well volumes had been removed and allowing the water levels in the wells to recover;

[2] Previously called Red Deer College.
[3] Formerly Alberta Environment and Parks (AEP).

  - Measuring field parameters (pH, electrical conductivity [EC], and water temperature) at the time of sampling;
  - Collecting groundwater samples from three wells (MW-05, 21MW-08, and 21MW-09) and submitting the samples for laboratory chemical analyses; and
  - Collecting one duplicate groundwater sample for quality assurance/quality control (QA/QC) purposes.
- Conducting an annual surface water sampling event in November 2022 consisting of:
  - Collecting surface water samples from Waskasoo Creek upstream (SW-02) and adjacent/downstream (SW-01) of the site and submitting the samples for laboratory chemical analyses; and
  - Measuring field parameters (pH, EC, and water temperature) at the time of sampling.
- Conducting one vapour sampling event in June 2023 consisting of:
  - Collecting vapour samples into Summa canisters for analysis; and
  - Collecting one duplicate vapour sample for QA/QC purposes.
- Conducting monitoring well repairs, as required.
- Updating the hazard quotients prepared during previous reports using the 2023 monitoring and sampling results.
- Preparing an annual report summarizing the field activities undertaken for the year and interpreting the groundwater, surface water, and soil vapour analytical results.

1.2 Alberta Environment and Protected Areas Review of 2021 Report

The AEPA review letter of the 2021 groundwater and soil vapour monitoring report (Tetra Tech 2020) for the RDC site provided two comments, which are provide below in *italized* font. The response to each comment is provided below and have also been incorporated into the report. A copy of the letter from AEPA and subsequent correspondence areprovided as Appendix B.

1. *AEPA has concerns with regards to the elevated concentrations of methane near VW-05 and along the surface cracks observed at Taylor Drive. As noted in the report concentrations measured are above the lower explosive limit for methane and the landfill gas explosive limits as described in the Standards for Landfills (EPA 2010) Section 5.12. Please provide comment on what exposure control mechanisms are currently being enacted or will be implemented to prevent adverse effect from landfill gas exposure*.

   Monitoring location VW-05 is a vapour probe that was installed as part of the Phase II Environmental Site Assessment completed at this site in 2013. It was installed within the waste with the intention of providing data on the profile of the historic waste material. Closed landfills like the Red Deer College site generate methane gas and will continue to do so for decades after closure as the waste slowly decomposes. As VW-05 is installed within the waste, methane gas concentrations in the order of magnitude that have been measured at VW-05 are expected.

   The Red Deer College site accepted household waste for disposal between July 1970 and December 1972, and to the best of our knowledge, the waste area is capped with topsoil resting on top of fill material comprised of sand, silt and clay which overlays and in some areas is mixed with the waste. With the natural settlement of the waste over time, it is not unexpected to for areas within the waste footprint to display surface cracking or

areas of stressed vegetation. The area along the eastern slope of the waste which borders Taylor Drive was identified to be displaying vegetative stress and have some visible surface cracking. In response to this, the City's consultant has completed several rounds of surface emissions testing to evaluate the risk from methane concentrations across the waste area. While elevated methane gas concentrations were measured within the surface cracks observed along the eastern slope of the site adjacent to Taylor Drive, the concentrations were non-detect when the gas meter was held at the ground surface immediately above the cracks.

As recommended in the 2021 Groundwater and Soil Vapour Monitoring Report, the City's consultant completed additional surface emissions surveys as part of the 2022/2023 monitoring and mapped the locations with surface cracking and evidence of stressed vegetation to further evaluate potential risk to outdoor users of the area. Findings will be discussed in the 2023 Monitoring Report, along with the consultant's recommendations for possible mitigative measures. However, based on the current data, the potential risk to the environment and safety of outdoor users associated with any vapour emissions from the waste area appear to be low..

2. *Given the updates in regulatory guidelines and additional soil, groundwater and soil vapour data acquired at the site since 2014, AEPA recommends development of an updated risk management plan (RMP) for the site. Please refer to the 2017 Alberta Risk Management Plan Guide, the 2022 Alberta Tier 1 Soil and Groundwater Remediation Guidelines, and the 2022 Alberta Tier 2 Soil and Groundwater Remediation Guidelines when developing the updated RMP.*

   The original Environmental Risk Management Plan (ERMP) completed in 2014 recommended reviewing and updating the ERMP every 5 years, based on aligning with timelines that standards and codes from regulatory agencies are generally updated. The 2021 Groundwater and Soil Vapour Monitoring Report also recommends additional assessment and risk management. The City is planning to address the recommendations from these reports, and is considering the strategy we will use to accomplish this. The current contract for the investigative work at The City's historic landfill sites has expired and once the final deliverables have been received for the 2022/2023 monitoring, the City will be scoping the next phase of the project. Timelines will be refined based on the recommendations in the 2022/2023 monitoring reports, and the procurement process to hire a consultant to conduct the next phase on the project. Once these timelines are firmed up, The City will be happy to provide EPA with a further update.

2.0 BACKGROUND INFORMATION

2.1 General Information

The site is located within the southeast portion of Section 08-38-27 W4M, at Lot 1 Block 1 Plan 0120303. The site is zoned PS – Public Service (Institutional and Government) District and is located on the east side of the RDP campus. The site is located at the southwest corner of Taylor Drive and 32 Street. Waskasoo Creek flows to the south of the site in an easterly direction, then flows north along the east side of Taylor Drive. The Red Deer River is approximately 1.7 km north of the site. A site location plan is shown on Figure 1. The area around the site has been developed, and includes RDP buildings, student residences, a running track, sports fields, walking paths, and paved and unpaved parking surfaces. These developments are outside (south and west) of the interpreted former waste disposal area, except for a portion of a paved surface parking lot. The surrounding land use consists of Environmental Preservation District, Residential (Low Density) District, and Commercial (Major Arterial) District. A residential subdivision is located northwest of the site. Natural areas at the site consist of grasses and trees. Figure 2 shows the general site plan and surrounding land use. Additional information on the site history, historical groundwater monitoring investigations, geology, and hydrogeology can be found in Appendix C. Cross-sections

that were prepared using the wells previously installed at the site in 2013 are included in Appendix D (from Tiamat Environmental Consultants Ltd. [Tiamat] 2014a).

2.2 2023 Conceptual Site Model Summary

The selection of comparative guidelines is based on the 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 Guidelines (AEP 2022a). The CSM that was developed for the site 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 table, below.

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.
		Groundwater ingestion (drinking water); migration to Waskasoo Creek via groundwater.	Domestic use aquifer (DUA) drinking water; freshwater aquatic life (FAL) in Waskasoo Creek.
		Nutrient and Energy Cycling	Microbial functioning of the soil.
LFG emissions.	VOCs, methane, benzene, toluene, ethylbenzene, and xylenes (BTEX) and PHC fractions, and siloxanes.	Vapour inhalation.	Human users of the parkland; inhabitants of buildings near the parkland; workers in excavations.

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 and inhalation pathways. The ecological receptor exposures applicable to the site include direct soil contact, FAL, 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.

As recommended by AEPA, the soil vapour results obtained during the 2019 investigation (Tetra Tech 2020) were compared to the 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). To determine the appropriate guidelines to compare the vapour sampling results to, indoor air risk calculations and methane explosive risks were calculated.

The CSM determined that the most applicable guidelines for groundwater and vapour results for the site were as follows:

- Groundwater concentrations at the site were compared to the Tier 1 Guidelines under residential land uses for coarse-grained soils (AEP 2022a).
- The surface water analytical results in 2022 were compared to the AEP Environmental Quality Guidelines for Alberta Surface Waters (SWQGs; Government of Alberta 2018) for the most conservative values (chronic or acute) for the protection of FAL.
- Soil vapour analytical results were compared to soil vapour screening criteria developed from A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours under residential land use for both slab-on-grade and basement for coarse-grained soils (CCME 2014). Soil vapour screening criteria have been updated using current toxicity reference values (TRVs) from Health Canada and the United States Environmental Protection Agency (USEPA).

2.3 Monitoring Well Network

The groundwater monitoring network at the site consists of nine monitoring wells (MW-01 toMW-07, 21MW-08, and 21MW-09). Monitoring wells 21MW-08 and 21MW-09 were installed in 2021. Monitoring well MW-01 was damaged shortly after installation and is not part of the monitoring program. Monitoring well completion details are summarized in Table 1. The monitoring wells were reported to be in good condition in 2023.

Surface water locations along Waskasoo Creek were chosen upstream (SW-02) and adjacent/downstream (SW-01) of the site and were sampled for the first time in 2021.

The vapour monitoring network consists of six vapour monitoring wells (VW-01 to VW-05 and 22VW-06). Most soil vapour wells were noted to be in good condition during the monitoring event in June 2023.

Several other vapour and groundwater wells have been installed at the site but were not included in the monitoring program. Monitoring wells MW-03 to MW-06, 21MW-08, and 21MW-09, and VW-05 are installed within the historical waste disposal area.

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

3.0 MONITORING AND SAMPLING PROGRAM

A discussion of the methods used for the fieldwork, laboratory testing, and data evaluation is presented in the following sections.

3.1 Groundwater Monitoring and Sampling Program

A discussion of the methods used for groundwater monitoring and sampling fieldwork and laboratory testing is presented in the following section. In 2023, Tetra Tech conducted groundwater monitoring on June 1 and groundwater sampling was conducted on June 2.

Monitoring at the groundwater monitoring wells (51 mm diameter) consisted of measuring methane in the monitoring well headspace, and static groundwater levels in each monitoring well.

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) and evaluating the water level relative to the screen to confirm the screen was not blinded.
- 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-05, 21MW-08, and 21MW-09) and placed into appropriate laboratory supplied, sterile glass and plastic vials and bottles for the required analytical package. If required, samples were filtered and/or preserved in the field.
- Field measurements were taken for pH, EC, and temperature at the time of sampling.
- Samples were submitted in coolers with ice to ALS Laboratory Group (ALS) in Calgary, Alberta for laboratory analysis under chain-of-custody (COC) documentation.

More information on the analytical program is provided in Section 3.1.1. The groundwater monitoring well locations are shown on Figure 2.

3.1.1 Analytical Program

The analytical program for the groundwater monitoring wells is summarized below:

- Routine water chemistry and dissolved metals.
- Ammonia.
- BTEX and PHC fractions F1 to F2.
- VOCs.

3.2 Surface Water Sampling Program

A discussion of the methods used for the surface water sampling fieldwork and laboratory testing is presented in the following section. Tetra Tech conducted surface water sampling on November 10, 2022 at Waskasoo Creek.

3.2.1 Surface Water Sampling Methodology

Surface water sampling consisted of sampling two surface water locations on Waskasoo Creek upstream (SW-02) and downstream (SW-01) of the site.

The methodology for surface water sampling included the following:

- Observing the flow and water level of Waskasoo Creek prior to sampling.
- Surface water samples were collected midstream by submerging the sampling bottle halfway between the water surface and the bottom of the creek bed, with the mouth of the bottle facing upstream.
- Surface water samples were collected from two sampling locations (SW-01 and SW-02). 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 in Calgary, Alberta for laboratory analysis under COC documentation.

3.2.2 Surface Water Analytical Program

The analytical program for the surface water sampling locations is summarized below:

- Routine water chemistry.
- Ammonia.
- Total metals.
- BTEX and PHC fractions F1 and F2.
- VOCs.

3.3 Vapour Well Installation

On December 5, 2022, a new vapour well (22VW-06) was installed using a tracked drill rig and solid stem augers along the north site boundary outside the waste footprint and approximately 60 m northeast of VW-04. While drilling the vapour well, no waste was encountered to the maximum depth drilled of 3.0 m below grade (mbg). The vapour well was installed with 19 mm diameter polyvinyl chloride (PVC) pipe to a depth of 2.5 mbg and screened with 19 mm slotted PVC pipe from 1.5 mbg to 2.5 mbg. Free water was not observed in the borehole during the installation of the vapour well; materials were noted as damp to a depth of 3.0 mbg. The borehole log for 22VW-06 is attached in Appendix E.

3.4 Vapour Monitoring and Sampling Program

A discussion of the methods used for the soil vapour program is presented in the following sections. Tetra Tech conducted vapour monitoring and sampling on June 1, 2023.

3.4.1 Field Program

Monitoring at the six vapour monitoring probes (25 mm diameter) consisted of measuring and recording soil gas pressure, composition (methane, carbon dioxide, oxygen, hydrogen sulphide, and balance) on a percent volumetric basis and groundwater elevation.

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 was recorded, the

soil gas probe was purged of three well volumes of air, or until readings stabilized. The soil vapour probes were purged directly with a CES-Landtec GEM 5000 (GEM) LFG analyzer.

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

In June 2023, measurements of surface emissions were made within the historical waste disposal area to assess the cover and possible surface vapour emissions. The site was walked over from north to south in lines approximately 20 m from each other and methane surface emissions were recorded along these lines near surface using an RKI Eagle calibrated for methane. At select locations where cracks or holes in the surface cover were noted, additional measurements were taken. At the time of measuring surface emissions, field staff also made observations to see whether there were any obvious changes to the surface, or issues like large cracks or exposed waste. This work was initiated after RDP staff had raised concerns about settlement around the RDC site. Specifics of the observations are included in Section 4.2.

A leak detection test was completed prior to probe sampling to ensure the vapour probes were 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 probes (VW-02, VW-03, and 22VW-06) was based on the methodology of the CCME sampling guidelines, which are 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.
- 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 with a COC form.
- The soil vapour probe sampling port was returned to the closed position and the well was securely locked.

The vapour samples were transferred to ALS for chemical analysis. A duplicate sample was collected from VW-03 during the vapour sampling event for QA/QC purposes.

The vapour monitoring well locations are shown on Figure 2.

3.4.2 Vapour Well Analytical Program

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

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

4.0 RESULTS AND DISCUSSION

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

4.1 Well Headspace Monitoring

Tetra Tech monitored eight groundwater monitoring wells (MW-02, MW-03, MW-04, MW-05, MW-06, MW-07, 21MW-08, and 21MW-09) in June 2023 for measurements of methane in well headspace using an RKI Eagle, calibrated to methane. 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.

Groundwater monitoring wells MW-02, MW-03, MW-05, and MW-06 were blinded (water level above screen) and the headspace vapour measurements may not be representative for in situ soil vapours. Hydraulically up-gradient monitoring well MW-07 and down-gradient monitoring wells MW-04, 21MW-08, and 21MW-09 were not blinded during the 2023 monitoring event. This is consistent with previous monitoring events conducted at the site.

During the June 2023 monitoring event, methane headspace concentrations at the groundwater wells ranged below the instrument detection limit at down-gradient well MW-04 to 37% LEL at 21MW-09 (screened within waste). Concentrations at all wells were within or less than historical readings. Monitoring at the soil vapour probes is described in Section 4.7.

The methane headspace concentrations at the groundwater monitoring wells are presented in Table 1.

4.2 Surface Emissions Survey

On June 1, 2023, Tetra Tech conducted a surface emissions survey using an RKI Eagle calibrated for methane. During the surface emissions survey, concentrations measured ranged from below the instrument's detection limit at most locations to a maximum of 22% LEL in a crack located east of MW-04 near Taylor Drive. However, it was noted that immediately above the cracks, at surface, readings decreased to below the detection limit. The highest surface emission methane concentrations measured on site were near Taylor Drive. Some lower detections (up to 60 ppm) were measured at various other locations within the limits of waste on site. The approximate area of the highest methane concentrations measured on site in September 2021 and June 2023 is outlined on Figure 2.

Observations made during the walkover related to any obvious changes to the surface, or issues like large cracks or exposed waste as described in Section 3.4.1., were that some settlement was noted in various locations on the site. Although changes in settlement could not be quantified, there is currently no reason to believe that there is more settlement than previously noted, or that there are any factors that would increase settlement, such as changes in site use, drainage, or groundwater levels.

4.3 Groundwater Elevations

The measured groundwater levels and calculated groundwater elevations for 2023 are presented in Table 1.

During the groundwater monitoring event in 2023, a measurable thickness of NAPL was not detected at any locations. Figure 3 presents the groundwater elevation trends (hydrographs) for the groundwater monitoring wells. Groundwater elevations at most wells have been generally stable since 2019, excluding MW-07, where the elevation increased by approximately 1.2 m between November 2021 and June 2023 but remained within the historical range. MW-07 is located near the northwest corner of the site, in an inferred up-gradient location.

The average depth to groundwater in June 2023 was 3.68 mbg. The groundwater elevations and interpreted elevation contours for June 2023 are shown on Figure 4. The groundwater elevation contours infer a direction of groundwater flow to the east/northeast towards Waskasoo Creek. The groundwater elevation contours are consistent with the historical results.

The average horizontal gradient in June 2023 was approximately 0.04 m/m and consistent with previous results.

4.4 Groundwater Field Parameters

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

Groundwater temperatures were 8.2°C (MW-05 and 21MW-08) and 9.9°C (21MW-09).

Field pH values were 8.01 (MW-05) and 8.05 (21MW-08 and 21MW-09) in June 2023. Field pH measurements were higher than the 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 June 2023, field EC measurements ranged from 1,323 µS/cm (MW-05) to 3,750 µS/cm (21MW-09). Field EC results were similar to the laboratory measured EC results at all monitoring wells.

4.5 Groundwater Analytical Results

The groundwater analytical data for 2023 is summarized in Table 2. The 2023 laboratory analytical reports are included in Appendix F and the historical tables are included in Appendix G.

4.5.1 Background Groundwater Characteristics

MW-07 is located to the northwest of the historical waste disposal area and was identified as an up-gradient well in the Phase II ESA (Tiamat 2014a). MW-07 was last sampled in 2019 and 2021 and contained concentrations of total dissolved solids (TDS) greater than the Tier 1 Guidelines. Concentrations of dissolved iron, dissolved manganese, and dissolved uranium were greater than the Tier 1 Guidelines in 2021; concentrations of dissolved iron and manganese increased in 2021 from the results in 2019. Along with an ammonia concentration of 0.329 mg-N/L and no nitrate, these results suggest that the inferred redox condition of the groundwater at this location is anoxic.

Monitoring well MW-02 is located to the southwest of the historical waste disposal area and is also considered up-gradient. The groundwater at MW-02 resembles the characteristics at MW-07 and has an even lower chloride concentration (both less than 10 mg/L), low ammonia concentrations, and only trace concentrations of dissolved manganese. Nitrate marginally exceeded the referenced Tier 1 Guideline; the nitrate concentration is interpreted to

be natural, and not related to historical landfill activities. The inferred oxic redox condition of the groundwater at this location is oxic.

These locations were not sampled in 2023.

4.5.2 Routine Water Chemistry Parameters

TDS and sodium concentrations at MW-05, 21MW-08, and 21MW-09 in 2023 were greater than the Tier 1 Guidelines (500 mg/L and 200 mg/L, respectively). TDS concentrations ranged from 881 mg/L (MW-05) to 2,650 mg/L
(21MW-09). Sodium concentrations ranged from 233 mg/L (21MW-08) to 398 mg/L (21MW-09). The 2023 TDS and sodium concentrations were similar to previous results.

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 at 21MW-08 (322 mg/L) and 21MW-09 (482 mg/L) were greater than the referenced guideline (120 mg/L) in 2023. The chloride concentration at 21MW-08 increased slightly compared to 2021 and the concentration decreased slightly at 21MW-09. The chloride concentration at MW-05 was much lower at 5.61 mg/L and similar to previous concentrations measured at this location.

Ammonia concentrations were greater than the Tier 1 Guidelines at all three monitoring wells sampled in 2023 with concentrations ranging from 4.68 mg-N/L at MW-05 to 46.5 mg-N/L at 21MW-08. Elevated ammonia concentrations suggest groundwater quality impact by municipal solid waste (MSW) landfill leachate. Conversely, nitrate concentrations at these wells were less than the analytical detection limit. The absence of nitrate when ammonia is elevated is often an indication of anoxic groundwater conditions and leachate impact.

The monitoring well with the highest ammonia concentrations (21MW-08) exhibited the lowest sulphate concentrations. This is expected to be an indication of deep anoxic (sulphate reducing) redox conditions, which are often observed in leachate impacted groundwater, and imply methanogenic conditions.

4.5.3 Dissolved Metals

Concentrations of dissolved arsenic were greater than the Tier 1 Guideline (0.005 mg/L) at all monitoring wells sampled in 2023. 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 arsenic exceedances are likely related to the presence of dissolved iron and anoxic conditions due to leachate impacts.

The concentration of dissolved barium at 21MW-08 (1.23 mg/L) was greater than the Tier 1 Guideline (1 mg/L) and similar to the concentration measured in 2021 (1.01 mg/L). The elevated barium concentration is likely related to the low sulphate concentrations at this well, which increases the dissolution of barium.

The dissolved cadmium concentration at 21MW-09 (0.0000950 mg/L) was greater than the Tier 1 Guideline; however, it was an order of magnitude lower than the 2021 measured concentration (0.000179 mg/L). Cadmium may be co-precipitated with manganese oxide or adsorbed onto mineral surfaces (Hem 1992). Manganese concentrations at 21MW-09 are notably higher than concentrations at the other wells located at the site and are interpreted to be caused by suboxic groundwater conditions. Therefore, the cadmium exceedance at 21MW-09 may be due to the dissolution of manganese, which can cause cadmium to become mobile, and the measured concentrations are not necessarily related to former landfill.

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 manganese and iron concentrations were greater than the Tier 1 Guidelines at all monitoring wells during the sampling event in 2023.

Concentrations of dissolved nickel were greater than the Tier 1 Guideline at 21MW-08 and 21MW-09 in June 2023 and similar to previously measured concentrations at these locations. Nickel is often present in elevated concentrations in MSW leachate (ASTDR 2005).

4.5.4 Organic Parameters

The benzene (0.0424 mg/L) and ethylbenzene (0.00646 mg/L) concentrations were greater than the Tier 1 Guidelines (0.005 mg/L and 0.0016 mg/L, respectively) at 21MW-08 in June 2023. Monitoring well 21MW-09 had detectable concentrations of benzene, toluene, and PHC fraction F2; however, concentrations did not exceed the guidelines.

The PHC fraction F2 concentration at MW-05 (1.39 mg/L) greater than the Tier 1 Guideline (1.1 mg/L) was the first exceedance for this parameter and should be confirmed during future monitoring events. All other BTEX and PHC fraction F1 and F2 concentrations were consistent with previous results.

The 1,2-dichlorobenzene concentration (0.00104 mg/L) at 21MW-08 was greater than the Tier 1 Guidelines (0.0007 mg/L) and similar to the 2021 concentration (0.00112 mg/L). Vinyl chloride concentrations were greater than Tier 1 Guideline (0.0011 mg/L) at monitoring wells 21MW-08 (0.0209 mg/L) and 21MW-09 (0.0782 mg/L). The 2023 vinyl chloride concentration at 21MW-08 was similar to 2021 (0.0194 mg/L) and the concentration at 21MW-09 increased notably compared to 2021 (0.0077 mg/L).

Detectable concentrations of one or more other (chlorinated) VOCs with concentrations less than the Tier 1 Guidelines or for which Tier 1 Guidelines have not been established were also detected at 21MW-08 and 21MW-09 (e.g., chloroethane, 1,2,4-trimethylbenzene, 1,2-dichloroethane, cis-1,2-dichloroethene [cis-1,2-DCE], trans-1,2-dichloroethene [trans-1,2-DCE], 1,3,5-trimethylbenzene, dichlorodifluoromethane, and methylene chloride). Such compounds are commonly present in MSW leachate.

There were no detectable VOC concentrations at down-gradient monitoring well MW-05 in June 2023.

VOC concentrations measured in 2023 were consistent with the concentrations measured in 2019 and 2021.

4.6 Surface Water Analytical Results

The surface water analytical data for 2022 is summarized in Table 3. The 2022 laboratory analytical reports are included in Appendix F.

In 2022, chloride concentrations at the downstream (SW-01) and upstream (SW-02) surface water locations were greater than the SWQG of 120 mg/L (139 mg/L and 136 mg/L at SW-01 and SW-02, respectively) and concentrations were slightly higher than those measured in 2021. It is not uncommon to have elevated chloride concentrations in an urban setting due to the use of road salt and other anthropogenic sources; because the upstream and downstream locations have similar chloride concentrations during both monitoring events, the elevated concentrations are not interpreted to be from leachate impacts.

Concentrations of the leachate indicator parameters nitrate and ammonia were less than the respective guidelines at SW-01 and SW-02 in November 2022.

Total iron and manganese concentrations were greater than the guidelines at both surface water sampling locations in November 2022. The iron concentration at the downstream location (SW-01) increased while the manganese concentration at SW-01 and the iron and manganese concentrations at the upstream location (SW-02) were similar to the 2021 results. The total aluminum concentration at SW-02 was also greater than the guideline and similar to the 2021 concentration. Total metals concentrations may be elevated by suspended sediment in the sample and the results do not necessarily reflect impact from the site.

In 2022, BTEX, PHC fractions F1 and F2, and VOCs were less than the analytical detection limits at both surface water locations and consistent with the 2021 results.

Surface water analytical results for samples collected from upstream and downstream of Waskasoo Creek in 2021 and 2022 do not suggest that leachate from the former landfill is adversely affecting the water quality in the creek as the water quality upstream and downstream of the site is very similar.

4.7 Soil Vapour Monitoring Results

The 2023 and historical soil vapour monitoring results are presented in Table 5.

During the June 2023 monitoring event, all vapour wells were able to be monitored except VW-01, which was blinded.

Methane concentrations (measured using the GEM) at vapour wells were below the instrument detection limit at VW-02, VW-04, and 22VW-06. The methane concentration at VW-03 was 2% and at VW-05 was 21.5%. VW-05 is completed within waste. Methane concentrations in 2023 were consistent with previous results.

Wellhead pressures at most vapour wells were negligible during the monitoring event in 2023, with the exception of VW-01 (0.8 mmHg), which was noted to be blinded by water. Carbon monoxide was detected at VW-03 (1 ppm) and VW-05 (77.0 ppm), which is consistent with previous results. Concentrations of carbon dioxide, oxygen, and the balance gas in June 2023 were generally consistent with previous monitoring results.

4.8 Soil Vapour Analytical Results

Table 6 summarizes the soil vapour chemical results collected for 2023 and compares them to the soil vapour screening criteria protective of vapour intrusion into indoor air. The 2023 laboratory analytical reports are included in Appendix F. Soil vapour samples were collected at VW-02, VW-03, and 22VW-06 in June 2023.

BTEX and PHC fractions F1 and F2 (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use for coarse-grained soil. Soil vapour concentrations at the three locations in June 2023 were between 4 and 10,000 times less than the soil vapour screening criteria, which are protective of vapour intrusion into indoor air.

VOCs (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use, coarse-grained soil. At VW-03, adjacent to the northern boundary of the waste area, cis-1,2-DCE and vinyl chloride were detected at concentrations exceeding the soil vapour screening criteria. The measured concentrations in June 2023 were less than the concentrations of these parameters measured in December 2019 and November 2021.

Several other VOC parameters were detected at low concentrations in the samples collected from VW-02, VW-03, and 22VW-06 in June 2023. However, soil vapour concentrations for these detectable parameters (excluding chloroform) were between 9 and 135,000 times less than the soil vapour screening criteria, which are protective of

vapour intrusion into indoor air. The chloroform concentration at 22VW-06 exceeded the soil vapour screening criteria and should be confirmed in 2024.

Methane concentrations in the gas samples were similar to the field measured values: both were non detect at VW-02 and 22VW-06; and 3.4% at VW-03 compared to the field measured value of 2%.

4.9 Quality Assurance/Quality Control

4.9.1 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 duplicate groundwater and vapour samples and submitting them to ALS for analyses; and
- Documenting field procedures and sampling activities.

4.9.2 Results

The groundwater and soil vapour QA/QC results are included in Table 4 and Table 7, respectively. The duplicate samples were submitted for analysis of the same parameters as the original samples.

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.

For the groundwater duplicate at MW-05 in June 2023, RPDs were less than 20% for most of the reportable concentrations, with the exception of ammonia. Based on the QA/QC results, the sample methods and results are overall considered acceptable.

For the vapour well duplicate sample at VW-03 in June 2023, RPDs were less than 20% for all of the reportable concentrations indicating the sample methods and results are acceptable.

5.0 UPDATED HAZARD QUOTIENT CALCULATIONS

Using the soil vapour screening levels and calculations described in the 2021 Groundwater and Soil Vapour Monitoring Report (Tetra Tech 2022a) and summarized in Section 4.0 of Appendix C, the soil vapour sampling results, estimated cancer risks (for carcinogens) and estimated hazard quotients (for non-carcinogens) were calculated for the site.

For this evaluation, cumulative target risk and hazard levels were determined in accordance with Alberta Tier 2 Guidelines (AEP 2022b). For carcinogens, the target risk level is 1×10^{-5}, as this value is considered by Health Canada to represent a negligible risk. This risk level applies to both individual compounds and a summation (i.e., cumulative) of individual compounds risks. For non-carcinogens a cumulative target hazard level of 1.0 is used as potential exposures that result in cumulative hazard indices equal to or less than 1.0 signify negligible potential for adverse health effects. For individual compounds, a hazard index of 0.2 was used. Each sampling location was screened individually for every chemical detected, and the results evaluated relative to both individual and cumulative risks and hazard levels. We note that for some compounds, both carcinogenic and non-carcinogenic effects require calculation.

The cumulative risk levels for carcinogens in samples from VW-02 and 22VW-06 were 1.2×10^{-6} and 9.4×10^{-6}, respectively, which is lower than the target risk level of 1.0×10^{-5}. The cumulative risk level for carcinogens in sample VW-03 was 5.8×10^{-4}, which is greater than the target risk level of 1.0×10^{-5}. This risk was due to vinyl chloride at a concentration of 4,010 µg/m^3, which is similar to previous results. At 22VW-06, the greatest risk level was for chloroform (although lower than the target risk) and this result should be confirmed in 2024. Table 8 summarizes the properties of the compounds being assessed. Table 9 summarizes the soil properties used for the calculations. Table 10 summarizes the building properties used for the calculations and Table 11 presents the generic soil vapour criteria calculated.

The cumulative hazard levels identified in samples VW-02 and 22VW-06 collected for the non-carcinogens were 0.007 and 0.035, respectively. The cumulative hazard level identified in sample VW-03 collected for the non-carcinogens was 9.7, which is greater than the target hazard level of 1.0. This hazard was due to cis-1,2-DCE with an individual hazard of 8.3 and vinyl chloride with an individual hazard of 1.3. These results are similar to previous results.

As shown in Table 12, the estimated individual and cumulative risks and hazards associated with soil vapour samples VW-02 and 22VW-06 collected in June 2023 did not exceed the corresponding target risk and hazard levels. The estimated individual and cumulative risks and hazards associated with soil vapour sample VW-03 indicate a potential risk from vapour intrusion to indoor air. Soil vapour well VW-03 is located in the northeast corner of the site and is bounded by roads on the north and east. It is approximately 230 m from the nearest residential building and approximately 170 m from the nearest commercial building; however, utility corridors are present along the road rights-of-way (ROWs), which could be a preferential pathway for the soil vapour. It is expected that the distance to buildings would decrease the soil vapour concentrations at the point of potential exposure from VW-03. The vapour concentrations in these wells should continue to be assessed for potential trends and to evaluate hazards.

Localized surface emissions of methane up to 22% LEL were also measured. The aerial extent of these emissions has not been fully assessed; however, measurements to date suggest they are in an area on the eastern site perimeter in the vicinity of surface cracking (Figure 2) and concentrations above the ground surface were confirmed to be at ambient levels. It is expected that some of the compounds for which risks from vapour intrusion to indoor air are calculated are also present where these surface emissions are measured. The extent to which LFG is being released through the landfill cover should be further assessed with repeated, more detailed (finer-grid) monitoring proximate to areas of greater emissions, and careful mapping of the locations with respect to cracking, holes, evidence of stressed vegetation and other potential observations. This would be followed by an evaluation of potential risk to outdoor users of the area and potential feasibility of, and requirements for mitigative measures.

6.0 EVALUATION OF SITE CONDITIONS

6.1 Summary of Site Conditions

Based on the 2022 and 2023 monitoring program and historical data for the site, there are concerns related to the presence of the historical RDC landfill. 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. From the current and historical results, the inferred migration of groundwater would be towards Waskasoo Creek. However, the surface water results from upstream and downstream Waskasoo Creek in 2022 do not suggest that leachate from the former landfill is affecting the water quality in the creek.

Soil vapour monitoring and sampling has identified elevated methane and several VOCs including vinyl chloride and cis-1,2-DCE. These elevated concentrations are most notable at the location installed within the waste mass (VW-05) and the vapour well to the north of the site (VW-03). These results are consistent with previous results.

The vapour monitoring has identified elevated methane and VOCs in the area of the landfill footprint. There is a potential for lateral migration of vapours at the site and emissions at the surface. The results indicate that methane concentrations at the two southerly wells near the adjacent residences (VW-01 and VW-02) were less than the instrument detection limit during monitoring in 2021. We note that Waskasoo Creek east and south of the site is likely to act as a physical barrier to gas migration in that direction based on groundwater elevations and the elevation of the creek bottom. When taking into consideration that Waskaoo Creek is likely to act as a physical barrier to the east and south of the site and the low VOC and methane concentrations at VW-01 (southwest) and VW-02 (southeast), the apparent risks of vapour migration to the south and east of the site are considered low. The methane concentration at the new well to the north (22VW-06) was also less than the instrument detection limit; however, detectable chloroform was measured; while at concentrations below target risk levels and generic criteria, this concentration should be confirmed in 2024.

During the 2021 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. Cracks in the grass and dead grass were observed on the east side of the site along Taylor Drive. Measurements of surface emissions were conducted in June 2023, which identified elevated methane concentrations (up 22% LEL) in surface cracks near Taylor Drive. Concentrations in the air above the surface were not detectable. Limited data is currently available and further investigative work is warranted to determine the nature and extent of the measured LFG emissions and whether it is feasible or necessary to implement mitigative measures. Additionally, some settlement was noted during the site walkover, however, there is no reason to believe there is more settlement than previously

noted or that there are any factors that would increase settlement, such as changes in site use, drainage, or groundwater levels.

Based upon the results of the groundwater and vapour monitoring program in 2023 and previous years, there are residual impacts to groundwater, soil vapours present, and buried landfill waste remains in place beneath the site. Furthermore, after drilling the two additional wells in 2021 (21MW-08 and 21MW-09), the limit of wastes and subsurface impacts extend towards Taylor Drive. Drilling additional wells in the median of Taylor Drive may provide additional information; however, the added value of further assessments between existing wells and the creek is questionable. Waskasoo Creek is believed to be a receptor of any leachate impacted groundwater and should continue to be monitored. Vapour monitoring should also be continued, as discussed further below.

6.2 Summary of Hazard Quotient Results

A summary of the hazard quotients from the 2014 RMP for the site that was completed by Tiamat (Tiamat 2014b) is attached in Appendix C.

For consistency with XCG Consulting Limited's (XCG's) approach (XCG 2018), we compared individual hazard quotients with the individual target hazard level (0.2). Based on the 2023 program, the greatest individual hazard quotient calculated for the site was 8.3 (vs target hazard level of 0.2), the greatest cumulative hazard quotient was 9.3 (vs target hazard level of 1.0), and the greatest estimated cancer risk was 5.8×10^{-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 2023 vapour data, passive Level C measures (passive sub-slap depressurization system with a minimum depressurization of 4 Pa to 10 Pa) would be required for development within the setback area (the 2019 data indicated active Level E measures). We note that these hazard quotients and risks are based on samples collected from VW-03 (immediately northeast of landfill footprint) and VW-05 (situated within the landfill footprint and an indicator of source concentrations). We also note that this approach does not consider methane concentrations.

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 soil vapour monitoring and sampling conducted in 2021 and previous years, Tetra Tech has developed the following conclusions:

- The groundwater elevations in 2023 indicated that the inferred groundwater flow direction was to the east-northeast, towards Waskasoo Creek, east of Taylor Drive. The average horizontal hydraulic gradient at the site in June 2023 was approximately 0.04 m/m, which is consistent with previous findings. Groundwater elevations in 2023 were stable or marginally increased at most monitoring wells compared to 2021, with the exception of MW-07, where the elevation increased by more than 1 m but was within the historical range.
- Groundwater quality parameters that exceeded the Tier 1 Guidelines at one or more monitoring wells installed within the waste footprint in 2023 included: TDS, sodium, sulphate, chloride, ammonia, dissolved metals (arsenic, barium, cadmium, iron, manganese, and nickel), benzene, ethylbenzene, 1,2-dichlorobenzene, and

vinyl chloride. The measured concentrations of one or more of these parameters, in addition to the presence of various VOCs with no established guideline values, suggest leachate has impacted the groundwater quality at MW-05, 21MW-08, and 21MW-09, all situated within the waste footprint. The measured concentrations of these parameters were generally consistent with previous results.

- Surface water analytical results in 2022 along Waskasoo Creek suggest that the surface water quality for most parameters analyzed is similar upstream and downstream of the site. The surface water analytical results in 2022 suggest that the site is not impacting the surface water quality in Waskasoo Creek.
- Concentrations of BTEX, PHCs, and VOCs were less than the soil vapour screening criteria in samples VW-02 and 22VW-06, situated southwest and north of the landfill footprint.
- VOCs cis-1,2-DCE and vinyl chloride exceeded the soil vapour screening criteria at VW-03 situated immediately adjacent to the waste footprint. Well headspace monitoring also identified methane at this location during the June 2023 event.
- The estimated individual and cumulative risks and hazards associated with the soil vapour samples collected in June 2023 did not exceed the corresponding target risk and hazard levels for samples VW-02 and 22VW-06; however, they exceeded at VW-03.
- A site walkover to survey for methane concentrations in June 2023 identified elevated concentrations up to 22% LEL in surface cracks near Taylor Drive; however, above the surface the readings were not detected. Additionally, some settlement was noted during the site walkover, however, there is no reason to believe there is more settlement than previously noted or that there are any factors that would increase settlement, such as changes in site use, drainage, or groundwater levels.

Six of the eight groundwater monitoring wells at the site are located within the waste footprint, and either screened within (MW-04, MW-05, 21MW-08, and 21MW-09) or below (MW-03 and MW-06) the waste. Each of these six wells are identified above to contain leachate impacts, and in at least four wells, the measured liquids may represent leachate. Two of the six vapour wells (VW-03 and VW-05) exhibited LFG impacts, as evidenced by elevated methane and VOCs; the greatest concentrations were measured at VW-05, located centrally in the waste mass, with lower (but elevated) concentrations noted at VW-03, located immediately adjacent to the waste mass at the northeast corner of the site. Elevated methane concentrations indicative of LFG were also measured in the headspace of monitoring wells 21MW-08 and 21MW-09, located along the eastern site perimeter. Elevated chloroform was noted at vapour well 22VW-06, which should be confirmed.

Based on the above, there is a strong correlation between observed impacts and the waste footprint. In the groundwater, the results indicate that impacts may be migrating off site in a hydraulically down-gradient direction (overall easterly towards Waskasoo Creek). However, the surface water results from upstream and downstream Waskasoo Creek in 2021 and 2022 do not suggest that leachate from the former landfill is affecting the water quality in the creek.

Previous soil vapour results from the two wells closest to the residences (VW-01 and VW-02) do not indicate impacts, and the measured concentrations were less than the target cumulative risks and hazard levels for residential land use. The vapours at VW-05 were collected from within the waste mass (and exceed the target risk and hazard levels) and confirm that LFG concentrations typical of a municipal landfill are present, including methane concentrations up to 21.5% in June 2023. The vapours at VW-03, at the northeast end of the site, are also indicative of LFG. This probe is situated immediately adjacent to the waste footprint and is bounded by a road intersection to the north and east. It Is an unlikely location for a building; however, the potential extents of LFG migration off site in this direction are not known. The methane gas concentrations measured to date at VW-03 have been considerably less than within the waste mass (e.g., at VW-05); however, they are still considered elevated.

Additionally, elevated surface emissions of methane (up to 22% LEL) were measured in the vicinity of surface cracks along the eastern side of the site, albeit they were non-detectable above the surface.

Based upon the results of the groundwater and vapour monitoring program in 2023 and previous years, there are residual impacts to groundwater, LFG is present, and buried landfill waste remains in place beneath the site. Furthermore, after drilling the two additional wells in 2021 (21MW-08 and 21MW-09), the limit of wastes and subsurface impacts appear to extend towards Taylor Drive. Drilling additional wells in the median of Taylor Drive may provide additional information; however, the added value of further assessments between existing wells and the creek is questionable. Waskasoo Creek is believed to be a receptor of any leachate impacted groundwater and should continue to be monitored. With respect to any migration of vapours, the depth to groundwater measured to date at the monitoring wells and the elevation of the creek bottom suggest the creek east and south of the site will act as a physical barrier. Monitoring in 2023 has suggested surface emissions are occurring in the vincicty of surface cracks along the eastern side of the site; however, emissions were non-detectable in the air above the surface and are not considered to be an immediate threat to outdoor users of the area at this time. Surface emissions should continue to be monitored to confirm this data.

Ongoing risk management is recommended, including the following risk management elements.

Ongoing Monitoring:

- Conduct annual groundwater elevation monitoring of all monitoring wells in the summer of 2024 to confirm the groundwater flow pattern.
- Conduct annual sampling in the summer of 2024 at down-gradient monitoring wells MW-05, 21MW-08, and 21MW-09 for routine groundwater chemistry parameters and dissolved metals, VOCs, BTEX, and PHCs to confirm previous concentrations and to monitor trends.
- Conduct annual surface water sampling in the summer of 2024 at upstream and downstream Waskasoo Creek for BTEX, PHC fractions F1 and F2, total metals, routine water chemistry, and VOCs.
- Conduct an additional year (winter of 2024) of annual monitoring at VW-01 to 22VW-06 and sampling of the perimeter vapour probes VW-02, VW-03, and 22VW-06.
- Conduct an annual surface emissions survey in the summer of 2024, similar to that undertaken in 2021 and 2023 to further evaluate the nature and extent of emissions. This work should include more detailed (finer grid) monitoring proximate to areas of greater emissions, and careful mapping of the locations with respect to cracking, holes, evidence of stressed vegetation and other potential observations. This would be followed by an evaluation of potential risk to outdoor users of the area and potential feasibility of, and requirements for mitigative measures.

Additional Assessment and Risk Management:

- During the annual monitoring event conduct a site walkover to evaluate for potential erosion, cracking, and/or exposed waste.

Administrative Actions:

- 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 The City policies.
- Ensure that the site is clearly identified within The City's utility mapping system. Elevated gas concentrations may be present in the subsurface proximate to the Taylor Drive and 32 Street ROWs. 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. It presently has a grass cover and the status of the cover should be reviewed 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. The recommended further assessment of the cover relative to surface emissions may determine additional requirements for the cover.

8.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.

Prepared by:
Jaymes Going, B.Sc., EP
Environmental Scientist
Environment & Water Practice
Direct Line: 403.308.4293
Jaymes.Going@tetratech.com

Prepared by (Soil Vapour):
Kelly Jones, B.Sc.
Environmental Scientist
Infrastructure and Environment
Direct Line: 306.347.4039
Kelly.Jones@tetratech.com

Reviewed by:
Frans Hettinga, B.Sc.
Principal Specialist
Solid Waste Management Practice
Direct Line: 403.723.6860
Frans.Hettinga@tetratech.com

Reviewed by:
Sean D. Buckles, M.Sc., P.Eng.
Senior Project Engineer – Team Lead
Solid Waste Management Practice
Direct Line: 403.723.6876
Sean.Buckles@tetratech.com

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
RM SIGNATURE: _____
RM APEGA ID #: 2024-08-02 Member 62764
DATE: _____
PERMIT NUMBER: P013774
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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TABLES

Table 1: Groundwater Monitoring Results

Monitoring Well		MW-01	MW-02	MW-03	MW-04	MW-05	MW-06	MW-07	21MW-08	21MW-09
Total Drilled Depth (m)		4.6	4.6	10.7	8.7	7.5	9.2	6.1	6.0	6.0
Top of Screened Interval (mbg)		2.5	2.5	7.6	5.6	4.4	6.1	1.5	3.0	3.0
Bottom of Screened Interval (mbg)		4.6	4.6	10.7	8.7	7.5	9.2	6.1	6.0	6.0
Stick up (m)		0.80	0.43	0.97	0.97	0.85	0.84	0.76	0.00	0.00
Ground Elevation (m)		876.98	877.85	877.17	876.01	872.45	877.91	877.41	873.08	874.29
TPC Elevation (m)		877.79	878.28	878.14	876.99	873.31	878.75	878.17	873.09	874.29
Depth to Groundwater (mBTPC)	Aug-13	Damaged	CNO	4.89	6.02	2.07	2.79	2.76	N/A	N/A
	May-19	Damaged	2.58	5.72	7.09	3.43	4.32	4.71	N/A	N/A
	Jun-19	Damaged	2.58	5.70	7.09	3.44	4.22	4.70	N/A	N/A
	Sep-19	Damaged	2.42	5.75	7.11	3.58	3.96	4.93	N/A	N/A
	Dec-19	Damaged	2.78	5.74	7.11	3.78	4.05	4.85	N/A	N/A
	Jul-21	Damaged	2.15	5.51	7.05	3.58	4.08	4.67	3.31	4.14
	Nov-21	Damaged	2.75	5.46	7.09	3.75	4.03	5.13	3.41	4.42
	Jun-23	Damaged	2.68	5.44	7.08	3.52	4.01	3.94	3.33	4.28
Groundwater Elevation (m)	Aug-13	Damaged	CNO	873.25	870.96	871.24	875.96	875.42	N/A	N/A
	May-19	Damaged	875.70	872.41	869.90	869.88	874.44	873.47	N/A	N/A
	Jun-19	Damaged	875.70	872.44	869.89	869.87	874.53	873.47	N/A	N/A
	Sep-19	Damaged	875.86	872.39	869.88	869.72	874.80	873.25	N/A	N/A
	Dec-19	Damaged	875.50	872.40	869.88	869.53	874.70	873.32	N/A	N/A
	Jul-21	Damaged	876.13	872.62	869.93	869.73	874.68	873.50	869.77	870.15
	Nov-21	Damaged	875.53	872.68	869.89	869.55	874.73	873.05	869.68	869.87
	Jun-23	Damaged	875.60	872.70	869.90	869.78	874.74	874.23	869.76	870.00
Volatile Organic Compounds* (VOCs) (ppm)	May-19	Damaged	0	0	1	5	0	0	-	-
	Jun-19	Damaged	0	0	1	1	0	15	-	-
	Sep-19	Damaged	0	0	1	5	0	10	-	-
	Dec-19	Damaged	0	0	0	2	1	0	-	-
Combustile Vapour Concentrations* (CVCs) (ppm)	May-19	Damaged	0	0	0	0	0	0	-	-
	Jun-19	Damaged	0	0	0	30	0	35	-	-
	Sep-19	Damaged	0	5	10	45	0	0	-	-
	Dec-19	Damaged	0	5	5	5	5	50	-	-
Methane Concentrations** (ppm)	Jul-21	Damaged	200	160	85	0	15	450	>50,000	>50,000
	Nov-21	Damaged	260	55	330	230	0	0	>50,000	>50,000
	Jun-23	Damaged	0	110	0	150	5	150	80	37% LEL

Notes:
mbg - Metres below grade.
ppm - Parts per million.
*- Measured using RKI Eagle II calibrated to hexane and isobutylene and operated in methane elimination mode.
**- Measured using RKI Eagle II calibrated to methane.
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
mBTPC - Metres below top of plastic pipe casing.
CNO - Could not open.
N/A - Not applicable; prior to well installation.

Table 2: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline [1]	MW-02		MW-03		MW-04		MW-05			MW-06		MW-07		21MW-08		21MW-09	
			06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	02 Jun 2023	06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	19 Nov 2021	02 Jun 2023	19 Nov 2021	02 Jun 2023
Field Parameters																			
Field pH	pH Units	6.5-8.5	**9.07**	7.5	7.58	6.98	**8.77**	6.78	**9.32**	7.46	8.01	**8.75**	6.51	**9.81**	7.04	6.64	8.05	6.66	8.05
Field Temperature	°C	-	6.5	9.48	8.6	5.93	5.82	7.44	7.25	7.35	8.2	5.89	6.78	5.3	6.82	8	8.2	7.01	9.9
Field Electric Conductivity	µS/cm	-	533	763	2,103	2,866	2,376	3,468	1,281	1,157	1,323	2,671	2,487	734	1,084	2,919	3,440	3,738	3,750
Routine																			
pH	pH Units	6.5-8.5	8.14	8.21	7.37	7.56	7.01	7.32	7.96	8.14	7.98	6.85	7.11	7.79	7.81	6.95	6.82	7.05	7.01
Electrical Conductivity (EC)	µS/cm	-	744	747	2,580	3,190	3,840	3,770	1,350	1,300	1,300	2,500	2,690	1,130	1,160	3,150	3,130	4,150	3,850
Total Dissolved Solids (TDS)	mg/L	500	443	443	**949**	**2,010**	**1,490**	**2,280**	**836**	**840**	**881**	**872**	**1,600**	**712**	**732**	**1,920**	**2,120**	**2,750**	**2,650**
Hardness as CaCO3	mg/L	-	377	363	1,090	1,180	1,550	1,240	258	213	242	1,230	1,180	634	590	1,210	1,490	1,590	1,450
Alkalinity (total)	mg/L	-	428	395	1,150	1,490	1,580	1,500	658	570	548	1,040	1,060	605	620	1,420	1,450	1,480	1,360
Bicarbonate	mg/L	-	523	481	1,400	1,820	1,930	1,830	803	695	668	1,270	1,300	738	757	1,730	1,770	1,800	1,660
Carbonate	mg/L	-	<5	<1	<5	<1	<5	<1	<5	<1	<1.0	<5	<1	<5	<1	<1	<1.0	<1	<1.0
Hydroxide	mg/L	-	<5	<1	<5	<1	<5	<1	<5	<1	<1.0	<5	<1	<5	<1	<1	<1.0	<1	<1.0
Calcium	mg/L	-	66.4	65.4	287	293	186	160	61.6	51.3	59.7	240	222	144	132	208	248	362	281
Magnesium	mg/L	-	51.3	48.5	91.1	109	264	205	25.3	20.7	22.5	154	153	66.6	63.2	167	211	166	182
Potassium	mg/L	-	2.77	2.7	11.7	12.5	13.8	9.56	5.52	3.71	3.73	18.5	16.2	7.66	7.62	33.4	43.8	14	15
Sodium	mg/L	200	26.6	26.7	**275**	**310**	**431**	**354**	**217**	**235**	**254**	104	112	26.1	29.8	188	**233**	**382**	**398**
Chloride	mg/L	120	3.75	3.2	**271**	**330**	**593**	**520**	14.2	4.54	5.61	**335**	**329**	7.1	6.72	**316**	**322**	**510**	**482**
Fluoride	mg/L	1.5	0.354	0.426	<0.1	0.11	0.16	0.234	0.28	0.368	0.474	<0.1	0.11	<0.1	0.101	0.112	0.142	<0.2	0.187
Sulphate	mg/L	128-429[#1]	19.7	18.3	13.4	9.73	<1.5	<3	117	**167**	**184**	20.8	45.3	97.2	89.7	<1.5	8.37	**375**	**402**
Ionic Balance	%	-	93.7	101	111	101.16	107	101.36	94.6	101.01	109.00	101	100.48	97.8	103.60	100.93	123	101.87	98.20
Nutrients																			
Ammonia as N	mg/L	0.018[#2]	<0.05	0.0132	**4.56**	**6.22**	**22.9**	**19.9**	**5.8**	**1.07**	**4.68**	**17.9**	**16.7**	**0.125**	**0.329**	**37.6**	**46.5**	**13.2**	**13.5**
Nitrate (as NO3-N)	mg/L	3	**3.46**	**3.79**	<0.1	<0.1	0.14	<0.2	<0.1	<0.1	<0.020	<0.1	<0.1	<0.1	<0.1	<0.1	<0.100	<0.2	<0.100
Nitrite (as NO2-N)	mg/L	0.02-0.2[#3]	<0.01	<0.01	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.1	<0.050
Nitrate and Nitrite (as N)	mg/L	-	3.46	-	<0.11	-	0.14	-	<0.11	-	<0.0224	<0.11	-	<0.11	-	-	<0.112	-	<0.112
Total Kjeldahl Nitrogen (TKN)	mg/L	-	0.69	-	14.4	-	24.1	-	6	-	-	24.3	-	24.6	-	-	-	-	-
Carbon																			
Dissolved Organic Carbon (DOC) (filtered)	mg/L	-	6.6	-	43.8	-	48.9	-	10.3	-	-	24.7	-	5.6	-	-	-	-	-
Dissolved Metals																			
Aluminum	mg/L	0.0007-0.05[#4]	0.0019	0.001	0.0151	0.0065	<0.001	<0.01	0.0058	0.0101	0.0020	0.0042	0.0208	0.0022	0.0016	0.0188	0.0219	0.0126	0.0054
Antimony	mg/L	0.006	<0.0001	<0.0001	0.00048	<0.0005	0.00023	<0.001	<0.0001	<0.0005	<0.00010	0.00024	<0.0005	0.00017	0.00011	<0.0005	0.00028	<0.001	0.00026
Arsenic	mg/L	0.005	0.00035	0.00031	**0.00733**	**0.0127**	0.00408	**0.0547**	**0.00722**	**0.00994**	**0.0140**	**0.0122**	**0.00873**	0.0005	0.0035	**0.0216**	**0.0176**	0.00439	**0.00532**
Barium	mg/L	1	0.147	0.131	0.249	0.287	**1.14**	**1.36**	0.107	0.049	0.0364	0.58	0.505	0.195	0.179	**1.01**	**1.23**	0.312	0.317
Beryllium	mg/L	-	-	<0.00002	-	<0.0001	-	<0.0002	-	<0.0001	-	-	<0.0001	-	<0.00002	<0.0001	-	<0.0002	-
Bismuth	mg/L	-	-	<0.00005	-	<0.00025	-	<0.0005	-	<0.00025	-	-	<0.00025	-	<0.00005	<0.00025	-	<0.0005	-
Boron	mg/L	1.5	0.076	0.08	0.392	0.457	0.38	0.393	0.225	0.222	0.225	0.226	0.235	0.059	0.068	0.353	0.313	0.388	0.209
Cadmium	mg/L	4E-05-0.00037[#1]	0.000017	0.00002	**0.0000961**	<0.000025	<0.000005	<0.00005	<0.000005	<0.000025	<0.0000050	<0.000005	<0.000025	**0.0000802**	0.0000198	<0.000025	<0.0000050	**0.000179**	**0.0000950**
Chromium	mg/L	0.05	<0.0001	<0.0005	0.00079	<0.0025	0.00076	<0.005	0.00025	<0.0025	<0.00050	0.00067	<0.0025	<0.0001	<0.0005	<0.0025	0.00156	<0.005	0.00107
Cobalt	mg/L	-	-	<0.0001	-	0.00366	-	0.00315	-	<0.0005	-	-	0.00265	-	0.00775	0.00782	-	0.0135	-
Copper	mg/L	0.007	0.00121	0.00129	0.00493	<0.001	0.00354	<0.002	0.00027	<0.001	0.00030	0.00021	<0.001	0.00615	0.0011	<0.001	0.00026	<0.002	0.00083
Iron	mg/L	0.3	<0.01	<0.01	**8.63**	**13.7**	0.102	**42.9**	**2.32**	**1.23**	**1.18**	**24.8**	**24.4**	0.019	**1.13**	**59.6**	**72.1**	**3.88**	**13.5**
Lead	mg/L	0.001-0.007[#1]	<0.00005	<0.00005	**0.00205**	<0.00025	<0.00005	<0.0005	0.000116	<0.00025	<0.000050	0.000066	<0.00025	0.0002	<0.00005	<0.00025	0.000139	<0.0005	<0.000050
Lithium	mg/L	-	-	0.0842	-	0.144	-	0.0604	-	0.032	-	-	0.125	-	0.0673	0.0484	-	0.162	-
Manganese	mg/L	0.05	0.00542	0.0062	**0.632**	**0.73**	**0.379**	**0.304**	**0.193**	**0.17**	**0.185**	**2.91**	**2.93**	**0.394**	**2.99**	**0.611**	**0.796**	**4.45**	**4.61**
Mercury	mg/L	0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.0000050	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.0000050	<0.000005	<0.0000050
Molybdenum	mg/L	-	-	0.00119	-	0.0138	-	0.003	-	0.00795	-	-	0.00067	-	0.00144	0.000735	-	0.00135	-
Nickel	mg/L	0.004-0.17[#1]	0.0013	0.00149	**0.0146**	**0.0177**	**0.0345**	**0.0281**	0.00128	<0.0025	<0.00050	**0.0145**	**0.0148**	**0.00582**	**0.025**	**0.0103**	**0.0104**	**0.0458**	**0.0348**
Phosphorus	mg/L	-	0.105	<0.05	3.61	<0.25	0.783	<0.5	0.337	<0.25	-	1.14	0.316	26.2	<0.05	0.773	-	<0.5	-
Selenium	mg/L	0.002	0.000386	0.000259	0.00022	0.000328	0.000399	0.000527	0.000133	<0.00025	<0.000050	0.000353	0.000296	0.000052	0.000088	0.000578	0.000815	<0.0005	0.000733
Silicon	mg/L	-	-	8.96	-	11.4	-	23.9	-	4.84	-	-	14.3	-	9.85	17.3	-	11.9	-
Silver	mg/L	0.0001	<0.00001	<0.00001	<0.00001	<0.00005	<0.00001	<0.0001	<0.00001	<0.00005	<0.000010	<0.00001	<0.00005	<0.00001	<0.00001	<0.00005	0.000011	<0.0001	0.000014
Strontium	mg/L	-	-	0.739	-	2.56	-	2.64	-	0.607	-	-	2.37	-	0.946	2.21	-	2.96	-
Thallium	mg/L	-	-	<0.00001	-	<0.00005	-	<0.0001	-	<0.00005	-	-	<0.00005	-	0.000082	<0.00005	-	<0.0001	-
Tin	mg/L	-	-	<0.0001	-	0.00084	-	<0.001	-	<0.0005	-	-	0.00105	-	0.00016	0.00136	-	<0.001	-
Titanium	mg/L	-	-	<0.0003	-	<0.0015	-	<0.003	-	<0.0015	-	-	0.00202	-	<0.0003	0.00308	-	<0.003	-
Uranium	mg/L	0.015	**0.0159**	0.0149	0.00151	0.00363	0.000048	<0.0001	0.00184	0.00291	0.00264	0.0061	0.00816	**0.0167**	**0.0153**	0.000303	0.000097	**0.0163**	0.00728
Vanadium	mg/L	-	-	<0.0005	-	<0.0025	-	<0.005	-	<0.0025	-	-	<0.0025	-	<0.0005	<0.0025	-	<0.005	-
Zinc	mg/L	0.03	<0.001	0.0028	0.0295	<0.005	0.0018	<0.01	<0.001	<0.005	0.0012	0.0015	0.0063	0.004	0.0041	0.0052	0.0031	<0.01	0.0099

Notes:

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

[#1] Guideline varies with hardness. Values shown based on site hardness range of 213 mg/L to 1,590 mg/L.

[#2] Guideline varies with pH and temperature. Values shown based on field pH range of 6.51 to 9.81 and temperature range of 5.30°C to 9.90°C. An average temperture of 6.15°C was used to calculate the appropriate guideline for MW-03.

[#3] Guideline varies with chloride. Values shown based on site chloride range of 3.20 mg/L to 593 mg/L.

[#4] Guideline varies with pH. Values shown based on site pH range of 6.51 to 9.81.

*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 2: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline [1]	MW-02		MW-03		MW-04		MW-05			MW-06		MW-07		21MW-08		21MW-09	
			06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	02 Jun 2023	06 Dec 2019	19 Nov 2021	06 Dec 2019	19 Nov 2021	19 Nov 2021	02 Jun 2023	19 Nov 2021	02 Jun 2023
Hydrocarbons																			
Benzene	mg/L	0.005	<0.0005	-	0.00186	0.00163	**0.0141**	**0.00951**	0.00415	0.00053	<0.00050	**0.009**	**0.00723**	<0.0005	-	**0.0273**	**0.0424**	0.00242	0.00314
Toluene	mg/L	0.021	<0.0005	-	0.00183	0.00158	0.00164	0.0009	0.00176	<0.0005	<0.00050	0.00317	0.00152	<0.0005	-	0.00121	0.00313	0.00061	0.00067
Ethylbenzene	mg/L	0.0016	<0.0005	-	**0.00192**	**0.00249**	0.00084	0.00076	**0.00454**	**0.00169**	<0.00050	**0.0132**	**0.015**	<0.0005	-	**0.00467**	**0.00646**	<0.0005	<0.00050
Xylene (o)	mg/L	-	<0.0005	-	<0.0005	0.00045	0.00116	0.00095	0.00255	0.0006	<0.00030	0.00596	0.00702	<0.0005	-	0.00501	0.00582	<0.0003	<0.00030
Xylenes (m & p)	mg/L	-	<0.0005	-	<0.0005	<0.0004	0.00147	0.00101	0.00663	0.00106	<0.00040	0.0196	0.0218	<0.0005	-	0.00435	0.0102	<0.0004	<0.00040
Xylenes Total	mg/L	0.02	<0.00071	-	<0.00071	<0.0005	0.00263	0.00196	0.00918	0.00166	<0.00050	**0.0256**	**0.0288**	<0.00071	-	0.00936	0.0160	<0.0005	<0.00050
Styrene	mg/L	0.072	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.00050	<0.0005	<0.00050
F1 (C6-C10_)	mg/L	0.81	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1
F1 (C6-C10) - BTEX	mg/L	0.81	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-
F2 (C10-C16 Hydrocarbons)	mg/L	1.1	<0.1	-	0.54	0.26	0.1	0.15	0.31	<0.1	**1.39**	0.51	0.29	<0.1	-	0.23	0.3	<0.1	0.13
Polycyclic Aromatic Hydrocarbons (PAHs)																			
Naphthalene	mg/L	0.001	-	-	-	**0.0013**	-	<0.001	-	**0.0032**	-	-	**0.0017**	-	-	**0.0036**	-	<0.001	-
Volatile Organic Compounds (VOCs)																			
Acetic Acid	mg/L	-	<10	-	<10	-	<10	-	<10	-	-	<10	-	<10	-	-	-	-	-
Butyric Acid	mg/L	-	<1	-	<1	-	<1	-	<1	-	-	<1	-	<1	-	-	-	-	-
Formic Acid	mg/L	-	<50	-	<50	-	<50	-	<50	-	-	<50	-	<50	-	-	-	-	-
Hexanoic Acid	mg/L	-	<1	-	<1	-	<1	-	<1	-	-	<1	-	<1	-	-	-	-	-
Valeric Acid	mg/L	-	<1	-	<1	-	<1	-	<1	-	-	<1	-	<1	-	-	-	-	-
Bromobenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Bromochloromethane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Bromodichloromethane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Bromoform	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Bromomethane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
n-Butylbenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
sec-Butylbenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
tert-Butylbenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Carbon tetrachloride	mg/L	0.00057	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.00050	<0.0005	<0.00050
Chlorobenzene	mg/L	0.0013	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Chloroethane	mg/L	-	<0.001	-	<0.001	<0.001	0.0403	0.0181	<0.001	<0.001	<0.0010	0.0079	0.0033	<0.001	-	0.002	0.0018	<0.001	<0.0010
Chloroform	mg/L	0.018	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Chloromethane	mg/L	-	<0.001	-	<0.001	<0.005	<0.001	<0.005	<0.001	<0.005	<0.0050	<0.001	<0.005	<0.001	-	<0.005	<0.0050	<0.005	<0.0050
2-Chlorotoluene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
4-Chlorotoluene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Dibromochloromethane	mg/L	0.19	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,2-Dibromo-3-chloropropane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,2-Dibromoethane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Dibromomethane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,2-Dichlorobenzene	mg/L	0.0007	<0.0005	-	<0.0005	<0.0005	**0.00401**	**0.00139**	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.0005	-	**0.00112**	**0.00104**	<0.0005	<0.00050
1,3-Dichlorobenzene	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,4-Dichlorobenzene	mg/L	0.001	<0.0005	-	<0.0005	<0.001	0.00074	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,1-Dichloroethane	mg/L	-	<0.0005	-	<0.0005	<0.001	0.00107	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,2-Dichloroethane	mg/L	0.005	<0.001	-	<0.001	<0.001	**0.0114**	**0.0068**	<0.001	<0.001	<0.0010	<0.0025	0.0014	<0.001	-	0.0016	0.0017	<0.001	<0.0010
1,1-Dichloroethene	mg/L	0.014	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,2-Dichloroethene (cis)	mg/L	-	<0.001	-	1.75	1.29	2.11	1.35	0.0014	<0.001	<0.0010	0.029	0.02	<0.001	-	1.14	0.0908	1.45	0.641
1,2-Dichloroethene (trans)	mg/L	-	<0.0005	-	0.0107	0.0064	0.0406	0.0246	0.0006	<0.001	<0.0010	0.00488	0.003	<0.0005	-	0.0163	0.0159	0.036	0.0448
Dichlorodifluoromethane	mg/L	-	<0.0005	-	0.00067	<0.001	0.00391	<0.001	<0.0005	<0.001	<0.0010	0.0789	0.0136	<0.0005	-	<0.001	<0.0010	0.0011	0.0016
1,2-Dichloropropane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,3-Dichloropropane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
2,2-Dichloropropane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,1-Dichloropropene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,3-Dichloropropene [cis]	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,3-Dichloropropene [trans]	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Hexachlorobutadiene	mg/L	0.0013	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
iso-Butyric Acid	mg/L	-	<1	-	<1	-	<1	-	<1	-	-	<1	-	<1	-	-	-	-	-
Isovaleric acid	mg/L	-	<1	-	<1	-	<1	-	<1	-	-	<1	-	<1	-	-	-	-	-
p-Isopropyltoluene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Proponic Acid	mg/L	-	<5	-	<5	-	<5	-	<5	-	-	<5	-	<5	-	-	-	-	-
Methyl t-Butyl Ether (MTBE)	mg/L	0.015	-	-	-	<0.0005	-	<0.0005	-	<0.0005	<0.00050	-	<0.0005	-	-	<0.0005	<0.00050	<0.0005	<0.00050
Methylene Chloride	mg/L	0.05	<0.001	-	0.0023	0.0016	0.0051	0.003	<0.001	<0.001	<0.0010	0.0017	<0.001	<0.001	-	<0.001	<0.0010	<0.001	0.0011
iso-Propylbenzene (cumene)	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
n-Propylbenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,1,1,2-Tetrachloroethane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,1,2,2-Tetrachloroethane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Tetrachloroethene	mg/L	0.01	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,2,3-Trichlorobenzene	mg/L	0.008	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,2,4-Trichlorobenzene	mg/L	0.015	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,1,2-Trichloroethane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Trichloroethene	mg/L	0.005	<0.0005	-	<0.0005	<0.001	0.00104	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
Trichlorofluoromethane	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001	-	<0.001	<0.0010	<0.001	<0.0010
Trihalomethanes	mg/L	0.1	-	-	-	<0.002	-	<0.002	-	<0.002	<0.0020	-	<0.002	-	-	<0.002	<0.0020	<0.002	<0.0020
1,2,3-Trichloropropane	mg/L	-	<0.0005	-	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.001	<0.0010	<0.0005	<0.001	<0.0005	-	<0.001	<0.0010	<0.001	<0.0010
1,2,4-Trimethylbenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	0.0058	0.0016	<0.0010	0.0089	0.004	<0.001	-	0.0024	0.0050	<0.001	<0.0010
1,3,5-Trimethylbenzene	mg/L	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	0.0014	<0.001	<0.001	-	0.0012	0.0022	<0.001	<0.0010
Vinyl chloride	mg/L	0.0011	<0.0005	-	**0.0138**	**0.0771**	**0.0259**	**0.115**	**0.00294**	<0.001	<0.0010	**0.0913**	**0.0363**	<0.0005	-	**0.0194**	**0.0209**	**0.0077**	**0.0782**

Notes:

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

[#1] Guideline varies with hardness. Values shown based on site hardness range of 213 mg/L to 1,590 mg/L.

[#2] Guideline varies with pH and temperature. Values shown based on field pH range of 6.51 to 9.81 and temperature range of 5.30°C to 9.90°C. An average temperture

[#3] Guideline varies with chloride. Values shown based on site chloride range of 3.20 mg/L to 593 mg/L.

[#4] Guideline varies with pH. Values shown based on site pH range of 6.51 to 9.81.

*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 3: Surface Water Analytical Results

Parameter	Unit	Guideline[1]	SW-01 DOWNSTREAM 13 Jul 2021	SW-01 DOWNSTREAM 09 Sep 2021	SW-01 DOWNSTREAM 10 Nov 2022	SW-02 UPSTREAM 13 Jul 2021	SW-02 UPSTREAM 09 Sep 2021	SW-02 UPSTREAM 10 Nov 2022
Field Parameters								
Field pH	pH Units	6.5-9	-	-	8.35	-	-	8.83
Field Temperature	°C	-	-	-	-0.3	-	-	-0.1
Field Electric Conductivity	µS/cm	-	-	-	1,734	-	-	2,350
Routine								
pH	pH Units	6.5-9	8.28	8.47	8.15	8.41	8.41	8.17
Electrical Conductivity (EC)	µS/cm	-	1,130	1,140	1,210	1,110	1,260	1,200
Total Dissolved Solids (TDS)	mg/L	-	680	664	793	672	763	786
Hardness as CaCO3	mg/L	-	457	469	552	440	573	550
Alkalinity (total as CaCO3)	mg/L	20	390	325	460	386	413	462
Bicarbonate	mg/L	-	475	364	561	442	474	563
Carbonate	mg/L	-	<5.0	15.7	<1	14.3	14.9	<1
Hydroxide	mg/L	-	<5.0	<5.0	<1	<5.0	<5.0	<1
Calcium	mg/L	-	93.5	77.4	120	89.6	119	119
Magnesium	mg/L	-	54.4	67.0	61.2	52.5	67.0	61.4
Potassium	mg/L	-	6.56	7.18	8.83	6.49	7.06	8.84
Sodium	mg/L	-	78.1	76.2	86.7	78.1	74.5	86.5
Chloride	mg/L	120	120	**146**	**139**	119	**146**	**136**
Fluoride	mg/L	-	0.20	0.14	0.201	0.20	0.16	0.197
Sulphate	mg/L	128-429[#1]	87.2	90.5	75	90.1	92.8	70.9
Ionic Balance	%	-	97.1	102	101	94.8	103	103
Nutrients								
Ammonia as N	mg/L	0.018-19.5[#2]	-	<0.050	0.0874	-	0.058	0.0792
Nitrate (as NO3-N)	mg/L	3	1.34	1.01	1.41	0.90	1.96	1.36
Nitrite (as NO2-N)	mg/L	0.02-0.2[#3]	<0.050	<0.050	<0.05	<0.050	<0.050	<0.05
Nitrate and Nitrite (as N) (mg/L)	mg/L	-	1.34	1.01	1.41	0.90	1.96	1.36
Total Metals								
Aluminum	mg/L	0.007-0.05[#4]	0.0390	0.0090	0.0284	0.0193	**0.0550**	**0.059**
Antimony	mg/L	-	0.00023	0.00034	0.00023	0.00023	0.00047	0.00021
Arsenic	mg/L	0.005	0.00327	0.00163	0.00121	0.00241	0.00216	0.00176
Barium	mg/L	-	0.200	0.222	0.196	0.167	0.307	0.2
Boron	mg/L	1.5	0.063	0.084	0.078	0.061	0.085	0.082
Cadmium	mg/L	4E-05-0.00037[#1]	0.0000169	<0.0000050	<0.000005	**0.0000690**	0.0000118	0.000013
Chromium	mg/L	0.001	0.00015	0.00014	<0.0005	0.00013	0.00022	<0.0005
Copper	mg/L	0.007[#1]	0.00107	0.00135	0.00122	0.00123	0.00194	0.00119
Iron	mg/L	0.3	**0.349**	0.231	**0.362**	0.181	**0.526**	**0.551**
Lead	mg/L	0.001-0.007[#1]	0.000133	<0.000050	0.000054	0.000089	0.000100	0.00009
Manganese	mg/L	-	0.0888	0.0194	0.0428	0.0167	0.103	0.0897
Mercury	mg/L	0.000005	<0.0000050	-	<0.000005	<0.0000050	-	<0.000005
Nickel	mg/L	0-0.17[#1]	**0.00255**	**0.00261**	**0.00306**	**0.00242**	**0.00294**	**0.00309**
Selenium	mg/L	0.002	0.000500	0.000813	0.000326	0.000404	0.000853	0.000382
Silver	mg/L	0.00025	<0.000010	<0.000010	<0.00001	<0.000010	<0.000010	<0.00001
Uranium	mg/L	0.015	0.00547	0.00821	0.00593	0.00502	0.00818	0.00587
Zinc	mg/L	0.03	0.0112	0.0030	0.0082	0.0059	0.0139	0.0111
Hydrocarbons								
Benzene	mg/L	0.04	<0.00050	<0.00050	<0.0005	<0.00050	<0.00050	<0.0005
Toluene	mg/L	0.0005	<0.00050	<0.00050	<0.0005	<0.00050	<0.00050	<0.0005
Ethylbenzene	mg/L	0.09	<0.00050	<0.00050	<0.0005	<0.00050	<0.00050	<0.0005
Xylene (o)	mg/L	-	<0.00050	<0.00050	<0.0003	<0.00050	<0.00050	<0.0003
Xylenes (m & p)	mg/L	-	<0.00050	<0.00050	<0.0004	<0.00050	<0.00050	<0.0004
Xylenes Total	mg/L	0.03	-	<0.00071	<0.0005	-	<0.00071	<0.0005
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.0005	<0.00050	<0.00050	<0.0005
F1 (C6-C10_)	mg/L	-	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1
F1 (C6-C10) - BTEX	mg/L	-	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1
F2 (C10-C16 Hydrocarbons)	mg/L	0.11	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1
Total BTEX	mg/L	-	-	-	<0.001	-	-	<0.001

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 mg/L 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°C 16.7°C.

[#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 3: Surface Water Analytical Results

Parameter	Unit	Guideline[1]	SW-01 DOWNSTREAM 13 Jul 2021	SW-01 DOWNSTREAM 09 Sep 2021	SW-01 DOWNSTREAM 10 Nov 2022	SW-02 UPSTREAM 13 Jul 2021	SW-02 UPSTREAM 09 Sep 2021	SW-02 UPSTREAM 10 Nov 2022
Volatile Organic Compounds (VOCs)								
Bromobenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Bromochloromethane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Bromodichloromethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Bromoform	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
n-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
sec-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
tert-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Carbon tetrachloride	mg/L	0.0133	<0.00050	<0.00050	<0.0005	<0.00050	<0.00050	<0.0005
Chlorobenzene	mg/L	0.0013	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Chloroform	mg/L	0.0018	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Chloromethane	mg/L	-	<0.0010	<0.0010	<0.005	<0.0010	<0.0010	<0.005
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Dibromochloromethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,2-Dibromoethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Dibromomethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.0005	<0.00050	<0.00050	<0.0005
1,3-Dichlorobenzene	mg/L	0.15	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,4-Dichlorobenzene	mg/L	0.026	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,1-Dichloroethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2-Dichloroethane	mg/L	0.1	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,1-Dichloroethene	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2-Dichloroethene (cis)	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,2-Dichloroethene (trans)	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2-Dichloropropane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,3-Dichloropropene	mg/L	-	-	-	<0.0015	-	-	<0.0015
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Methyl t-Butyl Ether (MTBE)	mg/L	10	-	-	<0.0005	-	-	<0.0005
Methylene Chloride	mg/L	0.0981	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
iso-Propylbenzene (cumene)	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Tetrachloroethene	mg/L	0.11	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,2,4-Trichlorobenzene	mg/L	0.024	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Trichloroethene	mg/L	0.021	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Trihalomethanes	mg/L	-	-	-	<0.002	-	-	<0.002
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	<0.001
Vinyl chloride	mg/L	-	<0.00050	<0.00050	<0.001	<0.00050	<0.00050	<0.001

Notes:

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[#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: Groundwater Quality Assurance/Quality Control Analytical Results

Parameter	Unit	RDL	MW-05	Duplicate	RPD (%)
			02 Jun 2023	02 Jun 2023	
Routine					
pH	pH Units	0.1	7.98	8.01	0.4
Electrical Conductivity (EC)	µS/cm	1	1,300	1,310	1
Total Dissolved Solids (TDS)	mg/L	1	881	884	0.3
Hardness as CaCO3	mg/L	0.5	242	241	0.4
Alkalinity (total)	mg/L	1	548	547	0.2
Bicarbonate	mg/L	1	668	667	0.1
Carbonate	mg/L	1	<1.0	<1.0	-
Hydroxide	mg/L	1	<1.0	<1.0	-
Calcium	mg/L	0.05	59.7	59.1	1
Magnesium	mg/L	0.005	22.5	22.6	0.4
Potassium	mg/L	0.05	3.73	3.78	1
Sodium	mg/L	0.05	254	262	3
Chloride	mg/L	0.5	5.61	5.77	3
Fluoride	mg/L	0.02	0.474	0.494	4
Sulphate	mg/L	0.3	184	184	0.0
Ionic Balance	%	0.01	109	109	0.0
Nutrients					
Ammonia as N	mg/L	0.005	4.68	1.14	**121.6**
Nitrate (as NO3-N)	mg/L	0.02	<0.020	<0.020	-
Nitrite (as NO2-N)	mg/L	0.01	<0.010	<0.010	-
Nitrate and Nitrite (as N)	mg/L	0.02	<0.0224	<0.0224	-
Dissolved Metals					
Aluminum (filtered)	mg/L	0.001	0.002	0.0011	-
Antimony (filtered)	mg/L	0.0001	<0.00010	<0.00010	-
Arsenic (filtered)	mg/L	0.0001	0.014	0.0142	1
Barium (filtered)	mg/L	0.0001	0.0364	0.0357	2
Boron (filtered)	mg/L	0.01	0.225	0.224	0.4
Cadmium (filtered)	mg/L	0.000005	<0.0000050	<0.0000050	-
Chromium (filtered)	mg/L	0.0001	<0.00050	<0.00050	-
Copper (filtered)	mg/L	0.0002	0.0003	<0.00020	-
Iron (filtered)	mg/L	0.01	1.18	1.2	2
Lead (filtered)	mg/L	0.00005	<0.000050	<0.000050	-
Manganese (filtered)	mg/L	0.0001	0.185	0.186	1
Mercury (filtered)	mg/L	0.000005	<0.0000050	<0.0000050	-
Nickel (filtered)	mg/L	0.0005	<0.00050	<0.00050	-
Selenium (filtered)	mg/L	0.00005	<0.000050	<0.000050	-
Silver (filtered)	mg/L	0.00001	<0.000010	<0.000010	-
Uranium (filtered)	mg/L	0.00001	0.00264	0.00272	3
Zinc (filtered)	mg/L	0.001	0.0012	<0.0010	-

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%.
Shaded - Detect Value in Blank Sample.

Table 4: Groundwater Quality Assurance/Quality Control Analytical Results

Parameter	Unit	RDL	MW-05	Duplicate	RPD (%)
			02 Jun 2023	02 Jun 2023	
Hydrocarbons					
Benzene	mg/L	0.0005	<0.00050	<0.00050	-
Toluene	mg/L	0.0005	<0.00050	<0.00050	-
Ethylbenzene	mg/L	0.0005	<0.00050	<0.00050	-
Xylene (o)	mg/L	0.0003	<0.00030	<0.00030	-
Xylenes (m & p)	mg/L	0.0004	<0.00040	<0.00040	-
Xylenes Total	mg/L	0.0005	<0.00050	<0.00050	-
Styrene	mg/L	0.0005	<0.00050	<0.00050	-
F1 (C6-C10_)	mg/L	0.1	<0.1	<0.1	-
F2 (C10-C16 Hydrocarbons)	mg/L	0.1	1.39	1.51	8
Volatile Organic Compounds (VOCs)					
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	-
n-Butylbenzene	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	-
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	-
2-Chlorotoluene	mg/L	0.001	<0.0010	<0.0010	-
4-Chlorotoluene	mg/L	0.001	<0.0010	<0.0010	-
Dibromochloromethane	mg/L	0.0005	<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	-
Dibromomethane	mg/L	0.0005	<0.0010	<0.0010	-
1,2-Dichlorobenzene	mg/L	0.0005	<0.00050	<0.00050	-
1,3-Dichlorobenzene	mg/L	0.0005	<0.0010	<0.0010	-
1,4-Dichlorobenzene	mg/L	0.0005	<0.0010	<0.0010	-
1,1-Dichloroethane	mg/L	0.0005	<0.0010	<0.0010	-
1,2-Dichloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1-Dichloroethene	mg/L	0.0005	<0.0010	<0.0010	-
1,2-Dichloroethene (cis)	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dichloroethene (trans)	mg/L	0.0005	<0.0010	<0.0010	-
Dichlorodifluoromethane	mg/L	0.0005	<0.0010	<0.0010	-
1,2-Dichloropropane	mg/L	0.0005	<0.0010	<0.0010	-
1,3-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
2,2-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
1,1-Dichloropropene	mg/L	0.001	<0.0010	<0.0010	-
1,3-Dichloropropene [cis]	mg/L	0.0005	<0.0010	<0.0010	-
1,3-Dichloropropene [trans]	mg/L	0.001	<0.0010	<0.0010	-
Hexachlorobutadiene	mg/L	0.001	<0.0010	<0.0010	-
p-Isopropyltoluene	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	-
iso-Propylbenzene (cumene)	mg/L	0.001	<0.0010	<0.0010	-
n-Propylbenzene	mg/L	0.001	<0.0010	<0.0010	-
1,1,1,2-Tetrachloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1,2,2-Tetrachloroethane	mg/L	0.0005	<0.0010	<0.0010	-
Tetrachloroethene	mg/L	0.0005	<0.0010	<0.0010	-
1,2,3-Trichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2,4-Trichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
1,1,1-Trichloroethane	mg/L	0.0005	<0.0010	<0.0010	-
1,1,2-Trichloroethane	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	-
1,2,3-Trichloropropane	mg/L	0.0005	<0.0010	<0.0010	-
1,2,4-Trimethylbenzene	mg/L	0.001	<0.0010	<0.0010	-
1,3,5-Trimethylbenzene	mg/L	0.001	<0.0010	<0.0010	-
Vinyl chloride	mg/L	0.0005	<0.0010	<0.0010	-

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%.
Shaded - Detect Value in Blank Sample.

Table 5: Soil Vapour Monitoring Results

Parameter	VW-01										VW-02									
	Aug-13	May-19	Jun-19	Sep-19	Dec-19	May-21	Jul-21	Sep-21	Nov-21	Jun-23	Aug-13	May-19	Jun-19	Sep-19	Dec-19	May-21	Jul-21	Sep-21	Nov-21	Jun-23
Stickup (m)	0.91										0.70									
Ground Elevation (m)	877.33										877.19									
Top of Screened Interval (mbg)[1]	875.03										873.19									
Bottom of Screened Interval (mbg)[1]	874.73										872.89									
Static Water Level (mbtoc)[2]	N/A	2.42	2.10	2.22	2.71	2.27	2.06	2.39	2.58	2.37	N/A	4.15	3.97	4.67	Dry	4.24	4.36	-	4.80	4.60
Static Water Level (mbg)[1]	N/A	875.82	876.14	876.03	875.53	875.97	876.18	875.85	875.66	875.87	N/A	873.74	873.92	873.22	Dry	873.65	873.54	-	873.09	873.29
Pressure (mmHg)[3]	N/A	0.0	0.0	0.0	0.6	-0.1	0.0	0.2	5.3	0.8	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
CH_4 (%)	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO (ppm)[4]	N/A	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0		N/A	0.0	8.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
CO_2 (%)	N/A	0.0	0.0	1.8	0.1	1.8	0.1	0.8	1.8	Blinded	N/A	0.1	0.0	0.0	0.1	0.7	0.1	1.0	4.4	2.4
O_2 (%)	N/A	22.0	19.9	18.6	19.1	18.8	20.6	20.0	21.5		N/A	21.4	20.1	20.2	18.7	19.4	20.1	19.5	19.2	18.2
Balance (% v/v)	N/A	78.0	80.1	79.6	80.8	79.3	79.3	79.2	78.2		N/A	78.6	79.9	79.8	81.2	79.9	79.8	79.5	76.5	79.4
Blinded (Yes/No)	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	N/A	No	No

Parameter	VW-03										VW-04									
	Aug-13	May-19	Jun-19	Sep-19	Dec-19	May-21	Jul-21	Sep-21	Nov-21	Jun-23	Aug-13	May-19	Jun-19	Sep-19	Dec-19	May-21	Jul-21	Sep-21	Nov-21	Jun-23
Stickup (m)	0.74										1.02									
Ground Elevation (m)	872.69										877.445									
Top of Screened Interval (mbg)[1]	870.29										875.35									
Bottom of Screened Interval (mbg)[1]	869.99										875.05									
Static Water Level (mbtoc)[2]	-	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	-	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Static Water Level (mbg)[1]	-	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	-	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Pressure (mmHg)[3]	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	-	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.1	0.0
CH_4 (%)	5.5	2.0	3.4	2.0	0.0	3.4	5.0	7.3	5.6	2.0	0.0	0.0	0.4	0.0	0.0	0.0	0.5	0.0	0.0	0.0
CO (ppm)[4]	-	3.0	12.0	0.0	0.0	2.0	2.0	3.0	0.0	1.0	-	1.0	20.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
CO_2 (%)	15.1	14.3	11.0	5.2	1.3	15.4	17.6	21.4	19.5	16.8	2.3	2.1	0.4	3.9	0.4	2.3	3.2	4.8	3.9	1.3
O_2 (%)	8.0	0.4	6.3	15.8	19.8	0.2	0.1	0.0	0.3	0.2	20.7	20.0	19.7	18.0	20.2	18.7	17.7	16.5	19.4	19.6
Balance (% v/v)	71.8	83.3	79.3	77.0	78.8	81.0	77.3	71.3	74.7	80.1	77.0	78.0	80.8	78.1	79.4	79.0	78.7	78.7	76.6	79.1
Blinded (Yes/No)	No	No	No	No	No	No	No	No	No	No	-	No	No	No	No	No	No	No	No	No

Parameter	VW-05										22VW-06
	Aug-13	May-19	Jun-19	Sep-19	Dec-19	May-21	Jul-21	Sep-21	Nov-21	Jun-23	Jun-23
Stickup (m)	1.00										-0.02
Ground Elevation (m)	877.72										NS
Top of Screened Interval (mbg)[1]	875.62										NS
Bottom of Screened Interval (mbg)[1]	875.32										NS
Static Water Level (mbtoc)[2]	N/A	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Static Water Level (mbg)[1]	N/A	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Pressure (mmHg)[3]	N/A	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CH_4 (%)	N/A	64.8	66.6	63.9	6.1	31.6	15.9	59.2	52.1	21.5	0.0
CO (ppm)[4]	N/A	45.0	29.4	0.0	0.0	27.0	18.0	58.0	40.0	77.0	0.0
CO_2 (%)	N/A	29.8	31.2	35.8	4.5	16.6	8.40	33.9	28.6	18.9	2.7
O_2 (%)	N/A	0.6	0.4	0.1	18.1	10.0	15.6	1.0	3.8	7.2	8.1
Balance (% v/v)	N/A	4.6	1.1	0.2	71.2	41.8	60.0	5.10	15.8	52.6	84.1
Blinded (Yes/No)	N/A	No	No	No	No	No	No	No	No	No	No

Notes:

[1] mmHg - millimetre of mercury

[2] ppm - Parts per million.

[3] mbtoc - Meters below top of casing.

[4] mbg - Meters below ground

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

NS - Not surveyed.

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-03				VW-04			VW-05		VW-05	22VW-06
Field ID			VW-01	VW-01	VW-02	VW-02	VW-02	VW-03	VW-03	VW-03	DUPLICATE	VW-04	VW-04	DUPLICATE	VW-05	19DUP01	VW-05	22VW-06
Sample Date			6-Dec-2019	19-Nov-2021	6-Dec-2019	19-Nov-2021	01-Jun-2023	6-Dec-2019	19-Nov-2021	01-Jun-2023	01-Jun-2023	6-Dec-2019	19-Nov-2021	19-Nov-2021	6-Dec-2019	6-Dec-2019	19-Nov-2021	01-Jun-2023
Lab Report Number			L2393575	L2671030	L2393575	L2671030	CG2307273	L2393575	L2671030	CG2307273	CG2307273	L2393575	L2671030	L2671030	L2393575	L2393575	L2671030	CG2307273
Laboratory ID			L2393575-1 / L2393575-7	L2671030-1	L2393575-2 / L2393575-8	L2671030-2	CG2307273-001	L2393575-3 / L2393575-9	L2671030-3	CG2307273-002	CG2307273-004	L2393575-4 / L2393575-10	L2671030-4	L2671030-6	L2393575-5 / L2393575-11	L2393575-6	L2671030-5	CG2307273-003
Parameter	**Unit**	**$\mu g/m^3$**																
Field Tests																		
Air Volume	L		0.06	-	0.06	-	-	0.06	-	-		0.06	-	-	0.06	-	-	-
Initial Pressure	in Hg		-5.3	-10.0	-10.2	-3.50	-7.56	-8.8	-8.00	-9.19	8.99	-9.4	-8.40	-3.50	-6.1	-6.7	-4.10	-10.0
Aliphatic/Aromatic PHC Sub-Fractionation																		
Aliphatics (C_6-C_8)	$\mu g/m^3$	740,737	73	-	45	-	19	912	-	479	456	196	-	-	56,900	50,600	-	226
Aliphatics (>C_8-C_{10})	$\mu g/m^3$	40,257	101	-	27	-	29	615	-	362	368	247	-	-	**331,000**	**290,000**	-	201
Aliphatics (>C_{10}-C_{12})	$\mu g/m^3$	40,257	17	-	<15	-	22	223	-	339	351	<15	-	-	37,500	32,800	-	66
Aliphatics (>C_{12}-C_{16})	$\mu g/m^3$	40,257	<30	-	<30	-	<30	<30	-	150	157	<30	-	-	<750	<750	-	<30
Aromatics (C_6-C_8)	$\mu g/m^3$	805	<15	-	<15	-	<15	65	-	17	15	45	-	-	**121,000**	**104,000**	-	<15
Aromatics (>C_8-C_{10})	$\mu g/m^3$	805	<15	-	<15	-	<15	65	-	16	<15	45	-	-	**121,000**	**104,000**	-	<15
Aromatics (>C_{10}-C_{12})	$\mu g/m^3$	8,051	<15	-	<15	-	<15	<15	-	<15	<15	<15	-	-	5,780	5,080	-	<15
Aromatics (>C_{12}-C_{16})	$\mu g/m^3$	8,051	<30	-	<30	-	<30	<30	-	<30	<30	<30	-	-	<750	<750	-	<30
Linear & Cyclic Methyl Siloxanes																		
Hexamethylcyclotrisiloxane, D3(CVMS)	$\mu g/m^3$	NG	<170	-	<170	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Octamethylcyclotetrasiloxane, D4(CVMS)	$\mu g/m^3$	NG	<170	-	<170	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Decamethylcyclopentasiloxane, D5(CVMS)	$\mu g/m^3$	NG	<170	-	<170	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Dodecamethylcyclohexasiloxane, D6(CVMS)	$\mu g/m^3$	NG	<170	-	210	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Hexamethyldisiloxane, MM(LVMS)	$\mu g/m^3$	NG	<170	-	<170	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Octamethyltrisiloxane, MDM(LVMS)	$\mu g/m^3$	NG	<170	-	<170	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Decamethyltetrasiloxane, MD2M(LVMS)	$\mu g/m^3$	NG	<170	-	<170	-	-	<170	-	-	-	<170	-	-	<170	-	-	-
Dodecamethylpentasiloxane, MD3M(LVMS)	$\mu g/m^3$	NG	<170	-	320	-	-	<170	-	-	-	170	-	-	<170	-	-	-
Hydrocarbons																		
Benzene	$\mu g/m^3$	41	9.62	3.06	1.41	0.77	5.08	11.6	<15	11.5	10.9	6.56	<0.32	<0.51	**1,570**	**1,500**	**1460**	7.09
Toluene	$\mu g/m^3$	75,190	18.7	3.0	1.05	0.76	0.75	8.91	<36	6.9	6.1	2.15	<0.75	22.1	1,280	1,230	135	1.02
Ethylbenzene	$\mu g/m^3$	68,650	<0.87	96.2	<0.87	<0.87	<0.43	2.42	<42	0.56	<0.43	1.08	<0.87	2.2	12,600	11,500	15,200	0.52
Xylenes (m & p)	$\mu g/m^3$	NG	3.1	129	<1.7	<1.7	<0.43	35	<84	1.3	0.87	59	<1.7	4.1	106,000	95,800	19,800	0.65
Xylene (o)	$\mu g/m^3$	NG	<0.87	3.28	<0.87	<0.87	<0.87	7.62	<42	3.43	1.04	2.23	<0.87	<1.4	7,400	6,700	352	1.39
Xylenes Total	$\mu g/m^3$	3,520	3.1	132	<2.0	<2.0	<1.3	42.7	<96	4.7	1.9	61.2	<2.0	4.1	**113,000**	**102,000**	**20,200**	2
Styrene	$\mu g/m^3$	3,220	<0.85	<0.85	<0.85	<0.85	<0.85	<0.85	<41	<0.85	<0.85	<0.85	<0.85	<1.4	<280	<280	<41	<0.85
F1 (C_6-C_{10})	$\mu g/m^3$	867,383	175	2420	63	387	53	1,410	9820	816	782	448	<15	40	543,000	478,000	291,000	404
F2 (C_{10}-C_{16})	$\mu g/m^3$	52,495	38	737	<15	77	30	375	<720	530	551	<15	<15	34	**67,600**	**59,700**	**96,100**	72
Alcohols																		
Isopropanol	$\mu g/m^3$	6,219	3.6	-	<2.5	-	-	<2.5	-	-	-	6.0	-	-	<61	<61	-	-
High Level Fixed Gases																		
Nitrogen	%	NG	79.7	76.9	78	76.8	78.8	74	73.3	80.2	80.3	75.8	75.7	76.7	3.4	2.4	30.7	82.7
Oxygen	%	NG	21.5	22.2	21.1	21.2	20.4	2.58	1.64	2.42	2.43	19.6	20.2	21.3	0.87	0.57	8.09	15.2
Carbon Dioxide	%	NG	0.190	0.164	0.404	2.08	0.548	16.1	19.1	15.6	15.7	2.84	3.58	1.85	30.6	26.7	22	2.24
Carbon Monoxide	%	NG	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Methane	%	NG	<0.050	<0.050	<0.050	<0.050	<0.050	4.63	5.14	3.36	3.37	<0.050	<0.050	<0.050	57.8	58.8	40.1	<0.050
Hydrocarbon Gases (C_1 to C_5)																		
Methane	%	NG	0.00026	0.00017	0.00023	<0.00010	<0.050	-	-	3.36	3.37	0.0108	0.00075	0.00416	-	-	-	<0.050
Ethane	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	<0.00020	<0.00020	<0.00020	0.0079	0.00747	0.00705	-
Ethene	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	<0.00020	<0.00020	<0.00020	0.0216	0.0223	0.0102	-
Propane	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	<0.00020	<0.00020	<0.00020	0.00027	0.00028	0.00022	-
Propene	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	<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	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	-
Pentane	%	NG	<0.00020	<0.00020	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	-
Polycyclic Aromatic Hydrocarbons (PAHs)																		
Naphthalene	$\mu g/m^3$	380	<2.6	<1.0	<2.6	<1.0	<0.52	<2.6	<50	<0.52	<0.52	<2.6	<1.0	<1.7	<860*	<860*	<50	<0.52

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 8 to 11 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-03				VW-04			VW-05		VW-05	22VW-06
Field ID			VW-01	VW-01	VW-02	VW-02	VW-02	VW-03	VW-03	VW-03	DUPLICATE	VW-04	VW-04	DUPLICATE	VW-05	19DUP01	VW-05	22VW-06
Sample Date			6-Dec-2019	19-Nov-2021	6-Dec-2019	19-Nov-2021	01-Jun-2023	6-Dec-2019	19-Nov-2021	01-Jun-2023	01-Jun-2023	6-Dec-2019	19-Nov-2021	19-Nov-2021	6-Dec-2019	6-Dec-2019	19-Nov-2021	01-Jun-2023
Lab Report Number			L2393575	L2671030	L2393575	L2671030	CG2307273	L2393575	L2671030	CG2307273	CG2307273	L2393575	L2671030	L2671030	L2393575	L2393575	L2671030	CG2307273
Laboratory ID			L2393575-1 / L2393575-7	L2671030-1	L2393575-2 / L2393575-8	L2671030-2	CG2307273-001	L2393575-3 / L2393575-9	L2671030-3	CG2307273-002	CG2307273-004	L2393575-4 / L2393575-10	L2671030-4	L2671030-6	L2393575-5 / L2393575-11	L2393575-6	L2671030-5	CG2307273-003
Parameter	**Unit**	**$\mu g/m^3$**																
Volatile Organic Compounds (VOCs)																		
1,1,1-Trichloroethane	$\mu g/m^3$	1,693,510	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<52	<1.1	<1.1	<1.1	<1.1	<1.7	<360	<360	<52	<1.1
1,1,2,2-Tetrachloroethane	$\mu g/m^3$	11	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<66*	<1.4	<1.4	<1.4	<1.4	<2.2	<450*	<450*	<66*	<1.4
1,1,2-Trichloroethane	$\mu g/m^3$	7	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<52*	<1.1	<1.1	<1.1	<1.1	<1.7	<360*	<360*	<52*	<1.1
1,1-Dichloroethane	$\mu g/m^3$	430	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<39	<0.81	<0.81	<0.81	<0.81	<1.3	<260	<260	<39	<0.81
1,1-Dichloroethene	$\mu g/m^3$	6,470	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<38	<0.79	<0.79	<0.79	<0.79	<1.3	<260	<260	<38	<0.79
1,2,4-Trichlorobenzene	$\mu g/m^3$	365	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<71	<1.5	<1.5	<1.5	<1.5	<2.4	<490*	<490*	<71	<1.5
1,2,4-Trimethylbenzene	$\mu g/m^3$	2,235	<0.98	14.7	<0.98	0.99	<1.0	7.07	<47	1.2	<1.0	1.38	<0.98	<1.6	**9,100**	**7,400**	**4480**	<1.0
1,2-Dibromoethane	$\mu g/m^3$	2.2	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<74*	<1.5	<1.5	<1.5	<1.5	<2.5*	<500*	<500*	<74*	<1.5
1,2-Dichlorobenzene	$\mu g/m^3$	7,072	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<58	<1.2	<1.2	<1.2	<1.2	<1.9	<390	<390	<58	<1.2
1,2-Dichloroethane	$\mu g/m^3$	24	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<39*	<0.81	<0.81	<0.81	<0.81	<1.3	<260*	<260*	<39*	<0.81
1,2-Dichloroethene (cis)	$\mu g/m^3$	242	<0.79	1.05	<0.79	<0.79	<0.79	**3,140**	**3400**	**1,820**	**2,000**	1.14	<0.79	<1.3	<260*	<260*	188	<0.79
1,2-Dichloroethene (trans)	$\mu g/m^3$	1,400	<0.79	<0.79	<0.79	<0.79	<0.79	116	229	156	163	5.18	<0.79	<1.3	1,100	1,110	778	<0.79
1,2-Dichloropropane	$\mu g/m^3$	135	<0.92	<0.92	<0.92	<0.92	<0.9	<0.92	<44	<0.9	<0.9	<0.92	<0.92	<1.5	<300*	<300*	<44	<0.9
1,2-Dichlorotetrafluoroethane	$\mu g/m^3$	566,335	<1.4	<1.4	<1.4	<1.4	<1.4	48.3	<67	26.8	20.5	3.6	<1.4	4.2	2,980	3,020	8550	<1.4
1,3,5-Trimethylbenzene	$\mu g/m^3$	2,235	<0.98	12.9	<0.98	<0.98	<1.0	3.24	<47	1.1	<1.0	1.28	<0.98	<1.6	**5,090**	**4,250**	**3410**	<1.0
1,3-Butadiene	$\mu g/m^3$	17	<0.44	<0.44	<0.44	<0.44	<0.44	<0.44	<21*	<3.27	<1.77	<0.44	<0.44	<0.71	<140*	<140*	<60*	<0.44
1,3-Dichlorobenzene	$\mu g/m^3$	64	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<58	<1.2	<1.2	<1.2	<1.2	<1.9	<390*	<390*	<58	<1.2
1,3-Dichloropropene [cis]	$\mu g/m^3$	163	<0.91	<0.91	<0.91	<0.91	<0.9	<0.91	<44	<0.9	<0.9	<0.91	<0.91	<1.5	<300*	<300*	<44	<0.9
1,3-Dichloropropene [trans]	$\mu g/m^3$	149	<0.91	<0.91	<0.91	<0.91	<0.9	<0.91	<44	<0.9	<0.9	<0.91	<0.91	<1.5	<300*	<300*	<44	<0.9
1,4-Dichlorobenzene	$\mu g/m^3$	64	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<58	<1.2	<1.2	<1.2	<1.2	<1.9	<390*	<390*	**105**	<1.2
1,4-Dioxane	$\mu g/m^3$	105	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<35	<0.72	<0.72	<0.72	<0.72	<1.2	<240*	<240*	<35	<0.72
1-Methyl-4 ethyl benzene	$\mu g/m^3$	14,461	<0.98	6.52	<0.98	<0.98	<1.0	1.59	<47	<1.0	<1.0	<0.98	<0.98	<1.6	1,890	1,510	1660	<1.0
2-Butanone (MEK)	$\mu g/m^3$	167,364	1.67	1.2	0.78	1.01	2.03	0.87	<28	<0.59	<0.59	1.76	0.90	<0.94	<190	<190	<28	1.39
2-Hexanone (MBK)	$\mu g/m^3$	1,053	<4.1	<4.1	<4.1	<4.1	<4.10	<5.4	<200	<5.74	<5.74	<4.1	<4.1	<6.6	<1,600*	<1,600*	<200	<4.10
4-Methyl-2-pentanone (MIBK)	$\mu g/m^3$	102,977	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<39	<5.16	<5.24	<0.82	<0.82	<1.3	<270*	<270*	<39	<4.10
Acetone	$\mu g/m^3$	918,788	22.8	4.5	8.0	2.7	16.6	<9.8	<57	<17.8	<14.5	14.6	2.1	23.5	840	<390	<57	12.8
Allyl chloride	$\mu g/m^3$	32	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<30	<0.63	<0.63	<0.63	<0.63	<1.0	<200*	<200*	<30	<0.63
Benzyl chloride	$\mu g/m^3$	34	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<50*	<1.0	<1.0	<1.0	<1.0	<1.7	<340*	<340*	<50*	<1.0
Bromodichloromethane	$\mu g/m^3$	28	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<64*	<1.3	<1.3	<1.3	<1.3	<2.1	<440*	<440*	<64*	<1.3
Bromoform	$\mu g/m^3$	1,494	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<99	<2.1	<2.1	<2.1	<2.1	<3.3	<680	<680	<99	<2.1
Bromomethane	$\mu g/m^3$	173	<0.78	<0.78	<0.78	<0.78	<0.78	<0.78	<37	<0.78	<0.78	<0.78	<0.78	<1.2	<250*	<250*	<37	<0.78
Carbon disulfide	$\mu g/m^3$	21,713	1.97	<0.62	3.67	0.75	8	3.84	<30	4.4	4	4.41	<0.62	<1.0	<200	<200	<30	33.6
Carbon tetrachloride	$\mu g/m^3$	113	<1.3	<1.3	<1.3	<1.3	<1.26	<1.3	<61	<1.26	<1.26	<1.3	<1.3	<2.0	<410*	<410*	<61	<1.26
Chlorobenzene	$\mu g/m^3$	347	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<44	<0.92	<0.92	<0.92	<0.92	<1.5	<300	<300	<44	<0.92
Chloroethane	$\mu g/m^3$	124,080	<0.53	<0.53	<0.53	<0.53	<0.53	11.8	<25	<6.86	<6.86	1.82	<0.53	<0.84	430	470	441	<0.53
Chloroform	$\mu g/m^3$	27	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<47*	<0.98	<0.98	<0.98	<0.98	<1.6	<320*	<320*	<47*	20.8
Chloromethane	$\mu g/m^3$	2,657	1.39	0.80	1.46	2.12	3.53	1.32	<20	<0.41	<0.41	1.98	<0.41	<0.66	<140	<140	<20	1.26
Cyclohexane	$\mu g/m^3$	201,510	3.66	2.6	0.72	<0.69	<0.69	71.8	103	54	52.3	11.8	<0.69	<1.1	2,290	2,380	2230	8.67
Dibromochloromethane	$\mu g/m^3$	6,070	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<82	<1.7	<1.7	<1.7	<1.7	<2.7	<560	<560	<82	<1.7
Dichlorodifluoromethane	$\mu g/m^3$	3,584	5.73	2.52	2.42	2.68	2.3	18.7	<48	14.3	10.8	128	4.23	6.1	**217,000**	**241,000**	**9160**	2.6
Ethyl acetate	$\mu g/m^3$	2,509	5.75	<0.72	<0.72	<0.72	7.57	<0.72	<35	<2.09	<2.09	-	<0.72	3.2	<240	<240	<35	<1.37
Freon 113	$\mu g/m^3$	230,627	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<74	<1.5	<1.5	<1.5	<1.5	<2.5	<500	<500	<74	<1.5
Heptane	$\mu g/m^3$	14,461	2.38	11.3	<0.82	<0.82	<0.82	17.6	<39	13.1	12.4	12.4	<0.82	<1.3	6,100	6,100	6760	<0.82
Hexachlorobutadiene	$\mu g/m^3$	51	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<100*	<2.1	<2.1	<2.1	<2.1	<3.4	<700*	<700*	<100*	<2.1
Hexane	$\mu g/m^3$	18,839	7.59	3.67	1.6	0.92	1.09	46.3	68	28.4	27.1	14.5	<0.70	3.9	2,940	2,890	3200	2.04
Isooctane	$\mu g/m^3$	14,917	<0.93	<0.93	<0.93	<0.93	<0.9	29.7	<45	<21.5	<20.6	2.68	<0.93	<1.5	520	540	465	<2.5
iso-Propylbenzene (cumene)	$\mu g/m^3$	14,461	1.13	5.51	<0.98	<0.98	<1.0	<0.98	<47	<1.0	<1.0	<0.98	<0.98	<1.6	990	880	941	4.3
Methyl t-Butyl Ether (MTBE)	$\mu g/m^3$	1,153	4.72	<0.72	<0.72	<0.72	<0.72	<0.72	<35	<0.72	<0.72	<0.72	<0.72	<1.2	<240	<240	<35	<0.72
Methylene Chloride	$\mu g/m^3$	18,764	1.80	<0.69	<0.69	<0.69	1.15	<0.69	<33	0.73	<0.69	<0.69	0.85	4.8	<230	<230	<33	<0.69
Propene	$\mu g/m^3$	91,723	<0.34	<4.6	<0.34	<2.6	<13.8	<0.34	182	<104	<119	<0.34	<0.34	<0.86	<110	<110	2540	<38.2
Tetrachloroethene	$\mu g/m^3$	1,390	<1.4	<1.4	<1.4	6.4	<1.4	<1.4	<65	<1.4	<1.4	<1.4	<1.4	<2.2	<440	<440	<65	<1.4
Tetrahydrofuran	$\mu g/m^3$	62,828	<0.59	<0.59	<0.59	<0.59	7.49	<0.59	<28	5.78	2	<0.59	<0.59	<0.94	<190	<190	<28	<0.59
Trichloroethene	$\mu g/m^3$	70	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<52	<1.1	<1.1	<1.1	<1.1	<1.7	<350*	<350*	<52	<1.1
Trichlorofluoromethane	$\mu g/m^3$	34,325	1.3	1.1	1.8	1.7	1.1	<1.1	<54	<1.1	<1.1	3.5	2.4	2.1	<370	<370	<54	2
Vinyl acetate	$\mu g/m^3$	6,586	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<85	<19.7	<19.5	<1.8	<1.8	<2.8	<580	<580	<85	<3.4
Vinyl bromide (bromoethene)	$\mu g/m^3$	40	<0.87	<0.87	<0.87	<0.87	<0.9	<0.87	<42*	<0.9	<0.9	<0.87	<0.87	<1.4	<290*	<290*	<42*	<0.9
Vinyl chloride	$\mu g/m^3$	70	<0.51	<0.51	<0.51	<0.51	<0.51	**5,220**	**5020**	**4,010**	**3,760**	2.44	<0.51	<0.82	**550**	**570**	**1000**	<0.51

Notes:

[1] Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours. Refer to Tables 8 to 11 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

* = Detection limit raised above criteria.

Table 7: Soil Vapour Quality Assurance/Quality Control Analytical Results

		Field ID	VW-05	19DUP01	RPD (%)	VW-04	DUPLICATE	RPD (%)	VW-03	DUPLICATE	RPD (%)
		Sample Date	6-Dec-2019	6-Dec-2019		19-Nov-2021	19-Nov-2021		01-Jun-2023	01-Jun-2023	
		Lab Report Number	L2393575	L2393575		L2671030	L2671030		CG2307273	CG2307273	
		Laboratory ID	L2393575-5 / L2393575-11	L2393575-6		L2671030-4	L2671030-6		CG2307273-002	CG2307273-004	
Parameter	**Unit**	**RDL**									
Field Tests											
Air Volume	L	0.01	0.06	-	-	-	-	-	-	-	-
Initial Pressure	in Hg	-30	-6.1	-6.7	-	-8.40	-3.50	-	-9.19	8.99	-
Aliphatic/Aromatic PHC Sub-Fractionation											
Aliphatics (C_6-C_8)	µg/m^3	15	56,900	50,600	12	-	-	-	479	456	5
Aliphatics (>C_8-C_{10})	µg/m^3	15	331,000	290,000	13	-	-	-	362	368	2
Aliphatics (>C_{10}-C_{12})	µg/m^3	15	37,500	32,800	13	-	-	-	339	351	3
Aliphatics (>C_{12}-C_{16})	µg/m^3	30	<750	<750	-	-	-	-	150	157	5
Aromatics (C_6-C_8)	µg/m^3	15	-	-	-	-	-	-	17	15	-
Aromatics (>C_8-C_{10})	µg/m^3	15	121,000	104,000	15	-	-	-	16	<15	-
Aromatics (>C_{10}-C_{12})	µg/m^3	15	5,780	5,080	13	-	-	-	<15	<15	-
Aromatics (>C_{12}-C_{16})	µg/m^3	30	<750	<750	-	-	-	-	<30	<30	-
Linear & Cyclic Methyl Siloxanes											
Hexamethylcyclotrisiloxane, D3(CVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Octamethylcyclotetrasiloxane, D4(CVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Decamethylcyclopentasiloxane, D5(CVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Dodecamethylcyclohexasiloxane, D6(CVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Hexamethyldisiloxane, MM(LVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Octamethyltrisiloxane, MDM(LVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Decamethyltetrasiloxane, MD2M(LVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Dodecamethylpentasiloxane, MD3M(LVMS)	µg/m^3	170	<170	-	-	-	-	-	-	-	-
Hydrocarbons											
Benzene	µg/m^3	0.64	1,570	1,500	5	<0.32	<0.51	-	11.5	10.9	5
Toluene	µg/m^3	0.75	1,280	1,230	4	<0.75	22.1	-	6.9	6.1	12
Ethylbenzene	µg/m^3	0.87	12,600	11,500	9	<0.87	2.2	-	0.56	<0.43	-
Xylenes (m & p)	µg/m^3	1.7	106,000	95,800	10	<1.7	4.1	-	1.3	0.87	-
Xylene (o)	µg/m^3	0.87	7,400	6,700	10	<0.87	<1.4	-	3.43	1.04	-
Xylenes Total	µg/m^3	2	113,000	102,000	10	<2.0	4.1	-	4.7	1.9	-
Styrene	µg/m^3	0.85	<280	<280	-	<0.85	<1.4	-	<0.85	<0.85	-
F1 (C_6-C_{10})	µg/m^3	15	543,000	478,000	13	<15	40	-	816	782	4
F2 (C_{10}-C_{16})	µg/m^3	15	67,600	59,700	12	<15	34	-	530	551	4
Alcohols											
Isopropanol	µg/m^3	2.5	<61	<61	-	-	-	-	-	-	-
High Level Fixed Gases											
Nitrogen	%	1	3.4	2.4	-	75.7	76.7	1	80.2	80.3	0
Oxygen	%	0.1	0.87	0.57	**34**	20.2	21.3	5	2.42	2.43	0
Carbon Dioxide	%	0.05	30.6	26.7	13	3.58	1.85	**64**	15.6	15.7	1
Carbon Monoxide	%	0.05	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050	-
Methane	%	0.05	57.8	58.8	2	<0.050	<0.050	-	3.36	3.37	0
Hydrocarbon Gases (C_1 to C_5)											
Methane	%	0.0001	-	-	-	0.00075	0.00416	**139**	3.36	3.37	0
Ethane	%	0.0002	0.0079	0.00747	5	<0.00020	<0.00020	-	-	-	-
Ethene	%	0.0002	0.0216	0.0223	3	<0.00020	<0.00020	-	-	-	-
Propane	%	0.0002	0.00027	0.00028	-	<0.00020	<0.00020	-	-	-	-
Propene	%	0.0002	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	-	-
Butane	%	0.0002	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	-	-
Pentane	%	0.0002	<0.00020	<0.00020	-	<0.00020	<0.00020	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)											
Naphthalene	µg/m^3	2.6	<860	<860	-	<1.0	<1.7	-	<0.52	<0.52	-

Notes:
- Not analyzed or RPD not calculated.
< Concentration is less than the laboratory detection limit indicated.

RDL - Laboratory reportable detection limit.

RPD - RPD is Relative Percentage Difference calculated as RPD(%)=(|V1-V2|/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.
RPDs have only been calculated where a concentration is greater than 5 times the RDL.
BOLD - RPD is greater than 20%.

Table 7: Soil Vapour Quality Assurance/Quality Control Analytical Results

			Field ID	VW-05	19DUP01	RPD (%)	VW-04	DUPLICATE	RPD (%)	VW-03	DUPLICATE	RPD (%)
			Sample Date	6-Dec-2019	6-Dec-2019		19-Nov-2021	19-Nov-2021		01-Jun-2023	01-Jun-2023	
			Lab Report Number	L2393575	L2393575		L2671030	L2671030		CG2307273	CG2307273	
			Laboratory ID	L2393575-5 / L2393575-11	L2393575-6		L2671030-4	L2671030-6		CG2307273-002	CG2307273-004	
Parameter	**Unit**	**RDL**										
Volatile Organic Compounds (VOCs)												
1,1,1-Trichloroethane	µg/m^3	1.1	<360	<360	-	<1.1	<1.7	-	<1.1	<1.1	-	
1,1,2,2-Tetrachloroethane	µg/m^3	1.4	<450	<450	-	<1.4	<2.2	-	<1.4	<1.4	-	
1,1,2-Trichloroethane	µg/m^3	1.1	<360	<360	-	<1.1	<1.7	-	<1.1	<1.1	-	
1,1-Dichloroethane	µg/m^3	0.81	<260	<260	-	<0.81	<1.3	-	<0.81	<0.81	-	
1,1-Dichloroethene	µg/m^3	0.79	<260	<260	-	<0.79	<1.3	-	<0.79	<0.79	-	
1,2,4-Trichlorobenzene	µg/m^3	1.5	<490	<490	-	<1.5	<2.4	-	<1.5	<1.5	-	
1,2,4-Trimethylbenzene	µg/m^3	0.98	9,100	7,400	21	<0.98	<1.6	-	1.2	<1.0	-	
1,2-Dibromoethane	µg/m^3	1.5	<500	<500	-	<1.5	<2.5	-	<1.5	<1.5	-	
1,2-Dichlorobenzene	µg/m^3	1.2	<390	<390	-	<1.2	<1.9	-	<1.2	<1.2	-	
1,2-Dichloroethane	µg/m^3	0.81	<260	<260	-	<0.81	<1.3	-	<0.81	<0.81	-	
1,2-Dichloroethene (cis)	µg/m^3	0.79	<260	<260	-	<0.79	<1.3	-	1,820	2,000	9	
1,2-Dichloroethene (trans)	µg/m^3	0.79	1,100	1,110	1	<0.79	<1.3	-	156	163	4	
1,2-Dichloropropane	µg/m^3	0.92	<300	<300	-	<0.92	<1.5	-	<0.9	<0.9	-	
1,2-Dichlorotetrafluoroethane	µg/m^3	1.4	2,980	3,020	1	<1.4	4.2	-	26.8	20.5	**27**	
1,3,5-Trimethylbenzene	µg/m^3	0.98	5,090	4,250	18	<0.98	<1.6	-	1.1	<1.0	-	
1,3-Butadiene	µg/m^3	0.44	<140	<140	-	<0.44	<0.71	-	<3.27	<1.77	-	
1,3-Dichlorobenzene	µg/m^3	1.2	<390	<390	-	<1.2	<1.9	-	<1.2	<1.2	-	
1,3-Dichloropropene [cis]	µg/m^3	0.91	<300	<300	-	<0.91	<1.5	-	<0.9	<0.9	-	
1,3-Dichloropropene [trans]	µg/m^3	0.91	<300	<300	-	<0.91	<1.5	-	<0.9	<0.9	-	
1,4-Dichlorobenzene	µg/m^3	1.2	<390	<390	-	<1.2	<1.9	-	<1.2	<1.2	-	
1,4-Dioxane	µg/m^3	0.72	<240	<240	-	<0.72	<1.2	-	<0.72	<0.72	-	
1-Methyl-4 ethyl benzene	µg/m^3	0.98	1,890	1,510	**22**	<0.98	<1.6	-	<1.0	<1.0	-	
2-Butanone (MEK)	µg/m^3	0.59	<190	<190	-	0.90	<0.94	-	<0.59	<0.59	-	
2-Hexanone (MBK)	µg/m^3	4.1	<1,600	<1,600	-	<4.1	<6.6	-	<5.74	<5.74	-	
4-Methyl-2-pentanone (MIBK)	µg/m^3	0.82	<270	<270	-	<0.82	<1.3	-	<5.16	<5.24	-	
Acetone	µg/m^3	1.2	840	<390	-	2.1	23.5	-	<17.8	<14.5	-	
Allyl chloride	µg/m^3	0.63	<200	<200	-	<0.63	<1.0	-	<0.63	<0.63	-	
Benzyl chloride	µg/m^3	1	<340	<340	-	<1.0	<1.7	-	<1.0	<1.0	-	
Bromodichloromethane	µg/m^3	1.3	<440	<440	-	<1.3	<2.1	-	<1.3	<1.3	-	
Bromoform	µg/m^3	2.1	<680	<680	-	<2.1	<3.3	-	<2.1	<2.1	-	
Bromomethane	µg/m^3	0.78	<250	<250	-	<0.78	<1.2	-	<0.78	<0.78	-	
Carbon disulfide	µg/m^3	0.62	<200	<200	-	<0.62	<1.0	-	4.4	4	10	
Carbon tetrachloride	µg/m^3	1.3	<410	<410	-	<1.3	<2.0	-	<1.26	<1.26	-	
Chlorobenzene	µg/m^3	0.92	<300	<300	-	<0.92	<1.5	-	<0.92	<0.92	-	
Chloroethane	µg/m^3	0.53	430	470	9	<0.53	<0.84	-	<6.86	<6.86	-	
Chloroform	µg/m^3	0.98	<320	<320	-	<0.98	<1.6	-	<0.98	<0.98	-	
Chloromethane	µg/m^3	0.41	<140	<140	-	<0.41	<0.66	-	<0.41	<0.41	-	
Cyclohexane	µg/m^3	0.69	2,290	2,380	4	<0.69	<1.1	-	54	52.3	3	
Dibromochloromethane	µg/m^3	1.7	<560	<560	-	<1.7	<2.7	-	<1.7	<1.7	-	
Dichlorodifluoromethane	µg/m^3	0.99	217,000	241,000	10	4.23	6.1	-	14.3	10.8	**28**	
Ethyl acetate	µg/m^3	0.72	<240	<240	-	<0.72	3.2	-	<2.09	<2.09	-	
Freon 113	µg/m^3	1.5	<500	<500	-	<1.5	<2.5	-	<1.5	<1.5	-	
Heptane	µg/m^3	0.82	6,100	6,100	0	<0.82	<1.3	-	13.1	12.4	5	
Hexachlorobutadiene	µg/m^3	2.1	<700	<700	-	<2.1	<3.4	-	<2.1	<2.1	-	
Hexane	µg/m^3	0.7	2,940	2,890	2	<0.70	3.9	-	28.4	27.1	5	
Isooctane	µg/m^3	0.93	520	540	4	<0.93	<1.5	-	<21.5	<20.6	-	
iso-Propylbenzene (cumene)	µg/m^3	0.98	990	880	12	<0.98	<1.6	-	<1.0	<1.0	-	
Methyl t-Butyl Ether (MTBE)	µg/m^3	0.72	<240	<240	-	<0.72	<1.2	-	<0.72	<0.72	-	
Methylene Chloride	µg/m^3	0.69	<230	<230	-	0.85	4.8	-	0.73	<0.69		
Propene	µg/m^3	0.34	<110	<110	-	<0.34	<0.86	-	<104	<119	-	
Tetrachloroethene	µg/m^3	1.4	<440	<440	-	<1.4	<2.2	-	<1.4	<1.4	-	
Tetrahydrofuran	µg/m^3	0.59	<190	<190	-	<0.59	<0.94	-	5.78	2	-	
Trichloroethene	µg/m^3	1.1	<350	<350	-	<1.1	<1.7	-	<1.1	<1.1	-	
Trichlorofluoromethane	µg/m^3	1.1	<370	<370	-	2.4	2.1	-	<1.1	<1.1	-	
Vinyl acetate	µg/m^3	1.8	<580	<580	-	<1.8	<2.8	-	<19.7	<19.5	-	
Vinyl bromide (bromoethene)	µg/m^3	0.87	<290	<290	-	<0.87	<1.4	-	<0.9	<0.9	-	
Vinyl chloride	µg/m^3	0.51	550	570	4	<0.51	<0.82	-	4,010	3,760	6	

Notes:
- Not analyzed or RPD not calculated.
< Concentration is less than the laboratory detection limit indicated.
RDL - Laboratory reportable detection limit.
RPD - RPD is Relative Percentage Difference calculated as RPD(%)=(|V1-V2|/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.
RPDs have only been calculated where a concentration is greater than 5 times the RDL.
BOLD - RPD is greater than 20%.

Table 8: 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.

Table 9: 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 10: 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 11: Generic Soil Vapour Criteria

Parameter	Units	Residential Land Use		
		Basement and Slab-on-Grade		
		Coarse-Grained	Units	Coarse-Grained
Benzene	mg/m^3	0.041	µg/m^3	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		919		918,788
Allyl chloride		0.03		32
Benzyl chloride		0.03		34
Bromodichloromethane		0.03		28
Bromoform		1.49		1,494
Bromomethane		0.17		173
Carbon disulfide		21.71		21,713
Carbon tetrachloride		0.11		113
Chlorobenzene		0.35		347
Chloroethane		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/m^3 milligrams per cubic metre.
µg/m^3 micrograms per cubic metre.

Table 12: Soil Vapour Risk Evaluation

Soil Vapour Results (µg/m³)

Parameter	Unit	Soil Vapour Screening Criteria [a]	VW-01		VW-02			VW-03			VW-04		VW-05		22VW-06
			6-Dec-19	19-Nov-21	6-Dec-19	19-Nov-21	1-Jun-23	6-Dec-19	19-Nov-21	1-Jun-23	6-Dec-19	19-Nov-21	6-Dec-19	19-Nov-21	1-Jun-23
Benzene	µg/m³	41	9.62	3.06	1.41	0.77	5.08	11.6	<15	11.5	6.56	<0.32	1,570	1460	7.09
Toluene	µg/m³	75,190	18.7	3.0	1.05	0.76	0.75	8.91	<36	6.9	2.15	22.1	1,280	135	1.02
Ethylbenzene	µg/m³	68,650	<0.87	96.2	<0.87	<0.87	<0.43	2.42	<42	0.56	1.08	2.2	12,600	15,200	0.52
Xylenes Total	µg/m³	3,520	3.1	132	<2.0	<2.0	<1.3	42.7	<96	4.7	61.2	4.1	113,000	20,200	2
F1 (C_6-C_{10})	µg/m³	867,383	175	2420	63	387	53	1,410	9820	816	448	40	543,000	291,000	404
F2 (C_{10}-C_{16})	µg/m³	52,495	38	737	<15	77	30	375	<720	551	<15	34	67,600	96,100	72
Aliphatics (C_6-C_8)	µg/m³	740,737	73	-	45	-	19	912	-	479	196	-	56,900	-	226
Aliphatics (>C_8-C_{10})	µg/m³	40,257	101	-	27	-	29	615	-	368	247	-	331,000	-	201
Aliphatics (>C_{10}-C_{12})	µg/m³	40,257	17	-	<15	-	22	223	-	351	<15	-	37,500	-	66
Aliphatics (>C_{12}-C_{16})	µg/m³	40,257	<30	-	<30	-	<30	<30	-	157	<30	-	<750	-	<30
Aromatics (>C_8-C_{10})	µg/m³	805	<15	-	<15	-	<15	65	-	16	45	-	121,000	-	<15
Aromatics (>C_{10}-C_{12})	µg/m³	8,051	<15	-	<15	-	<15	<15	-	<15	<15	-	5,780	-	<15
Isopropanol	µg/m³	6,219	3.6	-	<2.5	-	-	<2.5	-	-	6.0	-	<61	-	-
1,2,4-Trimethylbenzene	µg/m³	2,235	<0.98	14.7	<0.98	0.99	<1.0	7.07	<47	1.2	1.38	<0.98	9,100	4480	<1.0
1,2-Dichloroethene (cis)	µg/m³	242	<0.79	1.05	<0.79	<0.79	<0.79	3,140	3400	2,000	1.14	<0.79	<260*	188	<0.79
1,2-Dichloroethene (trans)	µg/m³	1,400	<0.79	<0.79	<0.79	<0.79	<0.79	116	229	163	5.18	<0.79	1,110	778	<0.79
1,2-Dichlorotetrafluoroethane	µg/m³	566,335	<1.4	<1.4	<1.4	<1.4	<1.4	48.3	<67	26.8	3.6	4.2	3,020	8550	<1.4
1,3,5-Trimethylbenzene	µg/m³	2,235	<0.98	12.9	<0.98	<0.98	<1.0	3.24	<47	1.1	1.28	<0.98	5,090	3410	<1.0
1,4-Dichlorobenzene	µg/m³	2,121 / 64[e]	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<58	<1.2	<1.2	<1.2	<390*	105	<1.2
1-Methyl-4 ethyl benzene	µg/m³	14,461	<0.98	6.52	<0.98	<0.98	<1.0	1.59	<47	<1.0	<0.98	<0.98	1,890	1660	<1.0
2-Butanone (MEK)	µg/m³	167,364	1.67	1.2	0.78	1.01	2.03	0.87	<28	<0.59	1.76	0.90	<190	<28	1.39
Acetone	µg/m³	918,788	22.8	4.5	8.0	2.7	16.6	<9.8	<57	<17.8	14.6	23.5	840	<57	12.8
Carbon disulfide	µg/m³	21,713	1.97	<0.62	3.67	0.75	8	3.84	<30	4.4	4.41	<0.62	<200	<30	33.6
Chloroethane	µg/m³	124,080	<0.53	<0.53	<0.53	<0.53	<0.53	11.8	<25	<6.86	1.82	<0.53	470	441	<0.53
Chloroform	µg/m³	869 / 27[e]	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<47*	<0.98	<0.98	<0.98	<320*	<47*	20.8
Chloromethane	µg/m³	2,657	1.39	0.80	1.46	2.12	3.53	1.32	<20	<0.41	1.98	<0.41	<140	<20	1.26
Cyclohexane	µg/m³	201,510	3.66	2.6	0.72	<0.69	<0.69	71.8	103	54	11.8	<0.69	2,380	2230	8.67
Dichlorodifluoromethane	µg/m³	3,584	5.73	2.52	2.42	2.68	2.3	18.7	<48	14.3	128	6.1	241,000	9160	2.6
Ethyl acetate	µg/m³	2,509	5.75	<0.72	<0.72	<0.72	7.57	<0.72	<35	<2.09	-	3.2	<240	<35	<1.37
Heptane	µg/m³	14,461	2.38	11.3	<0.82	<0.82	<0.82	17.6	<39	13.1	12.4	<1.3	6,100	6760	<0.82
Hexane	µg/m³	18,839	7.59	3.67	1.6	0.92	1.09	46.3	68	28.4	14.5	3.9	2,940	3200	2.04
Isooctane	µg/m³	14,917	<0.93	<0.93	<0.93	<0.93	<0.9	29.7	<45	<21.5	2.68	<1.5	540	465	<2.5
iso-Propylbenzene (cumene)	µg/m³	14,461	1.13	5.51	<0.98	<0.98	<1.0	<0.98	<47	<1.0	<0.98	<1.6	990	941	4.3
Methyl t-Butyl Ether (MTBE)	µg/m³	1,153	4.72	<0.72	<0.72	<0.72	<0.72	<0.72	<35	<0.72	<0.72	<1.2	<240	<35	<0.72
Methylene Chloride	µg/m³	18,764 / 62,546[e]	1.80	<0.69	<0.69	<0.69	1.15	<0.69	<33	0.73	<0.69	4.8	<230	<33	<0.69
Propene	µg/m³	91,723	<0.34	<4.6	<0.34	<2.6	<13.8	<0.34	182	<104	<0.34	<0.86	<110	2540	<38.2
Tetrachloroethene	µg/m³	1,392 / 2679[e]	<1.4	<1.4	<1.4	6.4	<1.4	<1.4	<65	<1.4	<1.4	<2.2	<440	<65	<1.4
Tetrahydrofuran	µg/m³	62,828	<0.59	<0.59	<0.59	<0.59	7.49	<0.59	<28	5.78	<0.59	<0.94	<190	<28	<0.59
Trichlorofluoromethane	µg/m³	6,586	1.3	1.1	1.8	1.7	1.1	<1.1	<54	<1.1	3.5	2.4	<370	<54	2
Vinyl chloride	µg/m³	3,086 / 70[e]	<0.51	<0.51	<0.51	<0.51	<0.51	5,220	5020	4,010	2.44	<0.51	570	1000	<0.51
Cumulative Risk and Hazard Index [d]															
Target Risk and Hazard Levels															

Comparisons of Soil Vapour Measurements to Soil Vapour Criteria – Estimated Cancer Risk [b]

Parameter	VW-01		VW-02			VW-03			VW-04		VW-05		22VW-06
	6-Dec-19	19-Nov-21	6-Dec-19	19-Nov-21	1-Jun-23	6-Dec-19	19-Nov-21	1-Jun-23	6-Dec-19	19-Nov-21	6-Dec-19	19-Nov-21	1-Jun-23
Benzene	2.35E-06	7.46E-07	3.44E-07	1.88E-07	1.24E-06	2.83E-06	ND	2.80E-06	1.60E-06	ND	**3.83E-04**	**3.56E-04**	1.73E-06
Toluene	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes Total	-	-	-	-	-	-	-	-	-	-	-	-	-
F1 (C_6-C_{10})	-	-	-	-	-	-	-	-	-	-	-	-	-
F2 (C_{10}-C_{16})	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics (C_6-C_8)	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics (>C_8-C_{10})	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics (>C_{10}-C_{12})	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics (>C_{12}-C_{16})	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics (>C_8-C_{10})	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics (>C_{10}-C_{12})	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropanol	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene (cis)	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene (trans)	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorotetrafluoroethane	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.64E-05	ND
1-Methyl-4 ethyl benzene	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone (MEK)	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.70E-06
Chloromethane	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclohexane	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl acetate	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptane	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane	-	-	-	-	-	-	-	-	-	-	-	-	-
Isooctane	-	-	-	-	-	-	-	-	-	-	-	-	-
iso-Propylbenzene (cumene)	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl t-Butyl Ether (MTBE)	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	2.88E-10	ND	ND	ND	1.84E-10	ND	ND	1.17E-10	ND	7.67E-10	ND	ND	ND
Propene	-	-	-	-		-	-		-	-	-	-	-
Tetrachloroethene	ND	ND	ND	2.39E-08	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	ND	ND	ND	ND	ND	**7.46E-04**	**7.17E-04**	**5.73E-04**	3.49E-07	ND	**8.14E-05**	**1.43E-04**	ND
Cumulative Risk and Hazard Index [d]	2.3E-06	7.5E-07	3.4E-07	2.1E-07	1.2E-06	**7.5E-04**	**7.2E-04**	**5.8E-04**	1.9E-06	7.7E-10	**4.6E-04**	**5.2E-04**	9.4E-06
Target Risk and Hazard Levels	**1.0 x 10^{-5}**												

Comparisons of Soil Vapour Measurements to Soil Vapour Criteria – Estimated Hazard Quotients [c]

Parameter	VW-01		VW-02			VW-03			VW-04		VW-05		22VW-06
	6-Dec-19	19-Nov-21	6-Dec-19	19-Nov-21	1-Jun-23	6-Dec-19	19-Nov-21	1-Jun-23	6-Dec-19	19-Nov-21	6-Dec-19	19-Nov-21	1-Jun-23
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	0.000249	0.000040	0.000014	0.000010	0.000010	0.000118	ND	0.000092	0.000029	ND	0.017024	0.001795	0.000014
Ethylbenzene	ND	0.001401	ND	ND	ND	0.000035	ND	0.000008	0.000016	ND	0.183540	**0.221413**	0.000008
Xylenes Total	0.000881	0.037500	ND	ND	ND	0.012131	ND	0.001335	0.017386	ND	**32.102273**	**5.738636**	0.000568
F1 (C_6-C_{10})	0.000202	0.002790	0.000073	0.000446	0.000061	0.001626	0.011321	0.000941	0.000516	ND	**0.626021**	**0.335492**	0.000466
F2 (C_{10}-C_{16})	0.000724	0.014039	ND	0.001467	0.000571	0.007144	ND	0.010496	ND	ND	**1.287742**	**1.830651**	0.001372
Aliphatics (C_6-C_8)	0.000099	-	0.000061	-	0.000026	0.001231	-	0.000647	0.000265	-	0.076815	-	0.000305
Aliphatics (>C_8-C_{10})	0.002509	-	0.000671	-	0.000720	0.015277	-	0.009141	0.006136	-	**8.222083**	-	0.004993
Aliphatics (>C_{10}-C_{12})	0.000422	-	ND	-	0.000546	0.005539	-	0.008719	ND	-	**0.931505**	-	0.001639
Aliphatics (>C_{12}-C_{16})	ND	-	ND	-	ND	ND	-	0.003900	ND	-	ND	-	ND
Aromatics (>C_8-C_{10})	ND	-	ND	-	ND	0.080730	-	0.019872	0.055890	-	**150.282556**	-	ND
Aromatics (>C_{10}-C_{12})	ND	-	ND	-	ND	ND	-	ND	ND	-	0.717880	-	ND
Isopropanol	0.000579	-	ND	-	ND	ND	-	ND	0.000965	-	ND	-	ND
1,2,4-Trimethylbenzene	ND	0.006577	ND	0.000443	ND	0.003163	ND	0.000537	0.000617	ND	**4.071588**	**2.004474**	ND
1,2-Dichloroethene (cis)	ND	0.004341	ND	ND	ND	**12.982717**	**14.057719**	**8.269247**	0.004713	ND	ND	**0.777309**	ND
1,2-Dichloroethene (trans)	ND	ND	ND	ND	ND	0.082857	0.163571	0.116429	0.003700	ND	**0.792857**	**0.555714**	ND
1,2-Dichlorotetrafluoroethane	ND	ND	ND	ND	ND	0.000085	ND	0.000047	0.000006	ND	0.005333	0.015097	ND
1,3,5-Trimethylbenzene	ND	0.005773	ND	ND	ND	0.001450	ND	0.000492	0.000573	ND	**2.277853**	**1.526027**	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.049505	ND
1-Methyl-4 ethyl benzene	ND	0.000451	ND	ND	ND	0.000110	ND	ND	ND	ND	0.130696	0.114792	ND
2-Butanone (MEK)	0.000010	0.000007	0.000005	0.000006	0.000012	0.000005	ND	ND	0.000011	0.000005	ND	ND	0.000008
Acetone	0.000025	0.000005	0.000009	0.000003	0.000018	ND	ND	ND	0.000016	0.000026	0.000914	ND	0.000014
Carbon disulfide	0.000091	ND	0.000169	0.000035	0.000368	0.000177	ND	0.000203	0.000203	ND	ND	ND	0.001547
Chloroethane	ND	ND	ND	ND	ND	0.000095	ND	ND	0.000015	ND	0.003788	0.003554	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.023936
Chloromethane	0.000523	0.000301	0.000549	0.000798	0.001329	0.000497	ND	ND	0.000745	ND	ND	ND	0.000474
Cyclohexane	0.000018	0.000013	0.000004	ND	ND	0.000356	0.000511	0.000268	0.000059	ND	0.011811	0.011066	0.000043
Dichlorodifluoromethane	0.001599	0.000703	0.000675	0.000748	0.000642	0.005218	ND	0.003990	0.035714	0.001702	**67.243304**	**2.555804**	0.000725
Ethyl acetate	0.002292	ND	ND	ND	0.003017	ND	ND	ND	ND	ND	ND	ND	ND
Heptane	0.000165	0.000781	ND	ND	ND	0.001217	ND	0.000906	0.000857	ND	**0.421824**	**0.467464**	ND
Hexane	0.000403	0.000195	0.000085	0.000049	0.000058	0.002458	0.003610	0.001508	0.000770	0.000207	0.156059	0.169860	0.000108
Isooctane	ND	ND	ND	ND	ND	0.001991	ND	ND	0.000180	ND	0.036200	0.031172	ND
iso-Propylbenzene (cumene)	0.000078	0.000381	ND	ND	ND	ND	ND	ND	ND	ND	0.068462	0.065074	0.000297
Methyl t-Butyl Ether (MTBE)	0.004094	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	0.000096	ND	ND	ND	0.000061	ND	ND	0.000039	ND	0.000256	ND	ND	ND
Propene	ND	ND	ND	ND	ND	ND	0.001984	ND	ND	ND	ND	0.027692	ND
Tetrachloroethene	ND	ND	ND	0.004598	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	ND	ND	ND	0.000119	ND	ND	0.000092	ND	ND	ND	ND	ND
Trichlorofluoromethane	0.000197	0.000167	0.000273	0.000258	0.000167	ND	ND	ND	0.000531	0.000364	ND	ND	0.000304
Vinyl chloride	ND	ND	ND	ND	ND	**1.691510**	**1.626701**	**1.299417**	0.000791	ND	0.184705	**0.324044**	ND
Cumulative Risk and Hazard Index [d]	0.014	0.075	0.003	0.009	0.007	**14.89**	**15.87**	**9.74**	0.130	0.003	**267.94**	**16.83**	0.035
Target Risk and Hazard Levels	**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 individual hazard quotient 0.2 and target risk level of 1 x 10^{-5} or target hazard level of 1.

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

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

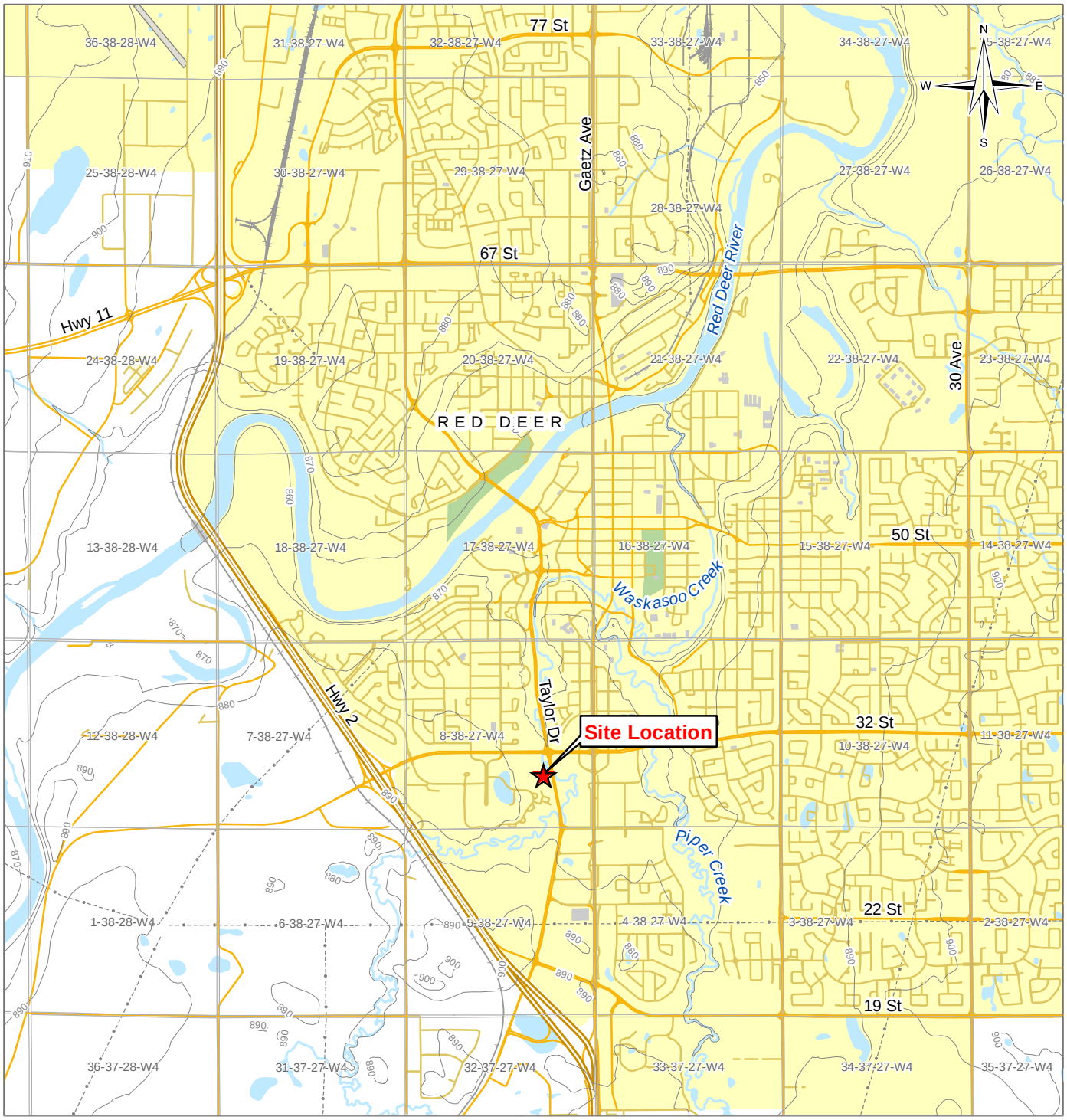
[c] Estimated hazard quotient = (soil vapour concentration/non-cancer soil vapour screening level).

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

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

* = Detection limit raised above the 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

2023 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER COLLEGE

Site Location Plan

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

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

FILE NO. SWOP04071-03_Figure1_SiteLocation.mxd

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

DATE January 17, 2024
PROJECT NO. SWM.SWOP04071-03.005

TETRA TECH

Figure 1

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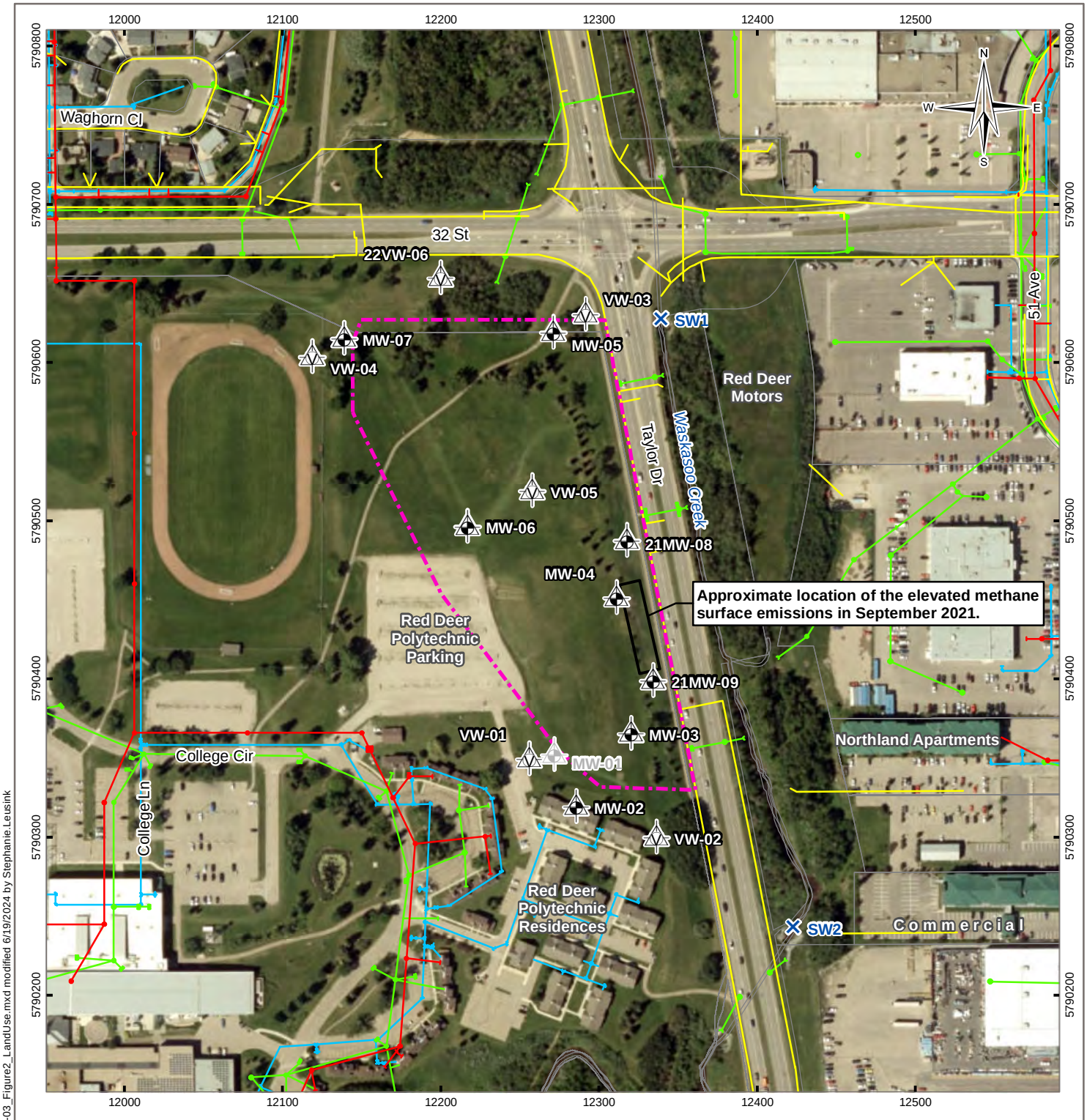


LEGEND

- Monitoring Well
- Damaged Monitoring Well
- Vapour 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; City of Red Deer (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.

STATUS
ISSUED FOR USE

2023 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER COLLEGE

Site Plan and Surrounding Land Use

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

Scale: 1:3,500
60 30 0 60
Metres

FILE NO.
SWOP04071-03_Figure2_LandUse.mxd

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

DATE
June 19, 2024

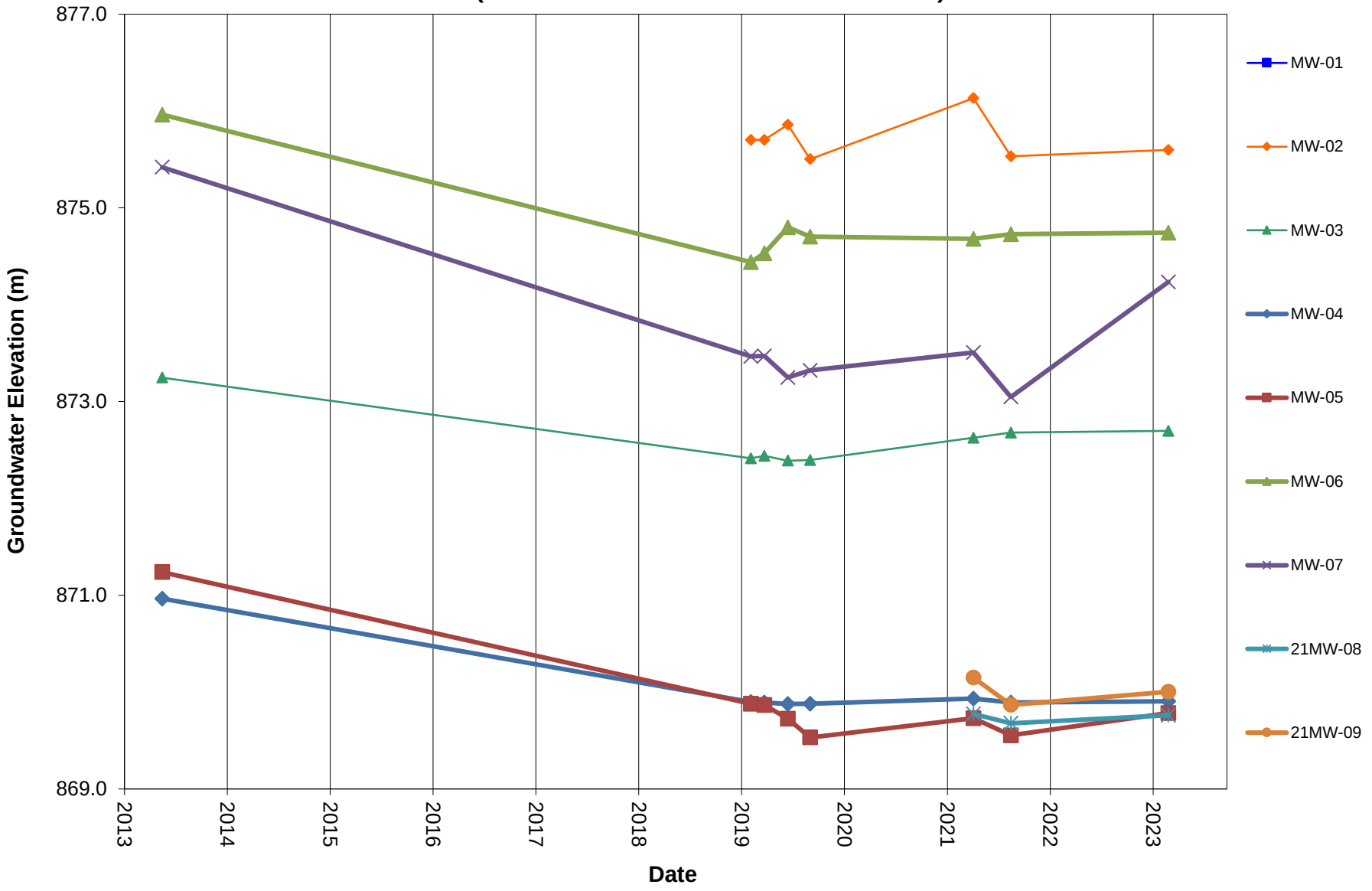
PROJECT NO.
SWM.SWOP04071-03.005

TETRA TECH

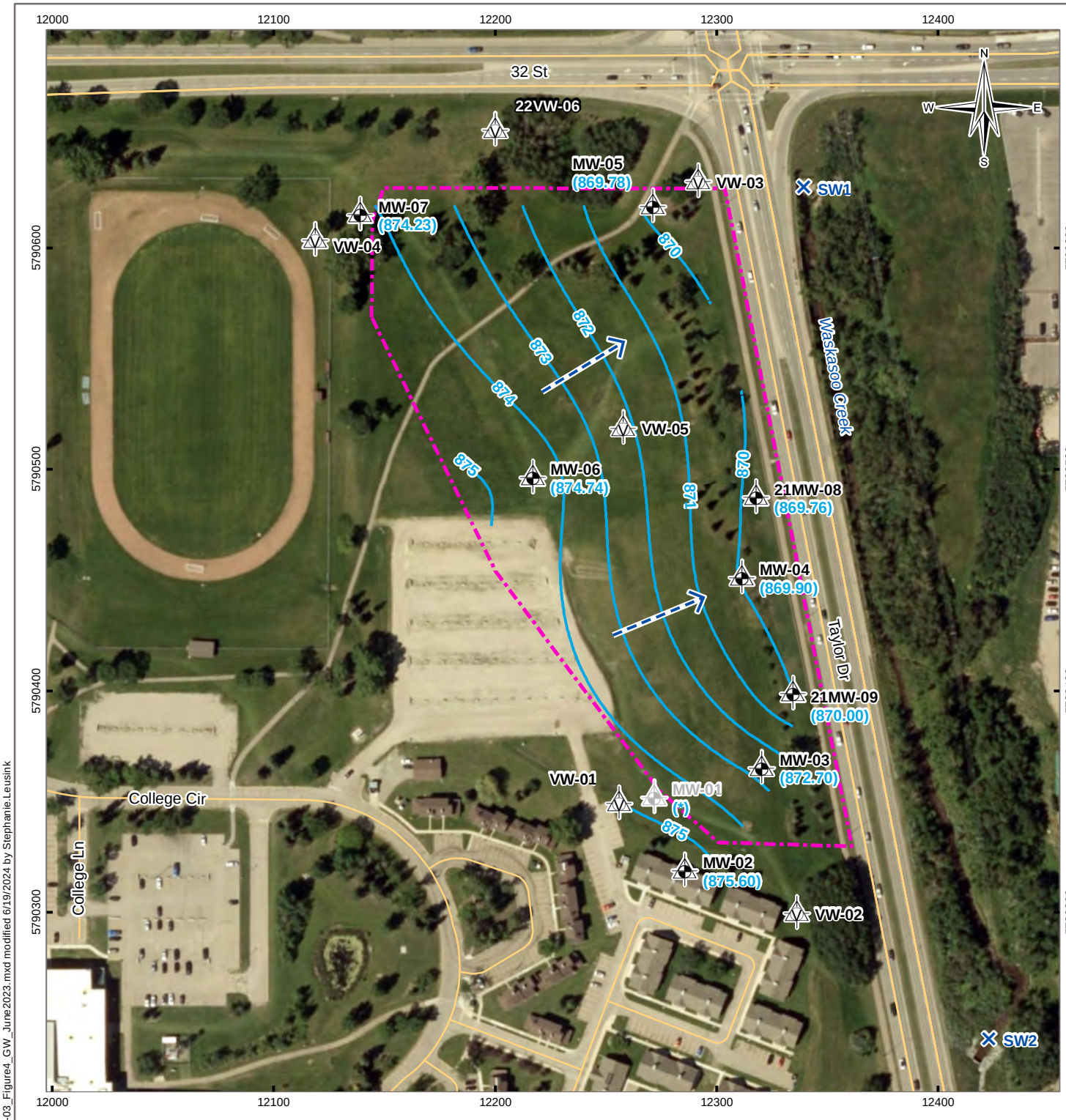
Figure 2

G:\SOLID_WASTE\SWOP\SWOP04071-03\Maps\Task005\SWOP04071-03_Figure2_LandUse.mxd modified 6/19/2024 by Stephanie.Leusink

FIGURE 3
HISTORICAL GROUNDWATER ELEVATIONS
(GROUNDWATER MONITORING WELLS)



TETRA TECH



LEGEND

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

NOTES
Base data source: Imagery provided by ESRI; City of Red Deer (2022)
Roads from City of Red Deer Open Data, 2018
masl - metres above sea level
* - damaged

STATUS
ISSUED FOR USE

2023 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER COLLEGE

Groundwater Elevation Contours June 2023

PROJECTION 3TM 114	**DATUM** NAD83			**CLIENT** The City of Red Deer
Scale: 1:2,500 — 50 25 0 50 Metres				
FILE NO. SWOP04071-03_Figure4_GW_June2023.mxd				TETRA TECH
OFFICE Tt-EDM	**DWN** BB	**CKD** SL	**APVD** JG	**REV** 0
DATE June 19, 2024	**PROJECT NO.** SWM.SWOP04071-03.005			**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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Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

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

ALBERTA ENVIRONMENT AND PROTECTED AREAS REVIEW LETTER

Environment and Protected Areas

Contaminated Sites and Remediation Program
Deerfoot Square
2938 11 St NE
Calgary, AB T2E 7L7
Telephone 403-297-7602
www.alberta.ca

December 21, 2023 File No. 00448509

Janet Whitesell
Waste Management Superintendent
City of Red Deer
Box 5008
Red Deer, Alberta T4N 3T4
Delivered by email: janet.whitesell@reddeer.ca

Dear Janet Whitesell,

Subject: Re: Review of 2021 Groundwater and Soil Vapour Monitoring Report
Red Deer College
Red Deer, Alberta

Alberta Environment and Protected Areas (EPA) has received the 2021 Groundwater and Soil Vapour Monitoring Report prepared by Tetra Tech dated August 02, 2022, for the property listed above.

Based on the information provided in this submission including data available from previous reports, EPA provides the following comments:

1. EPA has concerns with regards to the elevated concentrations of methane near VW-05 and along the surface cracks observed at Taylor Drive. As noted in the report concentrations measured are above the lower explosive limit for methane and the landfill gas explosive limits as described in the Standards for Landfills (EPA 2010) Section 5.12. Please provide comment on what exposure control mechanisms are currently being enacted or will be implemented to prevent adverse effect from landfill gas exposure.

2. Given the updates in regulatory guidelines and additional soil, groundwater and soil vapour data acquired at the site since 2014, EPA recommends development of an updated risk management plan (RMP) for the site. Please refer to the 2017 Alberta Risk Management Plan Guide, the 2022 Alberta Tier 1 Soil and Groundwater Remediation Guidelines, and the 2022 Alberta Tier 2 Soil and Groundwater Remediation Guidelines when developing the updated RMP.

As a person responsible for the substances, section 112 of the Environmental Protection and Enhancement Act obligates you to continue to take all reasonable remedial measures and mitigate any potential adverse impacts that could be associated with the contaminants released.

Please submit the requested information to AEP.EASCommunications@gov.ab.ca quoting the above noted file number on or before January 27th, 2024. If you require additional time to prepare the updated risk management plan, please provide a response prior to this date confirming the timeline for submission of the required information. Please note, the 2014 Risk Management Plan referred to in this report is not available in our records. Please provide a copy of this plan with your response to this letter.

If you have any questions or require clarification with respect to this letter, please contact me at Neil.Monteiro@gov.ab.ca or 403-297-5418.

Yours truly,

Neil Monteiro, M.Sc., P.Geo.
Contaminant Hydrogeologist

Enclosure

cc: Tracy Seppala
Tracy.Seppala@reddeer.ca

THE CITY OF Red Deer

UTILITIES

January 26, 2024

Neil Monteiro
Contaminant Hydrogeologist
Contaminated Sites and Remediation
Alberta Environment and Protected Areas
Delivered by email to: AEP.EASCommunications@gov.ab.ca

Dear Neil Monterio

Subject: **File No. 00448506 - Response to comments from the review of the 2021 Groundwater and Soil Vapour Monitoring Report for the former landfill site located at Red Deer College**

The City of Red Deer (The City) received a letter from Alberta Environment and Protected Areas (EPA) on December 21, 2023 containing comments from their review of the 2021 Groundwater and Soil Vapour Monitoring Report - Red Deer College (File No. 00448506).

As the operator of the former landfill, which was authorized under Permit 144 issued by the Provincial Board of Health, The City is happy to submit the below information in response to EPA's comments and as an update on The City's ongoing environmental monitoring of this former landfill site.

1. *EPA has concerns with regards to the elevated concentrations of methane near VW-05 and along the surface cracks observed to Taylor Drive. As noted in the report concentrations measured are above the lower explosive limit for methane and the landfill gas explosive limits as described in the Standards for Landfills (EPA 2010) Section 5.12. Please provide comment on what exposure control mechanisms are currently being enacted or will be implemented prevent adverse effect from landfill gas exposure.*

Monitoring location VW-05 is a vapour probe that was installed as part of the Phase II Environmental Site Assessment completed at this site in 2013. It was installed within the waste with the intention of providing data on the profile of the historic waste material. Closed landfills like the Red Deer College site generate methane gas and will continue to do so for decades after closure as the waste slowly decomposes. As VW-05 is installed within the waste, methane gas concentrations in the order of magnitude that have been measured at VW-05 are expected.

The Red Deer College site accepted household waste for disposal between July 1970 and December 1972, and to the best of our knowledge, the waste area is capped with topsoil resting on top of fill material comprised of sand, silt and clay which overlays and in some areas is mixed with the waste. With the natural settlement of the waste over time, it is not unexpected to for areas within the waste footprint to display surface cracking or areas of stressed vegetation. The area along the eastern slope of the waste which borders Taylor Drive was identified to be displaying vegetative stress and have some visible surface cracking. In response to this, the City's consultant has completed several rounds of surface emissions testing to evaluate the risk from methane concentrations across the waste area. While elevated methane gas concentrations were measured within the surface cracks observed along the eastern slope of the site adjacent to Taylor Drive, the concentrations were non-detect when the gas meter was held at the ground surface immediately above the cracks.

As recommended in the 2021 Groundwater and Soil Vapour Monitoring Report, the City's consultant completed additional surface emissions surveys as part of the 2022/2023 monitoring and mapped the locations with surface cracking and evidence of stressed vegetation to further evaluate potential risk to outdoor users of the area. Findings will be discussed in the 2023 Monitoring Report, along with the consultant's recommendations for possible mitigative measures. However, based on the current data, the potential risk to the environment and safety of outdoor users associated with any vapour emissions from the waste area appear to be low. We anticipate having the 2022/2023 Monitoring Report finalized by the end of March, at which time we will be able to submit it with the additional surface emissions results.

2. *Given the updates in regulatory guidelines and additional soil, groundwater and soil vapour data acquired at the site since 2014, EPA recommends development of an updated risk management plan (RMP) for the site. Please refer to the 2017 Alberta Risk Management Plan Guide, the 2022 Alberta Tier 1 Solid and Groundwater Remediation Guidelines, and the 2022 Alberta Tier 2 Soil and Groundwater Remediation Guidelines when developing the updated RMP.*

The original Environmental Risk Management Plan (ERMP) completed in 2014 recommended reviewing and updating the ERMP every 5 years, based on aligning with timelines that standards and codes from regulatory agencies are generally updated. The 2021 Groundwater and Soil Vapour Monitoring Report also recommends additional assessment and risk management. The City is planning to address the recommendations from these reports, and is considering the strategy we will use to accomplish this. The current contract for the investigative work at The City's historic landfill sites has expired and once the final deliverables have been received for the 2022/2023 monitoring, the City will be scoping the next phase of the project. Timelines will be refined based on the recommendations in the 2022/2023 monitoring reports, and the procurement process to hire a consultant to conduct the next phase on the project. Once these timelines are firmed up, The City will be happy to provide EPA with a further update.

Within the December 21, 2023 letter, EPA also requested that a copy of the 2014 Environmental Risk Management Plan for the Red Deer College site be provided for their records. This report has been included as an attachment to the email that included this letter response. Please note, the ERMP for the Red Deer College site is also the ERMP for the Red Deer Motors site, due to the proximity of the two landfill sites. Subsequent to that report, our practice has been to complete separate reports for the two landfill sites.

If there are any further questions, please don't hesitate to contact me.

Regards,

Janet Whitesell, P.Eng
Waste Management Superintendent
The City of Red Deer

Alberta Environment and Protected Areas

Contaminated Sites and Remediation Program
Deerfoot Square
2938 11 St NE
Calgary, AB T2E 7L7
Telephone 403-297-7602
www.alberta.ca

March 21, 2024 File No. 00448506

Janet Whitesell
Waste Management Superintendent
City of Red Deer
Box 5008
Red Deer, Alberta T4N 3T4
Delivered by email: janet.whitesell@reddeer.ca

Dear Janet Whitesell,

Subject: Re: City of Red Deer Response dated 26th January 2024
Red Deer College
Red Deer, Alberta

Alberta Environment and Protected Areas (EPA) has received the Letter dated January 26, 2024 prepared by The City of Red Deer (the City) for the property listed above.

Based on the information provided in the Letter, EPA acknowledges that the City is taking reasonable steps to assess and manage the risk associated with methane from surface cracks.

We look forward to receiving updates with regards to the development of the RMP as described in the Letter.

As a person responsible for the substances, section 112 of the *Environmental Protection and Enhancement Act* obligates you to take all reasonable remedial measures and mitigate any potential adverse impacts that could be associated with the contaminants released.

If you have any questions or require clarification with respect to this letter, please contact me at Neil.Monteiro@gov.ab.ca or 403-297-5418.

Yours truly,

Neil Monteiro, M.Sc., P.Geo.
Contaminant Hydrogeologist

Enclosure

cc: Tracy Seppala
Tracy.Seppala@reddeer.ca

APPENDIX C

SITE SETTING AND HISTORICAL INFORMATION

1.0 SITE HISTORY

The following section summarizes the history of the Red Deer College (RDC) site and was developed for the 2019 groundwater and soil vapour monitoring report[1].

Municipal records indicate that the waste disposal at the site occurred from 1970 to 1972. Historical information indicates the waste as being municipal solid waste (MSW) including a mix of plastics, cans, paper, scrap metals, wires, and glass.

Based on information in a Phase I environmental site assessment (ESA) report[2], Waskasoo Creek originally meandered through the area that was proposed for waste disposal. Since the construction of Taylor Drive, circa late-1980s early 1990s, Waskasoo Creek flows north in a straight channel immediately east of Taylor Drive. The report stated that the east edge of the landfill is near the west curb of Taylor Drive and that previous studies concluded that the rerouting of Waskasoo Creek may have altered the natural flow pattern of groundwater from the northeast to an easterly flow pattern.

The Phase I ESA report describes that investigations were conducted prior to the construction of the RDC residence buildings south the former landfill. Specifically: “The housing development is not expected to be adversely impacted by soil gas or leachate. Protective measures include the passive sub-foundation venting and regular perimeter monitoring, per the setback relaxation approval”.

Historical waste disposal was identified during the 2014 Phase II ESA[3] to extend from the north end of site near 32 Street to the student residence buildings on the south end of the site. The south end of site has a large mound of waste that is mixed with fill material and covered with sod and loam. During the drilling investigation, MSW was identified primarily in the north and central parts of the site. The former landfill is closed and inactive. The historical waste area was calculated to be approximately 38,530 m^2. The estimated waste area is shown on Figure 2.

The Phase II ESA indicated that the buried wastes were overlain by surficial sod and loam; in some locations, silty sand and clay fill was encountered below the sod to a depth of approximately 3 m. However, at some borehole locations practically no soil cover was noted below the sod. Bedrock was not encountered at any testholes through the maximum drilling depth of 10.7 m.

The results of the Phase II ESA indicated that leachate constituents were present in the groundwater at monitoring wells along Taylor Drive. Tiamat stated: “The results indicate a plume of the leachate constituents to be principally organic hydrocarbons and nutrient compounds. Various VOCs were detected in the local groundwater during this sampling event. The interpreted extent of the plume appears to extend beyond the current monitoring network and towards Waskasoo Creek.”

[1] Tetra Tech Canada Inc. 2020. 2019 Groundwater and Soil Vapour Monitoring Report – Red Deer College. Prepared for The City of Red Deer. October 2020. Project Number: 704-SWM.SWOP04071-01.005.

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

[3] Tiamat Environmental Consultants Ltd. 2014. Phase II Environmental Site Assessment, Historic Waste Disposal Site, Red Deer College, The City of Red Deer. February 12, 2014.

2.0 HISTORICAL GROUNDWATER MONITORING AND INVESTIGATION SUMMARY

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

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

Fourteen testholes (TH-01, TH-05, TH-09 to TH-15) were advanced in June 2013 as part of the Phase II ESA, five vapour wells (VW-01 to VW-05), and seven monitoring wells (MW-01 to MW-07) were installed.

The results of the Phase II ESA[3] indicated the following:

- No obvious activities pose a high risk to the site from the adjacent land uses. The historical waste boundary is within the college campus.
- The historical waste area is estimated to be 38,530 m^2.
- The hydraulically down-gradient groundwater monitoring wells had concentrations of petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs), and chlorinated hydrocarbons greater than Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines).
- Soil vapour concentrations from two vapour wells on site were determined to be mild to moderate. The results indicated concentrations of VOCs, aliphatic and aromatic hydrocarbons, and siloxanes. The concentrations could pose a risk on the water quality within the Waskasoo Creek.

The recommendations of the Phase II ESA[3] were as follows:

- Monitor groundwater elevations and soil vapour data quarterly for one hydrogeological cycle.
- In consultation with the Alberta Environment and Sustainable Resource Development (ESRD; currently AEPA), determine if surface water sampling should be included along with additional groundwater monitoring locations to better define flow patterns and 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 measurements during the winter months to determine seasonal changes in soil vapour concentrations.
- Develop a site-specific risk management plan (RMP) to consider future land uses and address environmental concerns.
- Review all data to update the RMP with new information.

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

The RMP prepared by Tiamat in 2014 stated: "the outcomes 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.

The RMP[4] summarized the key results from the Phase II ESA[3] that were not included in the Phase II results. The results were the following:

- The soil materials underlying the MSW on site are native sand or clay till.
- In 2013, the average depth to groundwater was approximately 2.9 m below grade (mbg), which is within the waste material on site. The average hydraulic horizontal gradient was approximately 0.04 m/m with an inferred east-northeast groundwater flow direction towards the northwest. Groundwater flow velocity was calculated to be 4.7 m/year using 30% porosity and 10^{-5} m/sec horizontal permeability.
- VOCs and other PHCs had detectable concentrations in 2013 at monitoring wells hydraulically down-gradient from the site. The concentrations consisted of parameters 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 RDC site, as well as the College student residences.
- The historical landfill has a sandy soil cap of approximately 15 cm to 30 cm thick. Grass coverage is overlying the fill cap. Settlement has occurred in areas of waste disposal on the site. No activities located on adjacent lands were interpreted to be contributing environmental concerns.
- Volatile PHC compounds with a carbon chain length of up to 12 carbon atoms were detected at the vapour wells at RDC. Semi-volatile, oxygenated, and halogenated volatile hydrocarbons and ketones were also detected in the soil vapour samples.

2.1 2021 Monitoring Well Installation

On May 5, 2021, two new groundwater monitoring wells (MW-08 and MW-09) were installed using a tracked drill rig and solid stem auger along the east site boundary near Taylor Drive. The well locations were selected to assess subsurface conditions immediately east of the RDC site, in consideration of the extent of former operations that were visible on the 1973 aerial photograph in the 2013 Phase I ESA (Tiamat 2013).

While drilling MW-08, waste was encountered from 2.5 m below ground (mbg) to 5.0 mbg, and while drilling MW-09, waste was encountered from 3.5 mbg to 4.5 mbg. The groundwater wells were installed with 51 mm diameter polyvinyl chloride (PVC) pipe to a depth of 6.0 mbg and were screened with 51 mm slotted PVC pipe from 3.0 mbg to 6.0 mbg. The bottom of the screen for MW-08 and MW-09 were drilled to elevations of 867.08 m and 868.29 m.

Monitoring wells MW-08 and MW-09 were drilled less than 1 m behind the retaining wall along the walking path west of Taylor Drive. The available locations to install MW-08 and MW-09 outside of the waste footprint were limited due to powerlines being located in the ground along the boulevard right next to Taylor Drive. Installing the wells in

the median on Taylor Drive would create complications for monitoring well installation as Taylor Drive has a high volume of traffic and traffic control methods would have to be implemented during monitoring well installation, groundwater monitoring, and groundwater sampling. Installing the wells on the east side of Taylor Drive above Waskasoo Creek was determined to not be a feasible location as there is less than 4 m between the edge of the road and the retaining wall along Waskasoo Creek. Additionally, there is a guard rail in-between the road and retaining wall further limiting drill rig access.

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 either side of the river, Waskasoo Creek drains northward, eventually draining into the Red Deer River northeast of the site. The geology in the river valley is characterized by fluvial surficial sediments deposited by the Red Deer River, overlying shale and sandstone bedrock of the Paskapoo Formation. Key elements of the geological setting are presented below from Tiamat's 2013 Phase I ESA report[2]:

"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.

Surficial soils comprise largely of poorly to moderately sorted sand, silt and gravel with a varying amount of clay. The fluvial sediments generally have obscure bedding planes. Medium to coarse sized gravel with cross-bedded sand have been documented.

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

3.1.2 Local Geology

Based on Tiamat's Phase II ESA[3], surficial soils at the site consist of gravel and sod overlying clay or sand fill material. Outside of the waste footprint, the fill was observed to approximately 3 mbg. A mound of soil and MSW is built up towards the southern end of the waste footprint. The mound is approximately 4.5 m higher than the surrounding land.

Within the waste footprint, sand fill typically overlays the MSW and in some locations the waste was encountered directly beneath the sod material (MW-03, MW-04, and MW-06). The waste materials were encountered at depths of up to 7.6 m.

The waste materials were overlying clay or sand fill in the central and west portion of the site and were overlying native sand or clay till elsewhere. No bedrock was encountered at any locations through the maximum depth of investigation of 10.7 m.

The Phase I ESA[2] indicated that the eastern portion of the landfill is near the west side of Taylor Drive and rerouting of Waskasoo Creek may have altered the geology in the area. There is deep fill in areas of the site that did not indicate waste disposal; therefore, possible fill may have been brought into the site during the creek rerouting process.

Cross-sections prepared for the Phase II ESA are included in Appendix D of this report. These sections show the significant topographical relief across the site, as well as the variable materials underlying the site.

3.2 Hydrogeology

The following sections summarize the regional and local hydrogeology.

3.2.1 Regional Hydrogeology

The regional hydrogeology is most influenced by the presence of the river sediments situated within the valley along the Red Deer River and a bedrock valley trending north-northeast in the vicinity of the site. Key elements of the hydrogeological setting are presented below from Tiamat's 2013 Phase I ESA report[2]:

"A significant buried valley and aquifer resource trending northeastward through the city has been partially mapped and lies in the SE 28-38-27 W4M (McKenzie Trail and Riverside). This buried valley extends to a depth of 21 m, more or less and may extend to the south into north portions of 21-28-27 W4M." Mapping by the Alberta Geological Survey[5] indicates that the valley could be beneath the site, however the width of the valley is not defined.

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

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

Numerous permanent surface water features within The City of Red Deer and vicinity include Red Deer River, Waskasoo Creek, Gaetz Lakes, Hazlett Lake, Bower Ponds (result of formerly mining gravel resources), various sloughs in the fringe areas of the city and an assortment of other smaller creeks and springs. The regional groundwater flow is expected to follow the bedrock topography and will be influenced by the varying distribution of sediments in the river valley, which will have been deposited in various historical channels since filled in under varying depositional environments."

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

3.2.2 Local Hydrogeology

Waskasoo Creek is located to the south and east of the RDC campus. It flows south of the campus before crossing underneath Taylor Drive and flowing north along the east side of the road. Waskasoo Creek is located approximately 45 m east of the site and eventually flows into the Red Deer River located approximately 1.7 km north of the site. Based on information presented in a Phase I ESA[2] report for the site, rerouting of Waskasoo Creek may have altered the natural flow pattern of groundwater from the northeast to an easterly flow pattern. It was also stated that the past landfilling activities and "variably transmissive shelves and/or gullies created by the previous location of Waskasoo Creek were redirecting the flow of the groundwater."

The Phase II ESA[3] indicates the area of the site is within a zone of groundwater recharge with a downward flow component. The average groundwater level is approximately 3 mbg. Shallow groundwater is assumed to flow to the east-northeast, towards the creek.

3.3 Groundwater Resource Usage

A search of the Alberta Water Well Database for groundwater users was conducted in January 2020 within a 1 km radius of the RDC site identified 17 groundwater wells; 7 of the wells are listed as domestic use, 1 is listed as domestic and stock use, 5 are listed as industrial use, 2 as "other", 1 as observation use, and 1 is listed as unknown use[6].

A water well was identified within 500 m of the site; but is believed to be plotted incorrectly based on the address on the water well report and is actually located further than 500 m from the site. No other wells were identified within 500 m of the site. The water wells within a 1 km radius of the site range in depth from 5.8 m to 122 m. The status and use of the surrounding groundwater wells were not confirmed and they were not field verified.

4.0 HAZARD QUOTIENTS

4.1 2019 Hazard Quotient Calculations

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

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

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

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

When the HQ is greater than the target risk value, the scenario poses a potential concern and requires further evaluation or risk management. It is important to note that HQs greater than the target risk value do not necessarily indicate that adverse health effects will occur. This is because of the conservative assumptions used in estimating

[6] Alberta Environment and Parks. 2019. Water Well Database. http://www.telusgeomatics.com/tgpub/ag_water/.

concentrations and in setting the target values. HQs that are less than the target risk value indicate that exposure is within acceptable levels and no further risk management is necessary. HQs greater than the target risk value suggest that further investigation or risk management (e.g., remediation) may be warranted.

For non-carcinogens, the individual target risk value used is 0.2 and the cumulative target risk value used is 1.0. This cumulative target risk value accounts for additional exposure to the chemicals of concern from sources other than the site. Therefore, the cumulative target risk value of 1.0 represents an allocation of 20% (the 0.2 target risk value from the individual compound) of a person's daily exposure from site sources and the remaining 80% would come from other sources. Other sources of exposure include ambient air, household products, and soil and water contact from locations other than the site.

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

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

Where:

R = Estimated individual excess lifetime cancer risk;

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

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

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

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

4.2 Review of the 2014 Hazard Quotients from the Risk Management Plan

The following section is a review of the 2014 RMP[4] 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 COPCs with a HQ greater than 1.0. Residential land use was considered most sensitive, and exposure ratings for other land uses (e.g., school, public institutions, commercial complexes) were considered to not be greater than residential; however, unique exceptions would have to be reviewed and addressed on a site-specific basis[3]. Further, underground utility workers and subsurface utility infrastructure were considered relevant to potential exposure.

The RMP applied a 10x factor of safety to the hazard quotients 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, Canadian Council of Ministers of the Environment (CCME) released the document "A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours"[7], designed to provide guidance for developing site-appropriate soil vapour quality guidelines. The guidelines developed using the methods outlined in the CCME document were used for this current study and are included with the vapour sampling results in Table 4. HQs were calculated using estimated dose (based on concentrations measured at the site) and divided by TDI. 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, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene) identified that none of the 2013 concentrations would have unacceptable HQs using the updated CCME methodology. It should be noted that only soil vapour wells VW-03 and VW-04 were sampled in 2013.

The 2014 RMP was prepared concurrent to RMPs at several other former City landfills, and a common set of mitigative measures was applied based on the HQs. Subsequent to the 2014 RMP and to the release of the CCME Protocol document, The City undertook additional assessment at another former City Landfill (Montfort); as part of that work, their consultant XCG Consulting Limited (XCG) revised the 2014 RMP criteria ranges for each generic mitigative measure category to include a cancer risk range to allow comparison of the 2014 RMP ranges with the individual HQs and cancer risks calculated by XCG[8]. 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.

[7] 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.

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

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

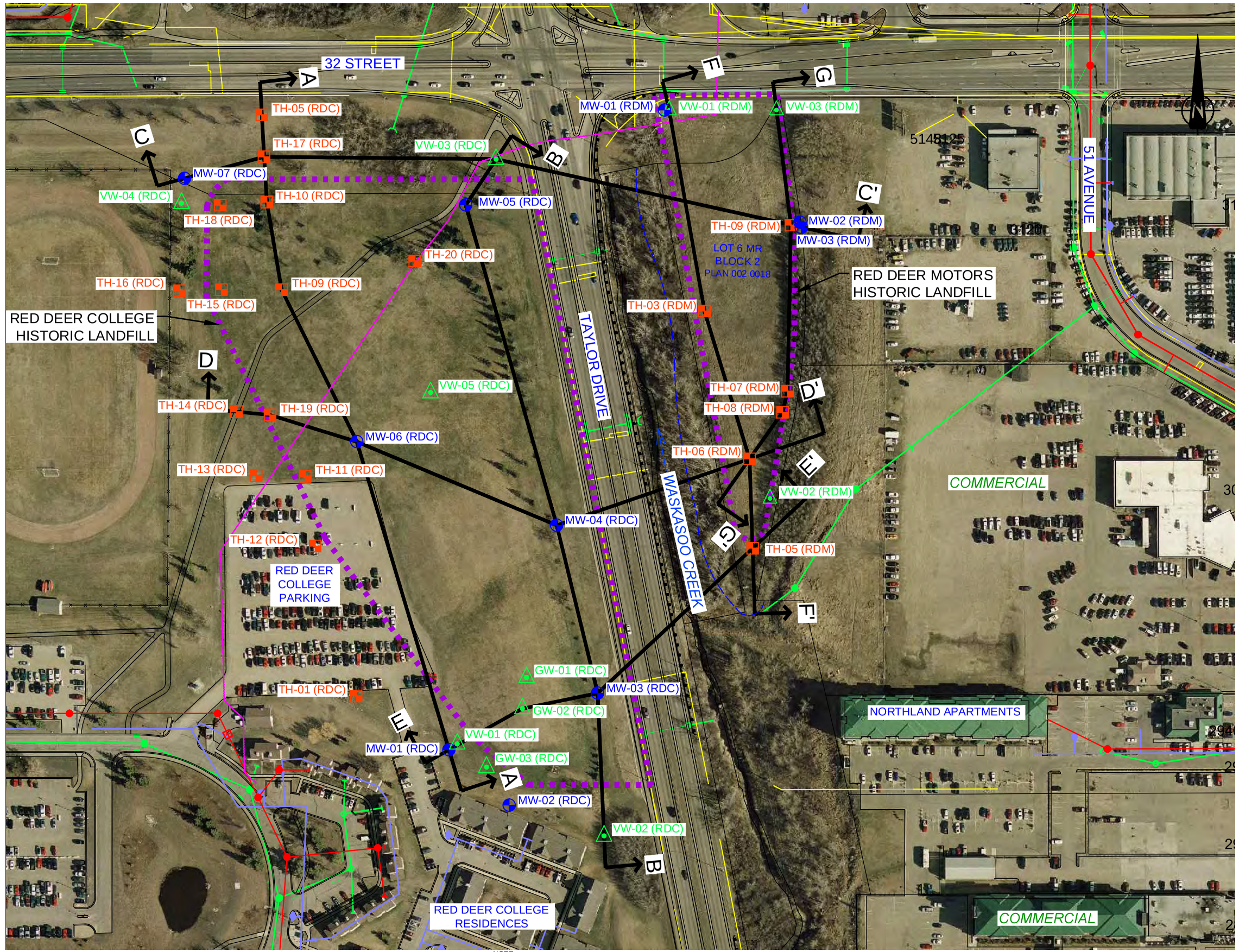
   Installation of geomembrane and active soil vapour extraction with system fault notification alarm.

For consistency with XCG's approach from 2017, we compared individual HQs with the individual target hazard level (0.2). Based on the 2023 program, the greatest individual HQ calculated for the site was 8.3 (vs target hazard level of 0.2), the greatest cumulative HQ was 9.3 (vs target hazard level of 1.0), and the greatest estimated cancer risk was 5.8×10^{-4} (vs target risk of 1.0×10^{-5}). While development at the site is not currently proposed, for illustrative purposes, based on these HQs and cancer risk levels calculated from the 2023 vapour data, passive Level C measures would be required for development within the setback area (the 2019 data indicated active Level E measures). We note that these HQs and risks are based on samples collected from VW-03 (immediately northeast of landfill footprint) and VW-05 (situated within the landfill footprint and an indicator of source concentrations)..

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

APPENDIX D

CROSS-SECTIONS (TIAMAT 2014A)



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	

A
NORTH

A'
SOUTH

TH-05 (RDC)
877.163 m

TH-17 (RDC)
876.876 m

TH-10 (RDC)
877.835 m

TH-09 (RDC)
877.869 m

MW-06 (RDC)
TOP OF PIPE 878.754 m
877.914 m

MW-01 (RDC)
876.982 m

TOPSOIL (FILL)

CLAY (FILL)

SAND (FILL)

CLAY (FILL)

MUNICIPAL
SOLID WASTE

875.122 m

SAND
(NATIVE)

CLAY (FILL)

SAND

SAND
(NATIVE)

EOH
871.063 m

EOH
870.776 m

EOH
872.235 m

EOH
872.382 m

CLAY
(NATIVE)

EOH
868.814 m

EOH
868.714 m

MW-04 (RDC)
Top of Pipe
876.986 m

876.013 m

MW-03 (RDC)
Top of Pipe
878.135 m

877.169 m

VW-02 (RDC)
Top of Pipe
877.190 m

B'
SOUTH

TOPSOIL (FILL)

SAND (FILL)

CLAY (FILL)

872.281 m

SAND
(NATIVE)

EOH
871.090 m

MW-05 (RDC)
876.3 m

B
NORTH

VW-03 (RDC)
872.690 m

872.459 m

SAND (FILL)

CLAY (FILL)

870.386 m

MUNICIPAL
SOLID WASTE

869.991 m

SAND
(NATIVE)

EOH
868.090 m

SAND (FILL)

CLAY
(NATIVE)

GRAVEL
(NATIVE)

EOH
867.313 m

EOH
866.469 m

EOH
864.954 m

878
877
876
875
874
873
872
871
870
869
868
867
866
865
864

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

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

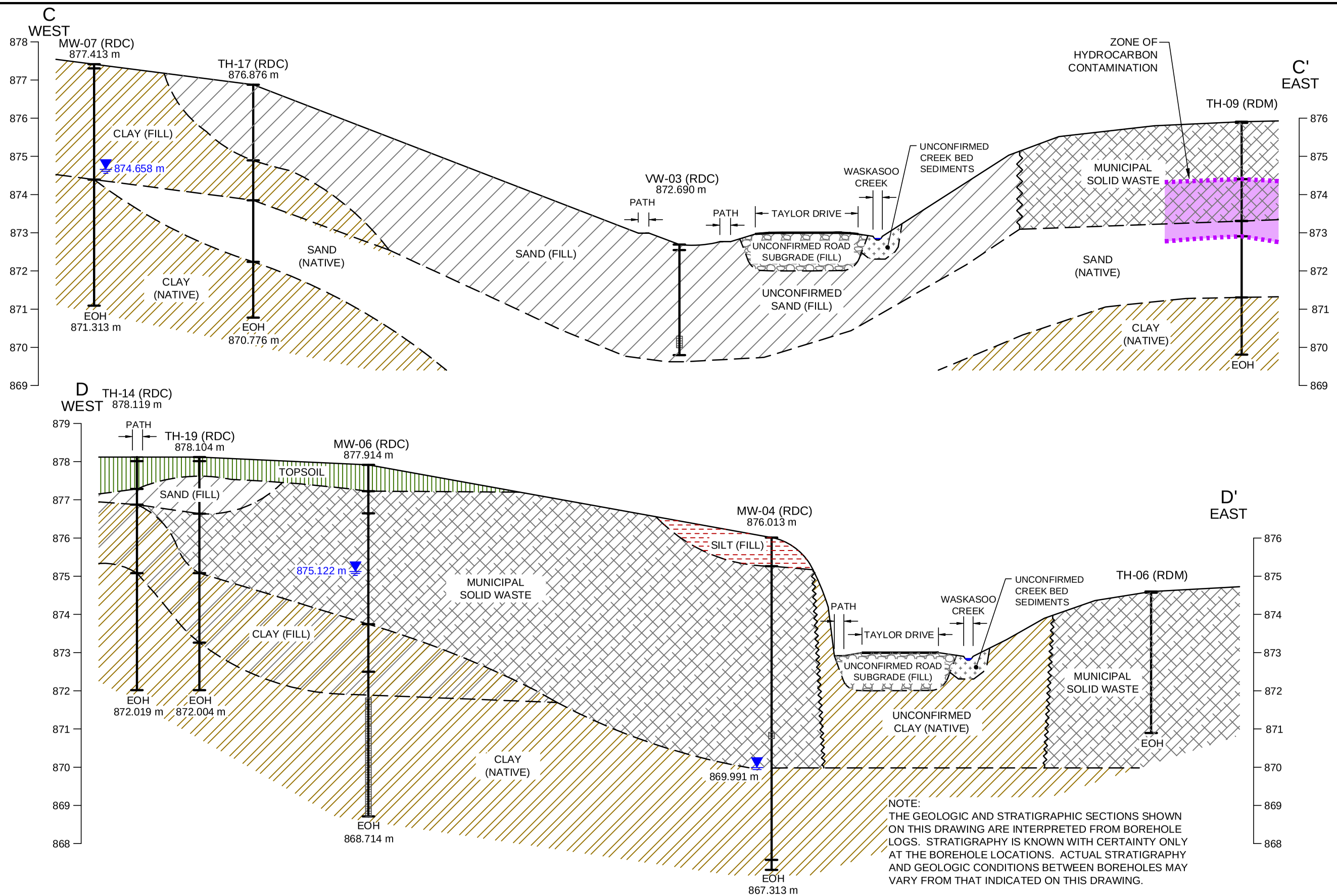
CLIENT: THE CITY OF RED DEER

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

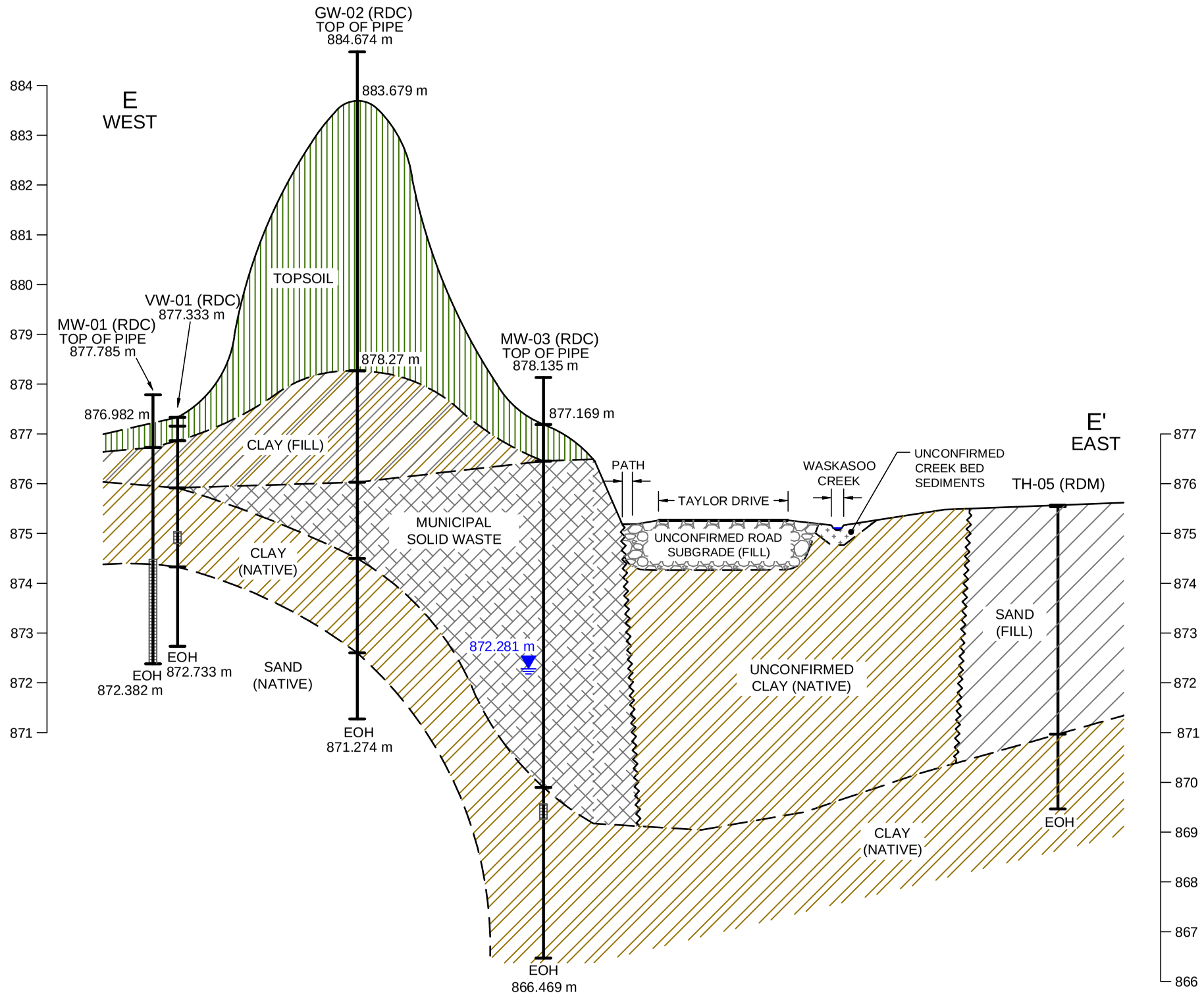
CLIENT: THE CITY OF RED DEER

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

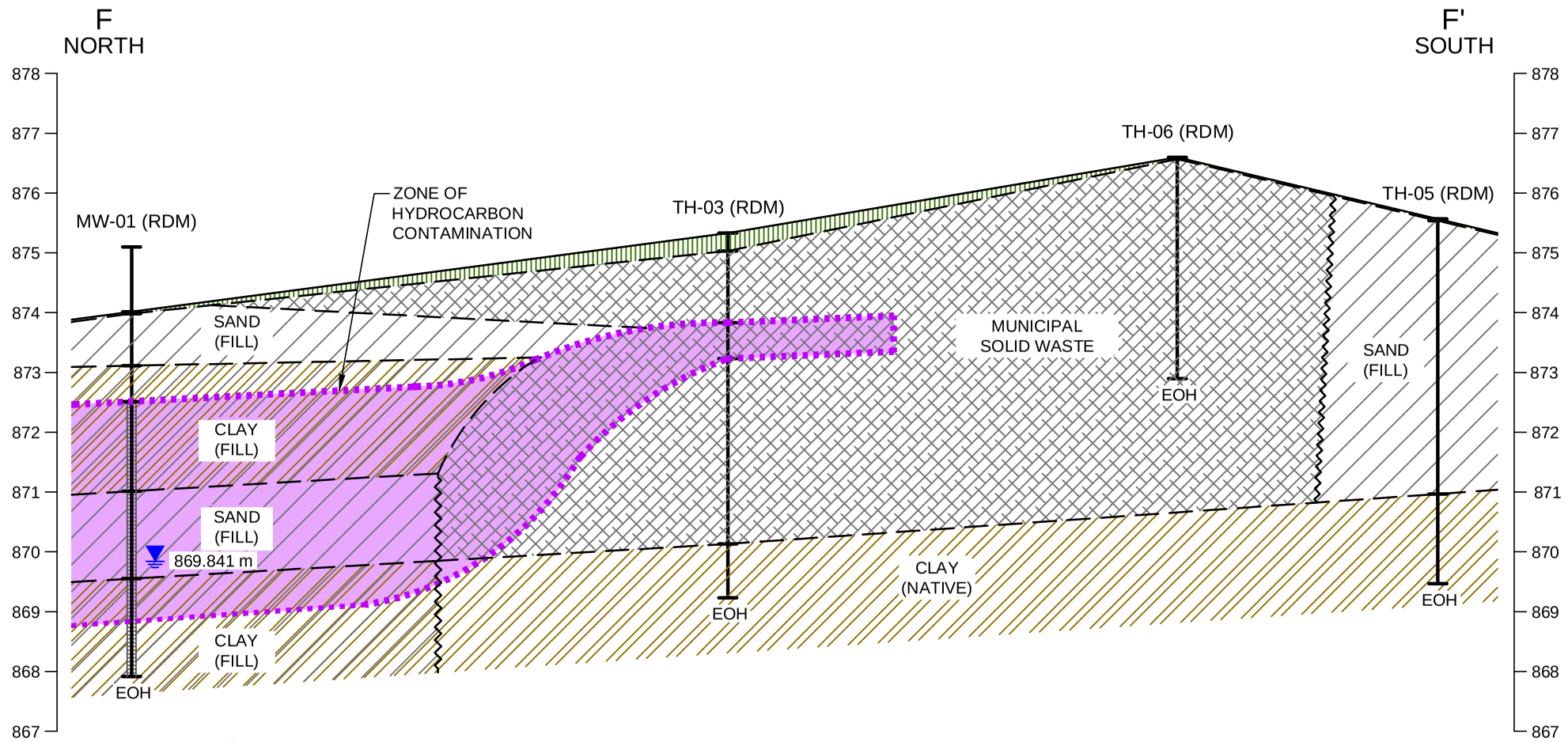
CLIENT: THE CITY OF RED DEER

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

Tiamat Environmental Consultants Ltd.

APPENDIX E

BOREHOLE LOGS

Client: RED DEER COLLEGE	GEOTECHNICAL INVESTIGATION	TEST HOLE NO: MW1
	PROPOSED STUDENT RESIDENCES	PROJECT NO: 'X06424
BECK DRILLING – SOLID STEM AUGERS	GROUNDWATER MONITORING WELL	ELEVATION: 877.02 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test; Grab Sample; Split Pen; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

DEPTH(m)	PLASTIC — M.C. — LIQUID (20 40 60 80)	SOIL SYMBOL	Soil Description	SAMPLE TYPE	SAMPLE NO	SPT(N)	WELL INSTALLATION	OTHER TESTS COMMENTS	ELEVATION(m)
0.0			TOPSOIL: clay, silty, some fine sand, black, rootlets, organics, moist						877.0
1.0			CLAY: silty, low plastic, brown, coal fragments, moist						876.0
2.0 ▽			– grey mottling, rust staining						875.0 ▽
3.0			SAND TILL: some clay pieces, little fine gravel, brown, coal fragments, rust staining, wet						874.0
4.0									873.0
5.0			End of hole at 4.6 m. 50 mm PVC pipe installed to 4.6 m. Bottom 2.1 m slotted. Borehole backfilled with sand to 2.4 m, drill cuttings to 0.5 m and bentonite to surface grade Aboveground steel well protector installed, locked and grouted in place. Well dry upon completion Water level at 1.69 m on November 14/99 Water level at 1.89 m on November 15/99.						872.0
6.0									871.0
7.0									870.0
8.0									869.0
9.0									868.0
10.0									867.0
11.0									866.0
12.0									865.0
13.0									864.0
14.0									863.0
15.0									

Agra Earth & Environmental Limited
Red Deer, Alberta

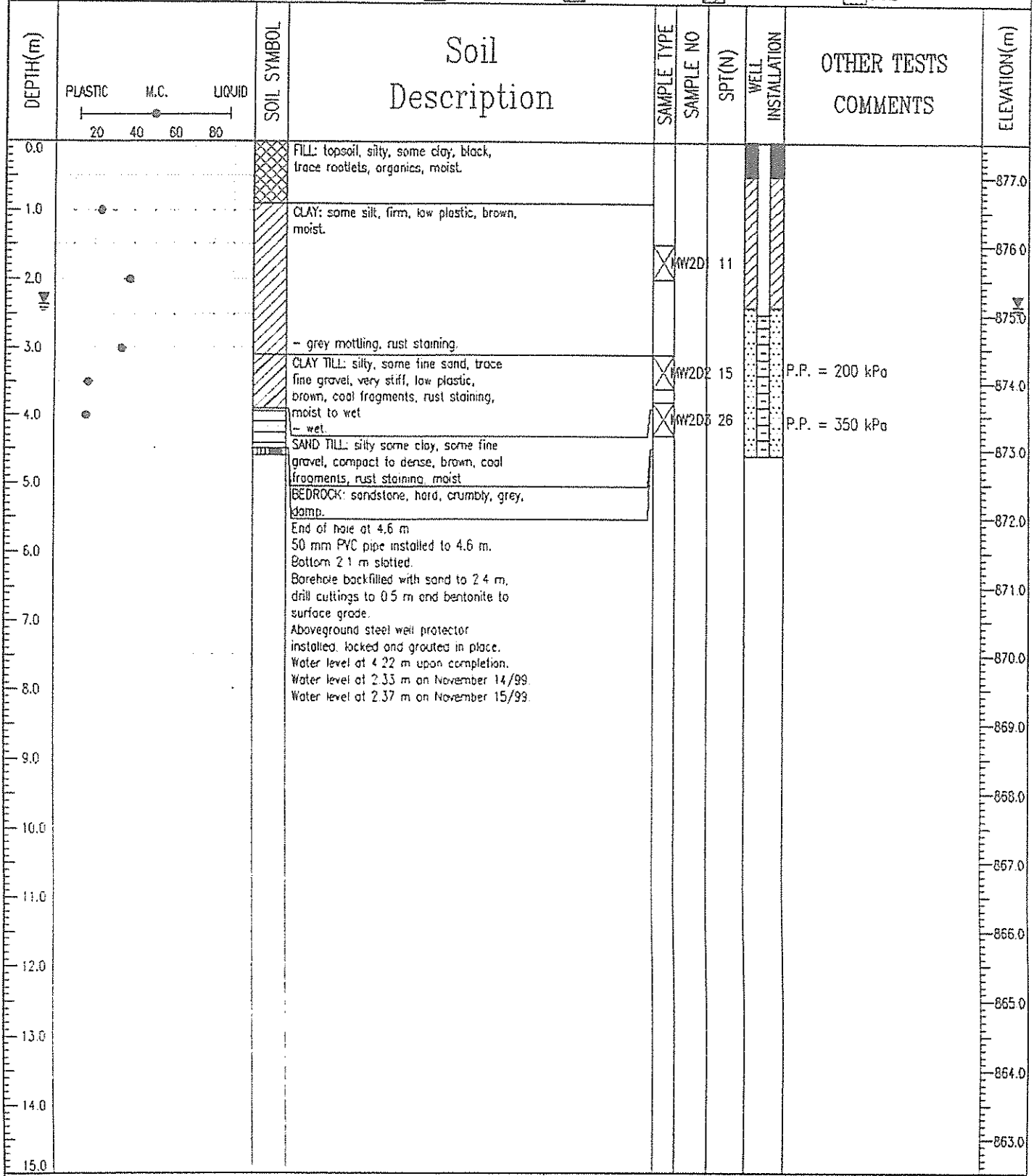
LOGGED BY: AR	COMPLETION DEPTH: 4.6 m
REVIEWED BY: MDB	COMPLETE: 11/08/99
Fig. No:	Page 1 of 1

99/11/23 12:04PM (AR-DEPTH)

Client: RED DEER COLLEGE	GEOTECHNICAL INVESTIGATION	TEST HOLE NO: MW2
	PROPOSED STUDENT RESIDENCES	PROJECT NO: RX06424
BECK DRILLING – SOLID STEM AUGERS	GROUNDWATER MONITORING WELL	ELEVATION: 877.5 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test; Grab Sample; Split Pen; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND



Agra Earth & Environmental Limited Red Deer Alberta	LOGGED BY: AR	COMPLETION DEPTH: 4.6 m
	REVIEWED BY: MDB	COMPLETE: 11/08/99
	Fig. No:	Page 1 of 1

99/11/23 12:05PM (AWDEFIN)

Client: RED DEER COLLEGE	GEOTECHNICAL INVESTIGATION	TEST HOLE NO: MW3
	PROPOSED STUDENT RESIDENCES	PROJECT NO: RX06424
BECK DRILLING – SOLID STEM AUGERS	GROUNDWATER MONITORING WELL	ELEVATION: 877.31 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test; Grab Sample; Split Pen; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

DEPTH(m)	PLASTIC – M.C. – LIQUID (20 40 60 80)	SOIL SYMBOL	Soil Description	SAMPLE TYPE	SAMPLE NO	SPT(N)	WELL INSTALLATION	OTHER TESTS COMMENTS	ELEVATION(m)
0.0			FILL: topsoil mixed with clay and silt, some fine sand, black and brown, moist.						877.0
1.0			LANDFILL: domestic waste mixed with clay fill.					TRACETECHTOR: Full Gas = >10000 ppm No Methane = 90 ppm	876.0
2.0									875.0
3.0									874.0
4.0									873.0
5.0			– wet.						872.0
6.0									871.0
7.0									870.0
8.0			CLAY TILL: some fine sand, little fine gravel, grey, coal fragments, moist to wet.						869.0
9.0									868.0
10.0									867.0
11.0			End of hole at 10.7 m 50 mm PVC pipe installed to 10.7 m Bottom 3.1 m slotted Borehole backfilled with sand to 7.3 m, bentonite to 6.3 m, drill cuttings to 0.5 m and bentonite to surface grade Aboveground steel well protector installed, locked and grouted in place Water level at 10.12 m upon completion. Water level at 7.15 m on November 14/99 Water level at 5.75 m on November 15/99						866.0
12.0									865.0
13.0									864.0
14.0									863.0
15.0									

Agra Earth & Environmental Limited
Red Deer Alberta

LOGGED BY: AR
REVIEWED BY: MDB
Fig. No:

COMPLETION DEPTH: 10.7 m
COMPLETE: 11/08/99

99/11/23 12:05PM (ANYDEPTH)

Client: RED DEER COLLEGE	GEOTECHNICAL INVESTIGATION	TEST HOLE NO: MW4
	PROPOSED STUDENT RESIDENCES	PROJECT NO: RX06424
BECK DRILLING – SOLID STEM AUGERS	GROUNDWATER MONITORING WELL	ELEVATION: 876.16 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test; Grab Sample; Split Pen; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

DEPTH(m)	PLASTIC – M.C. – LIQUID (20 40 60 80)	SOIL SYMBOL	Soil Description	SAMPLE TYPE	SAMPLE NO	SPT(N)	WELL INSTALLATION	OTHER TESTS COMMENTS	ELEVATION(m)
0.0			TOPSOIL: silty, little fine sand, black, trace rootlets, organics, frost.						876.0
1.0			FILL: silt, some fine sand, some clay, loose, brown, moist.						875.0
			LANDFILL: domestic waste mixed with clay fill, moist to wet.						
2.0									874.0
3.0			– wet					TRACETECHTOR: Full Gas = >10000 ppm No Methane = 60 ppm	873.0
4.0									872.0
5.0									871.0
6.0			SAND: silt seams, little fine gravel, grey, wet.						870.0
7.0									869.0
8.0			– medium sized cobbles						868.0
9.0			CLAY: some silt, grey, wet.						867.0
10.0			End of hole at 9.0 m. 50 mm PVC pipe installed to 8.7 m. Bottom 2.1 m slotted. Borehole backfilled with sand to 8.6 m, bentonite to 4.6 m, cuttings to 0.5 m and bentonite to surface grade. Aboveground steel well protector installed, locked and grouted in place. Water level at 7.47 m upon completion. Water level at 8.93 m on November 14/99. Water level at 8.60 m on November 15/99.						866.0
11.0									865.0
12.0									864.0
13.0									863.0
14.0									862.0
15.0									

Agra Earth & Environmental Limited Red Deer Alberta	LOGGED BY: AR	COMPLETION DEPTH: 9 m
	REVIEWED BY: MDB	COMPLETE: 11/09/99
	Fig. No:	Page 1 of 1

99/11/23 12:05PM tanDEPTH

Client: RED DEER COLLEGE	GEOTECHNICAL INVESTIGATION	TEST HOLE NO: MW5
	PROPOSED STUDENT RESIDENCES	PROJECT NO: RX06424
BECK DRILLING – SOLID STEM AUGERS	GROUNDWATER MONITORING WELL	ELEVATION: 872.5 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test; Grab Sample; Split Pen; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

PLASTIC M.C. LIQUID
20 40 60 80

DEPTH(m)	SOIL SYMBOL	Soil Description	SAMPLE TYPE	SAMPLE NO	SPT(N)	WELL INSTALLATION	OTHER TESTS COMMENTS	ELEVATION(m)
0.0		TOPSOIL: silty, sandy, black, rootlets, organics, moist.						872.0
1.0		FILL: sand, silty, loose, brown, moist.						
		FILL: clay, silty, fine sand seams, brown, with grey mottling, moist to wet						
2.0		– buried topsoil layer, (0.2 m thick), black, trace rootlets, organics, moist to wet.						871.0
								870.0
3.0		LANDFILL: domestic waste mixed with clay fill, moist to wet						
4.0		– wet						869.0
								868.0
5.0		CLAY: some silt, grey, rust staining, wet.					TRACETECHTOR: Full Gas = >10000 ppm No Methane = 64 ppm	
6.0								867.0
								866.0
7.0		GRAVEL, medium to coarse grained, some clay and silt layers, grey, cobbles, wet.						
		End of hole at 7.6 m						865.0
8.0		50 mm PVC pipe installed to 7.5 m						
		Bottom 3.1 m slotted						864.0
9.0		Borehole backfilled with sand to 4.2 m, bentonite to 3.2 m, drill cuttings to 0.5 m and bentonite to surface grade						
		Aggregate stick-up protective casing installed and set in place						863.0
10.0		Water level at 2.75 m upon completion						
		Water level at 2.1 m on November 14, 99						862.0
11.0		Water level at 2.11 m on November 15, 99						
								861.0
12.0								
								860.0
13.0								
								859.0
14.0								
								858.0
15.0								

Agra Earth & Environmental Limited
Red Deer, Alberta

LOGGED BY: AR	COMPLETION DEPTH: 7.6 m
REVIEWED BY: MDB	COMPLETE: 11/09/99
Fig. No:	Page 1 of 1

99/11/23 12:05PM (AR DEPTH)

Client: RED DEER COLLEGE	GEOTECHNICAL INVESTIGATION	TEST HOLE NO: MW6
	PROPOSED STUDENT RESIDENCES	PROJECT NO: RX06424
BECK DRILLING – SOLID STEM AUGERS	GROUNDWATER MONITORING WELL	ELEVATION: 877.99 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test; Grab Sample; Split Pen; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

DEPTH(m)	PLASTIC – M.C. – LIQUID (20 40 60 80)	SOIL SYMBOL	Soil Description	SAMPLE TYPE	SAMPLE NO	SPT(N)	WELL INSTALLATION	OTHER TESTS COMMENTS	ELEVATION(m)
0.0			TOPSOIL: silty, some fine sand, black, rootlets, organics, moist.						
1.0			FILL: clay and silt, brown with grey mottling, moist.						877.0
2.0			LANDFILL: domestic waste mixed with clay fill, moist to wet. – wet.					TRACETECHTOR: Full Gas = 2000 ppm No Methane = 58 ppm	876.0
3.0									875.0
4.0									874.0
5.0			FILL: clay, silty, some fine gravel, brown with grey mottling, rust staining, wet.						873.0
6.0			LANDFILL: domestic waste mixed with clay fill, wet						872.0
7.0			CLAY TILL: some fine sand, little fine gravel, brown, coal fragments, rust staining, moist.					TRACETECHTOR: Full Gas = >10000 ppm No Methane = 71 ppm	871.0
8.0									870.0
9.0			End of hole at 9.2 m 50 mm PVC pipe installed to 9.2 m Bottom 3.1 m slotted Borehole backfilled with sand to 6.1 m bentonite to 5.1 m, drill cuttings to 0.5 m and bentonite to surface grade Aboveground steel well protector installed, locked and grouted in place Water level at 4.35 m upon completion Water level at 3.21 m on November 14/99 Water level at 2.91 m on November 15/99						869.0
10.0									868.0
11.0									867.0
12.0									866.0
13.0									865.0
14.0									864.0
15.0									863.0

Agra Earth & Environmental Limited
Red Deer Alberta

LOGGED BY: AR	COMPLETION DEPTH: 9.2 m
REVIEWED BY: MDB	COMPLETE: 11/09/99
Fig. No:	Page 1 of 1

99/11/23 10:20 M HARDCOPY

PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** MW-07
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer College Site	**GROUND ELEVATION:** 877.413 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/28/2013

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 near the northeast corner of the fence for the running track, directly north of VW-04.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod (~ 3 cm thick).					
	Clay (fill) - soft, silty, trace sand, moist, light olive.					
1.0						
2.0						
	No obvious waste material.					
3.0	Clay till (native) - stiff, silty, trace sand, trace coal, trace oxides, wet, light olive.					
4.0						
5.0						
6.0	End of hole at 6.1 m. 51 mm diameter 4.6 m length 010 PVC screen. Aboveground lockable steel casing.					
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

Borehole No: **21MW-08**

Project: Red Deer Collect Well Installation	Project No: SWM.SWOP04071-02.008
Location: Red Deer College	
Red Deer, Alberta	UTM: 307536 E; 5792481 N; Z 12

Depth (m)	Method	Soil Description	Notes and Comments	MW08	Depth (ft)
0					0
	Solid stem auger	TOPSOIL - clay loam, organics, rootlets, black, (300 mm thick)			
		CLAY (FILL) - some sand, moist, grey to brown			
1					1
					2
2					3
					4
					5
					6
					7
					8
		WASTE - black, wood chips, plastic, strong odour			9
3					10
▼					▼11
					12
4					13
					14
					15
					16
5		CLAY - some silt, wet, firm, brown			17
					18
					19
6					20
		END OF BOREHOLE (6.0 metres) water - 3.4 metres Monitoring well installed to 6.0 metres			21
					22
7					23
7.5					24

TETRA TECH

Contractor: CP Drilling	Completion Depth: 6 m
Equipment Type: Truck mounted	Start Date: 2021 May 5
Logged By: MR	Completion Date: 2021 May 5
Reviewed By: FH	Page 1 of 1

Borehole No: **21MW-09**

Project: Red Deer Collect Well Installation	Project No: SWM.SWOP04071-02.008
Location: Red Deer College	
Red Deer, Alberta	UTM: 307541 E; 5792389 N; Z 12

Depth (m)	Method	Soil Description	Notes and Comments	MW09	Depth (ft)
0		TOPSOIL - organics, rootlets, black, (200 mm thick)			0
		CLAY (FILL) - sandy, trace gravel, dry, brown			
1					1
					2
					3
					4
					5
2					6
					7
					8
	Solid stem auger				9
3					10
					11
		WASTE AND CLAY (FILL) - sandy, damp to wet, grey, wood chips			12
					13
4					14
		CLAY - sandy, trace gravel, moist, brown to grey			15
					16
5					17
					18
▼					▼ 19
6		END OF BOREHOLE (6.0 metres) water - 5.9 metres Monitoring well installed to 6.0 metres			20
					21
					22
7					23
7.5					24

TETRA TECH

Contractor: CP Drilling	Completion Depth: 6 m
Equipment Type: Truck mounted	Start Date: 2021 May 5
Logged By: MR	Completion Date: 2021 May 5
Reviewed By: FH	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 College Site	**GROUND ELEVATION:** 877.333 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/28/2013

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 ~ 1.5 m north of MW-01, northwest of the student housing.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod (~ 3 cm thick).					
	Loam (fill) - stiff, silty, clayey, some sand, trace rootlets, damp, dark olive.					
	Clay (fill) - stiff, silty, trace loam, damp, light olive.					
1.0	No obvious waste material.					
	Clay (native) - stiff to soft, silty, moist, light olive.					
2.0						
3.0	Sand (native) - loose to compact, silty, wet, light olive brown.					
4.0						
	End of hole at 4.6 m.					
	25 mm diameter 30 cm length 020 PVC screen.					
5.0	Aboveground lockable steel casing.					
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 4.6
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 College Site	**GROUND ELEVATION:** 877.190 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/28/2013

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 ~ 1 m west of tree island, near the northeast corner of the student housing facilities.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod (~ 3 cm thick). Top soil (fill) - loose, silty, damp, dark olive.					
1.0	Sand (fill) - compact, silty, some clay, moist, light olive brown.					
2.0	Clay (fill) - firm to soft, silty, trace sand, moist, light olive brown. No obvious waste material.					
3.0	Sand (native) - compact, silty, some clay, trace coal, trace oxides, moist, light olive brown.					
4.0	becomes wet at 4.6 m.					
5.0						
6.0	End of hole at 6.1 m. 25 mm diameter 30 cm length 020 PVC screen. Aboveground lockable steel casing.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough : 0.9 m	Completion Depth (m): 6.2
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 College Site	**GROUND ELEVATION:** 872.690 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/28/2013

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 in the vicinity of the Red Deer College sign at the intersection of 32 Street and Taylor Drive.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod (~ 3 cm thick).					
	Sand (fill) - loose, loamy, silty, some clay, damp, light olive.					
1.0	becomes compact, silty, clayey, trace loam, trace pebbles at 1.5 m.					
2.0	No obvious waste material.					
3.0	Sand (native) - dense, silty, some gravel, trace clay, trace coal, wet, olive.					
4.0	End of hole at 4.6 m. 25 mm diameter 30 cm length 020 PVC screen. Aboveground lockable steel casing.					
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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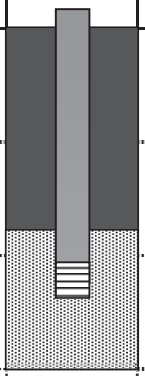
Slough : 3.0 m	Completion Depth (m): 4.6
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** VW-04
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer College Site	**GROUND ELEVATION:** 877.445 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/28/2013

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 fence for the running track.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod (~ 3 cm thick).					
	Clay (fill) - soft, silty, wet to moist, light olive.					
1.0	becomes firm at 1.5 m.					
2.0	No obvious waste material.					
3.0	End of hole at 3 m. 25 mm diameter 30 cm length 020 PVC screen. Aboveground lockable steel casing.					
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
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

PROJECT: Phase II Environmental Site Assessment	**BOREHOLE No.:** VW-05
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Red Deer College Site	**GROUND ELEVATION:** 877.724 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/28/2013

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 in the middle of the open field, north and east of the campus parking lot.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod (~ 3 cm thick).					
	Clay (fill) mixed with MSW - wire, wood debris, glass, paper, plastic, strong bitter pungent odour, firm to soft, loamy, silty, some sand, damp, dark olive.					
1.0	becomes wet at 1.4 m.					
2.0						
3.0	Sand (fill) mixed with MSW - wood debris, nylon, plastic, tin can, plastic bag, newspaper, strong bitter pungent odour, dense, silty, trace clay, moist to wet, dark olive.					
4.0						
	Sand mix becomes compact, moderate bitter pungent odour at 4.6 m.					
5.0						
6.0						
7.0						
	Sand and MSW mix - loose, poor recovery.					
	Clay till (native) - stiff, silty, trace pebbles, trace coal, moist, olive grey.					
8.0						
9.0						
10.0						
	End of hole at 10.7 m.					
11.0	25 mm diameter 30 cm length 020 PVC screen.					
	Aboveground lockable steel casing.					
	Backfilled with bentonite to 7.6 m, ~ 50:50 bentonite and sand to 2.7 m, play sand to 2.4 m.					
12.0						

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Slough :	Completion Depth (m): 10.7
Depth to Groundwater :	Checked By: LTM
Logged By: JAL	Page: 1 of 1

Borehole No: **22VW-06**

Project: 2023 Pre-1972 Site Monitoring Program	Project No: SWM.SWOP04071-03.009
Location: NW 1/4, Sec. 21-38-27 W4M	
Red Deer, Alberta	

Depth (m)	Method	Soil Description	Notes and Comments	22VW-06	Depth (ft)
0					0
	Solid stem auger	TOPSOIL - (200 mm thick)	Flush mount		
		CLAY - silty, trace gravel, damp, low plastic, brown			
1		- moist, medium plastic			
2		- iron inclusions			
3		END OF BOREHOLE (3.00 metres) slough - 2.40 metres at 0 hrs. Monitoring well installed to 2.40 metres			
4					
5					
6					
7					
7.5					

Contractor: CP Drilling	Completion Depth: 3 m
Equipment Type: Skid Steer	Start Date: 2022 December 5
Logged By: RM	Completion Date: 2022 December 5
Reviewed By:	Page 1 of 1

APPENDIX F

LABORATORY ANALYTICAL REPORTS

ALS Canada Ltd.

CERTIFICATE OF ANALYSIS

Work Order	: **CG2307272**	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.SWOP04071-03.005	Date Samples Received	: 04-Jun-2023 08:00
PO	: SWM.SWOP04071-03.005	Date Analysis Commenced	: 04-Jun-2023
C-O-C number	: CORD RDC GW	Issue Date	: 12-Jun-2023 15:51
Sampler	: Ryan Miller		
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*
Andrew Fox		Metals, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Cynthia Bauer	Organic Supervisor	Organics, Calgary, Alberta
George Huang	Supervisor - Inorganic	Inorganics, Calgary, Alberta
George Huang	Supervisor - Inorganic	Metals, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Jyotsnarani Devi	Laboratory Analyst	Organics, Calgary, Alberta
Katarzyna Glinka	Analyst	Inorganics, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Nguyen Tran	Laboratory Analyst	Organics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	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.*
RRV	*Reported result verified by repeat analysis.*

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MW-05	MW-08	MW-09	DUPLICATE	----
					Client sampling date / time	02-Jun-2023 10:00	02-Jun-2023 10:15	02-Jun-2023 10:25	02-Jun-2023	----
						CG2307272-001	CG2307272-002	CG2307272-003	CG2307272-004	--------
						Result	Result	Result	Result	----
Physical Tests										
Alkalinity, bicarbonate (as HCO3)	71-52-3	E290/CG	1.0	mg/L		668	1770	1660	667	----
Alkalinity, carbonate (as CO3)	3812-32-6	E290/CG	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	----
Alkalinity, hydroxide (as OH)	14280-30-9	E290/CG	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	----
Alkalinity, total (as CaCO3)	----	E290/CG	1.0	mg/L		548	1450	1360	547	----
Conductivity	----	E100/CG	1.0	µS/cm		1300	3130	3850	1310	----
Hardness (as CaCO3), dissolved	----	EC100/CG	0.50	mg/L		242	1490	1450	241	----
pH	----	E108/CG	0.10	pH units		7.98	6.82	7.01	8.01	----
Solids, total dissolved [TDS], calculated	----	EC103/CG	1.0	mg/L		881	2120	2650	884	----
Anions and Nutrients										
Ammonia, total (as N)	7664-41-7	E298/CG	0.0050	mg/L		4.68	46.5	13.5	1.14	----
Chloride	16887-00-6	E235.Cl/CG	0.50	mg/L		5.61	322	482	5.77	----
Fluoride	16984-48-8	E235.F/CG	0.020	mg/L		0.474	0.142	0.187	0.494	----
Nitrate (as N)	14797-55-8	E235.NO3/CG	0.020	mg/L		<0.020	<0.100 DLDS	<0.100 DLDS	<0.020	----
Nitrate + Nitrite (as N)	----	EC235.N+N/CG	0.0032	mg/L		<0.0224	<0.112	<0.112	<0.0224	----
Nitrite (as N)	14797-65-0	E235.NO2/CG	0.010	mg/L		<0.010	<0.050 DLDS	<0.050 DLDS	<0.010	----
Sulfate (as SO4)	14808-79-8	E235.SO4/CG	0.30	mg/L		184	8.37	402	184	----
Ion Balance										
Anion sum	----	EC101/CG	0.10	meq/L		15.0	38.2	49.2	15.0	----
Cation sum	----	EC101/CG	0.10	meq/L		16.4	46.9	48.3	16.4	----
Ion balance (APHA)	----	EC101/CG	0.01	%		4.46	10.2	-0.92	4.46	----
Ion balance (cations/anions)	----	EC101/CG	0.010	%		109	123	98.2	109	----
Dissolved Metals										
Aluminum, dissolved	7429-90-5	E421/CG	0.0010	mg/L		0.0020	0.0219	0.0054	0.0011	----
Antimony, dissolved	7440-36-0	E421/CG	0.00010	mg/L		<0.00010	0.00028	0.00026	<0.00010	----
Arsenic, dissolved	7440-38-2	E421/CG	0.00010	mg/L		0.0140	0.0176	0.00532	0.0142	----
Barium, dissolved	7440-39-3	E421/CG	0.00010	mg/L		0.0364	1.23	0.317	0.0357	----
Boron, dissolved	7440-42-8	E421/CG	0.010	mg/L		0.225	0.313	0.209	0.224	----
Cadmium, dissolved	7440-43-9	E421/CG	0.0000050	mg/L		<0.0000050	<0.0000050	0.0000950	<0.0000050	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	MW-05	MW-08	MW-09	DUPLICATE	----
					Client sampling date / time	02-Jun-2023 10:00	02-Jun-2023 10:15	02-Jun-2023 10:25	02-Jun-2023	----
Analyte	CAS Number	Method/Lab	LOR	Unit		CG2307272-001	CG2307272-002	CG2307272-003	CG2307272-004	--------
						Result	Result	Result	Result	----
Dissolved Metals										
Calcium, dissolved	7440-70-2	E421/CG	0.050	mg/L		59.7	248 RRV	281	59.1	----
Chromium, dissolved	7440-47-3	E421/CG	0.00050	mg/L		<0.00050	0.00156	0.00107	<0.00050	----
Copper, dissolved	7440-50-8	E421/CG	0.00020	mg/L		0.00030	0.00026	0.00083	<0.00020	----
Iron, dissolved	7439-89-6	E421/CG	0.010	mg/L		1.18	72.1	13.5	1.20	----
Lead, dissolved	7439-92-1	E421/CG	0.000050	mg/L		<0.000050	0.000139	<0.000050	<0.000050	----
Magnesium, dissolved	7439-95-4	E421/CG	0.0050	mg/L		22.5	211 RRV	182	22.6	----
Manganese, dissolved	7439-96-5	E421/CG	0.00010	mg/L		0.185	0.796	4.61 RRV	0.186	----
Mercury, dissolved	7439-97-6	E509/CG	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
Nickel, dissolved	7440-02-0	E421/CG	0.00050	mg/L		<0.00050	0.0104	0.0348	<0.00050	----
Potassium, dissolved	7440-09-7	E421/CG	0.050	mg/L		3.73	43.8 RRV	15.0	3.78	----
Selenium, dissolved	7782-49-2	E421/CG	0.000050	mg/L		<0.000050	0.000815	0.000733	<0.000050	----
Silver, dissolved	7440-22-4	E421/CG	0.000010	mg/L		<0.000010	0.000011	0.000014	<0.000010	----
Sodium, dissolved	7440-23-5	E421/CG	0.050	mg/L		254	233 RRV	398	262	----
Uranium, dissolved	7440-61-1	E421/CG	0.000010	mg/L		0.00264	0.000097	0.00728	0.00272	----
Zinc, dissolved	7440-66-6	E421/CG	0.0010	mg/L		0.0012	0.0031	0.0099	<0.0010	----
Dissolved mercury filtration location	----	EP509/CG	-	-		Field	Field	Field	Field	----
Dissolved metals filtration location	----	EP421/CG	-	-		Field	Field	Field	Field	----
Volatile Organic Compounds										
Benzene	71-43-2	E611A/CG	0.50	µg/L		<0.50	42.4	3.14	<0.50	----
Bromobenzene	108-86-1	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Bromochloromethane	74-97-5	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Bromodichloromethane	75-27-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Bromoform	75-25-2	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Bromomethane	74-83-9	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Butylbenzene, n-	104-51-8	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Butylbenzene, sec-	135-98-8	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Butylbenzene, tert-	98-06-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Carbon tetrachloride	56-23-5	E611E/CG	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
Chlorobenzene	108-90-7	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Chloroethane	75-00-3	E611E/CG	1.0	µg/L		<1.0	1.8	<1.0	<1.0	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MW-05	MW-08	MW-09	DUPLICATE	----
					Client sampling date / time	02-Jun-2023 10:00	02-Jun-2023 10:15	02-Jun-2023 10:25	02-Jun-2023	----
						CG2307272-001	CG2307272-002	CG2307272-003	CG2307272-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
Chloroform	67-66-3	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Chloromethane	74-87-3	E611E/CG	5.0	µg/L		<5.0	<5.0	<5.0	<5.0	----
Chlorotoluene, 2-	95-49-8	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Chlorotoluene, 4-	106-43-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Cymene, p-	99-87-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dibromo-3-chloropropane, 1,2-	96-12-8	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dibromochloromethane	124-48-1	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dibromoethane, 1,2-	106-93-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dibromomethane	74-95-3	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichlorobenzene, 1,2-	95-50-1	E611E/CG	0.50	µg/L		<0.50	1.04	<0.50	<0.50	----
Dichlorobenzene, 1,3-	541-73-1	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichlorobenzene, 1,4-	106-46-7	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichlorodifluoromethane	75-71-8	E611E/CG	1.0	µg/L		<1.0	<1.0	1.6	<1.0	----
Dichloroethane, 1,1-	75-34-3	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloroethane, 1,2-	107-06-2	E611E/CG	1.0	µg/L		<1.0	1.7	<1.0	<1.0	----
Dichloroethylene, 1,1-	75-35-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloroethylene, cis-1,2-	156-59-2	E611E/CG	1.0	µg/L		<1.0	90.8	641	<1.0	----
Dichloroethylene, trans-1,2-	156-60-5	E611E/CG	1.0	µg/L		<1.0	15.9	44.8	<1.0	----
Dichloromethane	75-09-2	E611E/CG	1.0	µg/L		<1.0	<1.0	1.1	<1.0	----
Dichloropropane, 1,2-	78-87-5	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloropropane, 1,3-	142-28-9	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloropropane, 2,2-	594-20-7	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloropropylene, 1,1-	563-58-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloropropylene, cis+trans-1,3-	542-75-6	E611E/CG	1.5	µg/L		<1.5	<1.5	<1.5	<1.5	----
Dichloropropylene, cis-1,3-	10061-01-5	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dichloropropylene, trans-1,3-	10061-02-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Ethylbenzene	100-41-4	E611A/CG	0.50	µg/L		<0.50	6.46	<0.50	<0.50	----
Hexachlorobutadiene	87-68-3	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Isopropylbenzene	98-82-8	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E611E/CG	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MW-05	MW-08	MW-09	DUPLICATE	----
					Client sampling date / time	02-Jun-2023 10:00	02-Jun-2023 10:15	02-Jun-2023 10:25	02-Jun-2023	----
						CG2307272-001	CG2307272-002	CG2307272-003	CG2307272-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
Propylbenzene, n-	103-65-1	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Styrene	100-42-5	E611E/CG	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
Tetrachloroethane, 1,1,1,2-	630-20-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Tetrachloroethylene	127-18-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Toluene	108-88-3	E611A/CG	0.50	µg/L		<0.50	3.13	0.67	<0.50	----
Trichlorobenzene, 1,2,3-	87-61-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trichlorobenzene, 1,2,4-	120-82-1	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trichloroethane, 1,1,1-	71-55-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trichloroethane, 1,1,2-	79-00-5	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trichloroethylene	79-01-6	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trichlorofluoromethane	75-69-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trichloropropane, 1,2,3-	96-18-4	E611E/CG	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Trimethylbenzene, 1,2,4-	95-63-6	E611E/CG	1.0	µg/L		<1.0	5.0	<1.0	<1.0	----
Trimethylbenzene, 1,3,5-	108-67-8	E611E/CG	1.0	µg/L		<1.0	2.2	<1.0	<1.0	----
Vinyl chloride	75-01-4	E611E/CG	1.0	µg/L		<1.0	20.9	78.2	<1.0	----
Xylene, m+p-	179601-23-1	E611A/CG	0.40	µg/L		<0.40	10.2	<0.40	<0.40	----
Xylene, o-	95-47-6	E611A/CG	0.30	µg/L		<0.30	5.82	<0.30	<0.30	----
Xylenes, total	1330-20-7	E611A/CG	0.50	µg/L		<0.50	16.0	<0.50	<0.50	----
Trihalomethanes [THMs], total	----	E611E/CG	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Hydrocarbons										
F1 (C6-C10)	----	E581.F1/CG	100	µg/L		<100	<100	<100	<100	----
F1-BTEX	----	EC580/CG	25	µg/L		<100	<100	<100	<100	----
F2 (C10-C16)	----	E601/CG	100	µg/L		1390	300	130	1510	----
Hydrocarbons Surrogates										
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	E601/CG	1.0	%		108	108	106	109	----
Dichlorotoluene, 3,4-	95-75-0	E581.F1/CG	1.0	%		106	94.0	91.1	106	----
Volatile Organic Compounds Surrogates										
Bromofluorobenzene, 4-	460-00-4	E611A/CG	1.0	%		96.2	95.9	100	98.9	----
Difluorobenzene, 1,4-	540-36-3	E611A/CG	1.0	%		99.0	96.0	97.7	98.8	----

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

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2307272**	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.SWOP04071-03.005	Date Samples Received	: 04-Jun-2023 08:00
PO	: SWM.SWOP04071-03.005	Issue Date	: 12-Jun-2023 15:52
C-O-C number	: CORD RDC GW		
Sampler	: Ryan Miller		
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	02-Jun-2023	07-Jun-2023	----	----		07-Jun-2023	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) MW-05	E298	02-Jun-2023	07-Jun-2023	----	----		07-Jun-2023	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) MW-08	E298	02-Jun-2023	07-Jun-2023	----	----		07-Jun-2023	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) MW-09	E298	02-Jun-2023	07-Jun-2023	----	----		07-Jun-2023	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE DUPLICATE	E235.Cl	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-05	E235.Cl	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-08	E235.Cl	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 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-09	E235.Cl	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
DUPLICATE	E235.F	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
MW-05	E235.F	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
MW-08	E235.F	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
MW-09	E235.F	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
DUPLICATE	E235.NO3	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
MW-05	E235.NO3	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
MW-08	E235.NO3	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
MW-09	E235.NO3	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 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	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-05	E235.NO2	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-08	E235.NO2	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-09	E235.NO2	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	3 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE DUPLICATE	E235.SO4	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW-05	E235.SO4	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW-08	E235.SO4	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE MW-09	E235.SO4	02-Jun-2023	04-Jun-2023	----	----		04-Jun-2023	28 days	2 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) DUPLICATE	E509	02-Jun-2023	11-Jun-2023	----	----		11-Jun-2023	28 days	9 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-05	E509	02-Jun-2023	11-Jun-2023	----	----		11-Jun-2023	28 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW-08	E509	02-Jun-2023	11-Jun-2023	----	----		11-Jun-2023	28 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW-09	E509	02-Jun-2023	11-Jun-2023	----	----		11-Jun-2023	28 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) DUPLICATE	E421	02-Jun-2023	08-Jun-2023	----	----		08-Jun-2023	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW-05	E421	02-Jun-2023	08-Jun-2023	----	----		08-Jun-2023	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW-08	E421	02-Jun-2023	08-Jun-2023	----	----		08-Jun-2023	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) MW-09	E421	02-Jun-2023	08-Jun-2023	----	----		08-Jun-2023	180 days	6 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) DUPLICATE	E581.F1	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW-05	E581.F1	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	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-08	E581.F1	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW-09	E581.F1	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) DUPLICATE	E601	02-Jun-2023	07-Jun-2023	14 days	5 days	✓	08-Jun-2023	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW-05	E601	02-Jun-2023	07-Jun-2023	14 days	5 days	✓	08-Jun-2023	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW-08	E601	02-Jun-2023	07-Jun-2023	14 days	5 days	✓	08-Jun-2023	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW-09	E601	02-Jun-2023	07-Jun-2023	14 days	5 days	✓	08-Jun-2023	40 days	1 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE DUPLICATE	E290	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW-05	E290	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW-08	E290	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	14 days	4 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-09	E290	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	14 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE DUPLICATE	E100	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-05	E100	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-08	E100	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-09	E100	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	28 days	4 days	✓
Physical Tests : pH by Meter										
HDPE DUPLICATE	E108	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-05	E108	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-08	E108	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-09	E108	02-Jun-2023	06-Jun-2023	----	----		06-Jun-2023	0.25 hrs	0.26 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	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-05	E611A	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-08	E611A	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-09	E611A	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUPLICATE	E611E	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-05	E611E	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-08	E611E	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	14 days	3 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-09	E611E	02-Jun-2023	05-Jun-2023	----	----		05-Jun-2023	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	974276	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	977709	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	971761	1	17	5.8	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	971763	1	17	5.8	5.0	✓
Chloride in Water by IC	E235.Cl	971375	1	20	5.0	5.0	✓
Conductivity in Water	E100	974275	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	978371	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	977754	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	971372	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	971373	1	20	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	971374	1	20	5.0	5.0	✓
pH by Meter	E108	974274	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	971376	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	971762	1	15	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	974276	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	977709	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	971761	1	17	5.8	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	971763	1	17	5.8	5.0	✓
CCME PHCs - F2-F4 by GC-FID	E601	974695	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	971375	1	20	5.0	5.0	✓
Conductivity in Water	E100	974275	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	978371	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	977754	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	971372	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	971373	1	20	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	971374	1	20	5.0	5.0	✓
pH by Meter	E108	974274	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	971376	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	971762	1	15	6.6	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	974276	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	977709	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	971761	1	17	5.8	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	971763	1	17	5.8	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	974695	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	971375	1	20	5.0	5.0	✓
Conductivity in Water	E100	974275	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	978371	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	977754	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	971372	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	971373	1	20	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	971374	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	971376	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	971762	1	15	6.6	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	977709	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	971761	1	17	5.8	5.0	✓
Chloride in Water by IC	E235.Cl	971375	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	978371	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	977754	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	971372	1	20	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	971373	1	20	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	971374	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	971376	1	20	5.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	971762	1	15	6.6	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	: **CG2307272**	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	: 04-Jun-2023 08:00
PO	: SWM.SWOP04071-03.005	Date Analysis Commenced	: 04-Jun-2023
C-O-C number	: CORD RDC GW	Issue Date	: 12-Jun-2023 15:52
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	: 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*
Andrew Fox		Calgary Metals, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Cynthia Bauer	Organic Supervisor	Calgary Organics, Calgary, Alberta
George Huang	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
George Huang	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Jyotsnarani Devi	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Katarzyna Glinka	Analyst	Calgary Inorganics, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Nguyen Tran	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	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: 974274)											
CG2307263-018	Anonymous	pH	----	E108	0.10	pH units	7.62	7.62	0.00%	4%	----
Physical Tests (QC Lot: 974275)											
CG2307263-018	Anonymous	Conductivity	----	E100	2.0	µS/cm	2140	2110	1.41%	10%	----
Physical Tests (QC Lot: 974276)											
CG2307263-018	Anonymous	Alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	574	568	1.12%	20%	----
Anions and Nutrients (QC Lot: 971372)											
CG2307244-001	Anonymous	Fluoride	16984-48-8	E235.F	0.020	mg/L	0.382	0.370	2.98%	20%	----
Anions and Nutrients (QC Lot: 971373)											
CG2307244-001	Anonymous	Nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L	7.60	7.61	0.220%	20%	----
Anions and Nutrients (QC Lot: 971374)											
CG2307244-001	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: 971375)											
CG2307244-001	Anonymous	Chloride	16887-00-6	E235.Cl	0.50	mg/L	18.2	18.2	0.400%	20%	----
Anions and Nutrients (QC Lot: 971376)											
CG2307244-001	Anonymous	Sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	388	388	0.162%	20%	----
Anions and Nutrients (QC Lot: 977709)											
CG2307263-016	Anonymous	Ammonia, total (as N)	7664-41-7	E298	0.0500	mg/L	1.24	1.22	1.70%	20%	----
Dissolved Metals (QC Lot: 977754)											
CG2307243-001	Anonymous	Aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		Antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00037	0.00037	0.000003	Diff <2x LOR	----
		Arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0993	0.104	4.35%	20%	----
		Boron, dissolved	7440-42-8	E421	0.010	mg/L	0.015	0.014	0.0007	Diff <2x LOR	----
		Cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0405 µg/L	0.0000454	0.0000049	Diff <2x LOR	----
		Calcium, dissolved	7440-70-2	E421	0.050	mg/L	151	153	1.56%	20%	----
		Chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		Iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		Lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	80.1	82.2	2.62%	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: 977754) - continued											
CG2307243-001	Anonymous	Manganese, dissolved	7439-96-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.34	2.41	2.94%	20%	----
		Selenium, dissolved	7782-49-2	E421	0.000050	mg/L	150 µg/L	0.146	3.02%	20%	----
		Silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		Sodium, dissolved	7440-23-5	E421	0.050	mg/L	4.37	4.52	3.30%	20%	----
		Uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00472	0.00474	0.434%	20%	----
		Zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 978371)											
CG2307255-001	Anonymous	Mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 971761)											
CG2307184-001	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	0.40	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: 971762)											
CG2307184-001	Anonymous	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	<0.00050 mg/L	<0.50	0	Diff <2x LOR	----
		Chlorobenzene	108-90-7	E611E	1.0	µg/L	<0.0010 mg/L	<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	0.0022 mg/L	2.2	0.06	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	1.8	1.8	0.02	Diff <2x LOR	----
		Dibromo-3-chloropropane, 1,2-	96-12-8	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: 971762) - continued											
CG2307184-001	Anonymous	Dibromochloromethane	124-48-1	E611E	1.0	µg/L	<0.0010 mg/L	<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	<0.00050 mg/L	<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	<0.0010 mg/L	<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	<0.0010 mg/L	<1.0	0	Diff <2x LOR	----
		Dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L	<0.0010 mg/L	<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	<0.0010 mg/L	<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	0.0026 mg/L	2.6	0.002	Diff <2x LOR	----
		Trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L	<0.0010 mg/L	<1.0	0	Diff <2x LOR	----
		Trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L	<0.0010 mg/L	<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	<0.0010 mg/L	<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	----

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: 971762) - continued											
CG2307184-001	Anonymous	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	<0.0010 mg/L	<1.0	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 971763)											
CG2307184-001	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: 974275)						
Conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 974276)						
Alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 971372)						
Fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 971373)						
Nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 971374)						
Nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 971375)						
Chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 971376)						
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 977709)						
Ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Dissolved Metals (QCLot: 977754)						
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	----
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	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 977754) - continued						
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	----
Dissolved Metals (QCLot: 978371)						
Mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Volatile Organic Compounds (QCLot: 971761)						
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: 971762)						
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	----
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	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 971762) - continued						
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	----
Vinyl chloride	75-01-4	E611E	1	µg/L	<1.0	----
Hydrocarbons (QCLot: 971763)						
F1 (C6-C10)	----	E581.F1	100	µg/L	<100	----
Hydrocarbons (QCLot: 974695)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Hydrocarbons (QCLot: 974695) - continued						
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: 974274)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 974275)									
Conductivity	----	E100	1	µS/cm	146.9 µS/cm	108	90.0	110	----
Physical Tests (QCLot: 974276)									
Alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	107	85.0	115	----
Anions and Nutrients (QCLot: 971372)									
Fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 971373)									
Nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 971374)									
Nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	97.6	90.0	110	----
Anions and Nutrients (QCLot: 971375)									
Chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	99.6	90.0	110	----
Anions and Nutrients (QCLot: 971376)									
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 977709)									
Ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	106	85.0	115	----
Dissolved Metals (QCLot: 977754)									
Aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	97.4	80.0	120	----
Antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	99.0	80.0	120	----
Arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	98.8	80.0	120	----
Barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.1	80.0	120	----
Boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	100	80.0	120	----
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.4	80.0	120	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
Chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	96.1	80.0	120	----
Copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	96.2	80.0	120	----
Iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	114	80.0	120	----
Lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	99.6	80.0	120	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	103	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 977754) - continued									
Manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	97.1	80.0	120	----
Nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	95.8	80.0	120	----
Potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	96.1	80.0	120	----
Selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	92.2	80.0	120	----
Silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	91.7	80.0	120	----
Sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	99.5	80.0	120	----
Uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	96.2	80.0	120	----
Zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	92.1	80.0	120	----
Mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	106	80.0	120	----
Volatile Organic Compounds (QCLot: 971761)									
Benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	104	70.0	130	----
Ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	84.2	70.0	130	----
Toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	85.8	70.0	130	----
Xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	91.3	70.0	130	----
Xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	91.3	70.0	130	----
Volatile Organic Compounds (QCLot: 971762)									
Bromobenzene	108-86-1	E611E	1	µg/L	100 µg/L	99.1	70.0	130	----
Bromochloromethane	74-97-5	E611E	1	µg/L	100 µg/L	111	70.0	130	----
Bromodichloromethane	75-27-4	E611E	1	µg/L	100 µg/L	114	70.0	130	----
Bromoform	75-25-2	E611E	1	µg/L	100 µg/L	106	70.0	130	----
Bromomethane	74-83-9	E611E	1	µg/L	100 µg/L	99.4	60.0	140	----
Butylbenzene, n-	104-51-8	E611E	1	µg/L	100 µg/L	88.7	70.0	130	----
Butylbenzene, sec-	135-98-8	E611E	1	µg/L	100 µg/L	93.7	70.0	130	----
Butylbenzene, tert-	98-06-6	E611E	1	µg/L	100 µg/L	84.1	70.0	130	----
Carbon tetrachloride	56-23-5	E611E	0.5	µg/L	100 µg/L	88.9	70.0	130	----
Chlorobenzene	108-90-7	E611E	1	µg/L	100 µg/L	100	70.0	130	----
Chloroethane	75-00-3	E611E	1	µg/L	100 µg/L	104	60.0	140	----
Chloroform	67-66-3	E611E	1	µg/L	100 µg/L	113	70.0	130	----
Chloromethane	74-87-3	E611E	5	µg/L	100 µg/L	93.4	60.0	140	----
Chlorotoluene, 2-	95-49-8	E611E	1	µg/L	100 µg/L	88.2	70.0	130	----
Chlorotoluene, 4-	106-43-4	E611E	1	µg/L	100 µg/L	93.7	70.0	130	----
Cymene, p-	99-87-6	E611E	1	µg/L	100 µg/L	84.9	70.0	130	----
Dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	100 µg/L	101	70.0	130	----
Dibromochloromethane	124-48-1	E611E	1	µg/L	100 µg/L	114	70.0	130	----
Dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	100 µg/L	127	70.0	130	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 971762) - continued									
Dibromomethane	74-95-3	E611E	1	µg/L	100 µg/L	104	70.0	130	----
Dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	100 µg/L	100	70.0	130	----
Dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	100 µg/L	93.0	70.0	130	----
Dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	100 µg/L	87.9	70.0	130	----
Dichlorodifluoromethane	75-71-8	E611E	1	µg/L	100 µg/L	94.4	60.0	140	----
Dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	100 µg/L	107	70.0	130	----
Dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	100 µg/L	114	70.0	130	----
Dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	100 µg/L	91.6	70.0	130	----
Dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	100 µg/L	113	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	98.4	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	113	70.0	130	----
Dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	100 µg/L	93.6	70.0	130	----
Dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	100 µg/L	94.8	70.0	130	----
Dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	100 µg/L	107	70.0	130	----
Dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	100 µg/L	105	70.0	130	----
Hexachlorobutadiene	87-68-3	E611E	1	µg/L	100 µg/L	79.1	70.0	130	----
Isopropylbenzene	98-82-8	E611E	1	µg/L	100 µg/L	84.7	70.0	130	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	100 µg/L	101	70.0	130	----
Propylbenzene, n-	103-65-1	E611E	1	µg/L	100 µg/L	91.0	70.0	130	----
Styrene	100-42-5	E611E	0.5	µg/L	100 µg/L	92.1	70.0	130	----
Tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	100 µg/L	108	70.0	130	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	100 µg/L	103	70.0	130	----
Tetrachloroethylene	127-18-4	E611E	1	µg/L	100 µg/L	79.5	70.0	130	----
Trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	100 µg/L	108	70.0	130	----
Trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	100 µg/L	94.2	70.0	130	----
Trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	100 µg/L	107	70.0	130	----
Trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	100 µg/L	128	70.0	130	----
Trichloroethylene	79-01-6	E611E	1	µg/L	100 µg/L	101	70.0	130	----
Trichlorofluoromethane	75-69-4	E611E	1	µg/L	100 µg/L	93.9	60.0	140	----
Trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	100 µg/L	96.2	70.0	130	----
Trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	100 µg/L	87.7	70.0	130	----
Trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	100 µg/L	86.1	70.0	130	----
Vinyl chloride	75-01-4	E611E	1	µg/L	100 µg/L	87.2	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
Hydrocarbons (QCLot: 971763)									
F1 (C6-C10)	----	E581.F1	100	µg/L	100 µg/L	91.4	70.0	130	----
Hydrocarbons (QCLot: 974695)									
F2 (C10-C16)	----	E601	100	µg/L	3669.135 µg/L	122	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: 971372)										
CG2307244-014	Anonymous	Fluoride	16984-48-8	E235.F	0.959 mg/L	1 mg/L	95.9	75.0	125	----
Anions and Nutrients (QCLot: 971373)										
CG2307244-014	Anonymous	Nitrate (as N)	14797-55-8	E235.NO3	2.45 mg/L	2.5 mg/L	98.1	75.0	125	----
Anions and Nutrients (QCLot: 971374)										
CG2307244-014	Anonymous	Nitrite (as N)	14797-65-0	E235.NO2	0.486 mg/L	0.5 mg/L	97.1	75.0	125	----
Anions and Nutrients (QCLot: 971375)										
CG2307244-014	Anonymous	Chloride	16887-00-6	E235.Cl	97.0 mg/L	100 mg/L	97.0	75.0	125	----
Anions and Nutrients (QCLot: 971376)										
CG2307244-014	Anonymous	Sulfate (as SO4)	14808-79-8	E235.SO4	97.0 mg/L	100 mg/L	97.0	75.0	125	----
Anions and Nutrients (QCLot: 977709)										
CG2307263-017	Anonymous	Ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	----
Dissolved Metals (QCLot: 977754)										
CG2307243-002	Anonymous	Aluminum, dissolved	7429-90-5	E421	1.82 mg/L	2 mg/L	91.1	70.0	130	----
		Antimony, dissolved	7440-36-0	E421	0.192 mg/L	0.2 mg/L	96.2	70.0	130	----
		Arsenic, dissolved	7440-38-2	E421	0.190 mg/L	0.2 mg/L	95.1	70.0	130	----
		Barium, dissolved	7440-39-3	E421	0.179 mg/L	0.2 mg/L	89.4	70.0	130	----
		Boron, dissolved	7440-42-8	E421	1.00 mg/L	1 mg/L	100	70.0	130	----
		Cadmium, dissolved	7440-43-9	E421	0.0393 mg/L	0.04 mg/L	98.3	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	0.367 mg/L	0.4 mg/L	91.7	70.0	130	----
		Copper, dissolved	7440-50-8	E421	0.190 mg/L	0.2 mg/L	94.8	70.0	130	----
		Iron, dissolved	7439-89-6	E421	18.9 mg/L	20 mg/L	94.6	70.0	130	----
		Lead, dissolved	7439-92-1	E421	0.189 mg/L	0.2 mg/L	94.4	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	0.185 mg/L	0.2 mg/L	92.7	70.0	130	----
		Nickel, dissolved	7440-02-0	E421	0.372 mg/L	0.4 mg/L	93.1	70.0	130	----
		Potassium, dissolved	7440-09-7	E421	36.2 mg/L	40 mg/L	90.6	70.0	130	----
		Selenium, dissolved	7782-49-2	E421	0.349 mg/L	0.4 mg/L	87.2	70.0	130	----
		Silver, dissolved	7440-22-4	E421	0.0386 mg/L	0.04 mg/L	96.4	70.0	130	----
		Sodium, dissolved	7440-23-5	E421	19.2 mg/L	20 mg/L	96.0	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: 977754) - continued										
CG2307243-002	Anonymous	Uranium, dissolved	7440-61-1	E421	0.0374 mg/L	0.04 mg/L	93.6	70.0	130	----
		Zinc, dissolved	7440-66-6	E421	3.74 mg/L	4 mg/L	93.6	70.0	130	----
Dissolved Metals (QCLot: 978371)										
CG2307270-001	Anonymous	Mercury, dissolved	7439-97-6	E509	0.000105 mg/L	0.0001 mg/L	105	70.0	130	----
Volatile Organic Compounds (QCLot: 971761)										
CG2307184-001	Anonymous	Benzene	71-43-2	E611A	97.0 µg/L	100 µg/L	97.0	70.0	130	----
		Ethylbenzene	100-41-4	E611A	82.8 µg/L	100 µg/L	82.8	70.0	130	----
		Toluene	108-88-3	E611A	84.4 µg/L	100 µg/L	84.4	70.0	130	----
		Xylene, m+p-	179601-23-1	E611A	177 µg/L	200 µg/L	88.6	70.0	130	----
		Xylene, o-	95-47-6	E611A	90.2 µg/L	100 µg/L	90.2	70.0	130	----
Volatile Organic Compounds (QCLot: 971762)										
CG2307184-001	Anonymous	Bromobenzene	108-86-1	E611E	100 µg/L	100 µg/L	100	70.0	130	----
		Bromochloromethane	74-97-5	E611E	118 µg/L	100 µg/L	118	70.0	130	----
		Bromodichloromethane	75-27-4	E611E	116 µg/L	100 µg/L	116	70.0	130	----
		Bromoform	75-25-2	E611E	107 µg/L	100 µg/L	107	70.0	130	----
		Bromomethane	74-83-9	E611E	92.8 µg/L	100 µg/L	92.8	60.0	140	----
		Butylbenzene, n-	104-51-8	E611E	88.5 µg/L	100 µg/L	88.5	70.0	130	----
		Butylbenzene, sec-	135-98-8	E611E	91.2 µg/L	100 µg/L	91.2	70.0	130	----
		Butylbenzene, tert-	98-06-6	E611E	81.8 µg/L	100 µg/L	81.8	70.0	130	----
		Carbon tetrachloride	56-23-5	E611E	80.9 µg/L	100 µg/L	80.9	70.0	130	----
		Chlorobenzene	108-90-7	E611E	99.1 µg/L	100 µg/L	99.1	70.0	130	----
		Chloroethane	75-00-3	E611E	95.9 µg/L	100 µg/L	95.9	60.0	140	----
		Chloroform	67-66-3	E611E	104 µg/L	100 µg/L	104	70.0	130	----
		Chloromethane	74-87-3	E611E	86.5 µg/L	100 µg/L	86.5	60.0	140	----
		Chlorotoluene, 2-	95-49-8	E611E	86.4 µg/L	100 µg/L	86.4	70.0	130	----
		Chlorotoluene, 4-	106-43-4	E611E	93.7 µg/L	100 µg/L	93.7	70.0	130	----
		Cymene, p-	99-87-6	E611E	84.4 µg/L	100 µg/L	84.4	70.0	130	----
		Dibromo-3-chloropropane, 1,2-	96-12-8	E611E	111 µg/L	100 µg/L	111	70.0	130	----
		Dibromochloromethane	124-48-1	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		Dibromoethane, 1,2-	106-93-4	E611E	130 µg/L	100 µg/L	130	70.0	130	----
		Dibromomethane	74-95-3	E611E	126 µg/L	100 µg/L	126	70.0	130	----
		Dichlorobenzene, 1,2-	95-50-1	E611E	99.7 µg/L	100 µg/L	99.7	70.0	130	----
		Dichlorobenzene, 1,3-	541-73-1	E611E	93.3 µg/L	100 µg/L	93.3	70.0	130	----
		Dichlorobenzene, 1,4-	106-46-7	E611E	88.7 µg/L	100 µg/L	88.7	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: 971762) - continued										
CG2307184-001	Anonymous	Dichlorodifluoromethane	75-71-8	E611E	97.8 µg/L	100 µg/L	97.8	60.0	140	----
		Dichloroethane, 1,1-	75-34-3	E611E	99.0 µg/L	100 µg/L	99.0	70.0	130	----
		Dichloroethane, 1,2-	107-06-2	E611E	116 µg/L	100 µg/L	116	70.0	130	----
		Dichloroethylene, 1,1-	75-35-4	E611E	83.4 µg/L	100 µg/L	83.4	70.0	130	----
		Dichloroethylene, cis-1,2-	156-59-2	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		Dichloroethylene, trans-1,2-	156-60-5	E611E	94.7 µg/L	100 µg/L	94.7	70.0	130	----
		Dichloromethane	75-09-2	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		Dichloropropane, 1,2-	78-87-5	E611E	113 µg/L	100 µg/L	113	70.0	130	----
		Dichloropropane, 1,3-	142-28-9	E611E	115 µg/L	100 µg/L	115	70.0	130	----
		Dichloropropane, 2,2-	594-20-7	E611E	89.2 µg/L	100 µg/L	89.2	70.0	130	----
		Dichloropropylene, 1,1-	563-58-6	E611E	87.3 µg/L	100 µg/L	87.3	70.0	130	----
		Dichloropropylene, cis-1,3-	10061-01-5	E611E	108 µg/L	100 µg/L	108	70.0	130	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		Hexachlorobutadiene	87-68-3	E611E	71.0 µg/L	100 µg/L	71.0	70.0	130	----
		Isopropylbenzene	98-82-8	E611E	82.0 µg/L	100 µg/L	82.0	70.0	130	----
		Methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	99.9 µg/L	100 µg/L	99.9	70.0	130	----
		Propylbenzene, n-	103-65-1	E611E	90.8 µg/L	100 µg/L	90.8	70.0	130	----
		Styrene	100-42-5	E611E	90.7 µg/L	100 µg/L	90.7	70.0	130	----
		Tetrachloroethane, 1,1,1,2-	630-20-6	E611E	107 µg/L	100 µg/L	107	70.0	130	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611E	122 µg/L	100 µg/L	122	70.0	130	----
		Tetrachloroethylene	127-18-4	E611E	77.6 µg/L	100 µg/L	77.6	70.0	130	----
		Trichlorobenzene, 1,2,3-	87-61-6	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		Trichlorobenzene, 1,2,4-	120-82-1	E611E	94.7 µg/L	100 µg/L	94.7	70.0	130	----
		Trichloroethane, 1,1,1-	71-55-6	E611E	97.9 µg/L	100 µg/L	97.9	70.0	130	----
		Trichloroethane, 1,1,2-	79-00-5	E611E	128 µg/L	100 µg/L	128	70.0	130	----
		Trichloroethylene	79-01-6	E611E	93.6 µg/L	100 µg/L	93.6	70.0	130	----
		Trichlorofluoromethane	75-69-4	E611E	86.7 µg/L	100 µg/L	86.7	60.0	140	----
		Trichloropropane, 1,2,3-	96-18-4	E611E	126 µg/L	100 µg/L	126	70.0	130	----
		Trimethylbenzene, 1,2,4-	95-63-6	E611E	86.1 µg/L	100 µg/L	86.1	70.0	130	----
		Trimethylbenzene, 1,3,5-	108-67-8	E611E	85.3 µg/L	100 µg/L	85.3	70.0	130	----
		Vinyl chloride	75-01-4	E611E	80.4 µg/L	100 µg/L	80.4	60.0	140	----

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Environmental Division
Calgary
Work Order Reference
CG2307272

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.SWOP04071-03.005		
Address:		PO/AFE:	SWM.SWOP04071-03.005		
Sample		Legal Site Description:			
Phone:	Fax:	Quote #:	CG22-EBAE100-0021		
Lab Work Order # (lab use only)		ALS Contact: Melissa Rapic	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 + Diss Meta	E611E - VOCs	E298 - Ammonia	S665A.F (BTEX, F1 and F2)
1	MW-05	02-06-23	10:00	Water	X	X	X	X
2	MW-08	"	10:15	Water	X	X	X	X
3	MW-09	"	10:25	Water	X	X	X	X
4	Duplicate	"	—	Water	X	X	X	X

Environmental Division
Calgary
Work Order Reference
CG2307272

Telephone : +1 403 407 1800

Guidelines / Regulations

Special Instructions / Hazardous Details

Diss Metals + Hg Field F + P

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the adjacent worksheet.

								Sample Condition (lab use only)	
Relinquished By:	Ryan Miller	Date & Time:	June 3/23	Received By:		Date & Time:		Temperature	Samples Received in Good Condition? Y / N (if no provided details)
Relinquished By:		Date & Time:	17:00	Received By:		Date & Time:	06/04 9:00	10.1 °C	

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **CG2307273**	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.SWOP04071-03.005	Date Samples Received	: 04-Jun-2023 12:36
PO	: SWM.SWOP04071-03.005	Date Analysis Commenced	: 07-Jun-2023
C-O-C number	: CORD RDC VWs	Issue Date	: 16-Jun-2023 14:33
Sampler	: Ryan Miller		
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*
David Tremblett	VOC Section Supervisor	Air Quality, Waterloo, Ontario
Simon Campsall	Analyst	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.*
DLQ	*Detection Limit raised due to co-eluting interference. Mass Spectrometry qualifier ion ratio did not meet acceptance criteria.*

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	VW-02	VW-03	VW-06	DUPLICATE	----
					Client sampling date / time	01-Jun-2023 12:22	01-Jun-2023 11:40	01-Jun-2023 10:34	01-Jun-2023 11:40	----
						CG2307273-001	CG2307273-002	CG2307273-003	CG2307273-004	--------
						Result	Result	Result	Result	----
Field Tests										
ID, batch proof	----	EF001/WT	-	-		230507.106	230507.101	221127.202	230507.112	----
ID, canister	----	EF001/WT	-	-		01400-0532	01400-0012	01400-0472	01400-0160	----
ID, regulator	----	EF001/WT	-	-		G105	G239	G192	G239	----
Pressure on receipt	----	EF001/WT	0.10	Inches Hg		-7.56	-9.19	-10.0	-8.99	----
Permanent Gases										
Carbon dioxide	124-38-9	E629B-H/WT	0.050	%		0.548	15.6	2.24	15.7	----
Carbon monoxide	630-08-0	E629B-H/WT	0.050	%		<0.050	<0.050	<0.050	<0.050	----
Methane	74-82-8	E629B-H/WT	0.050	%		<0.050	3.36	<0.050	3.37	----
Nitrogen	7727-37-9	E629B-H/WT	1.0	%		78.8	80.2	82.7	80.3	----
Oxygen	7782-44-7	E629B-H/WT	0.10	%		20.4	2.42	15.2	2.43	----
Volatile Organic Compounds										
Acetone	67-64-1	EC621B/WT	2.4	µg/m³		16.6	<17.8	12.8	<14.5	----
Acetone	67-64-1	E621B/WT	1.0	ppbv		7.0	<7.5 DLQ	5.4 AI	<6.1 DLQ	----
Allyl chloride	107-05-1	EC621B/WT	0.63	µg/m³		<0.63	<0.63	<0.63	<0.63	----
Allyl chloride	107-05-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Benzene	71-43-2	EC621B/WT	0.32	µg/m³		5.08	11.5	7.09	10.9	----
Benzene	71-43-2	E621B/WT	0.10	ppbv		1.59	3.61	2.22	3.42	----
Benzyl chloride	100-44-7	EC621B/WT	1.0	µg/m³		<1.0	<1.0	<1.0	<1.0	----
Benzyl chloride	100-44-7	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Bromodichloromethane	75-27-4	EC621B/WT	1.3	µg/m³		<1.3	<1.3	<1.3	<1.3	----
Bromodichloromethane	75-27-4	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Bromoform	75-25-2	EC621B/WT	2.1	µg/m³		<2.1	<2.1	<2.1	<2.1	----
Bromoform	75-25-2	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Bromomethane	74-83-9	EC621B/WT	0.78	µg/m³		<0.78	<0.78	<0.78	<0.78	----
Bromomethane	74-83-9	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Butadiene, 1,3-	106-99-0	EC621B/WT	0.44	µg/m³		<0.44	<3.27	<0.44	<1.77	----
Butadiene, 1,3-	106-99-0	E621B/WT	0.20	ppbv		<0.20	<1.48 DLQ	<0.20	<0.80 DLQ	----
Carbon disulfide	75-15-0	EC621B/WT	1.6	µg/m³		8.0	4.4	33.6	4.0	----
Carbon disulfide	75-15-0	E621B/WT	0.50	ppbv		2.58	1.41	10.8	1.30	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	VW-02	VW-03	VW-06	DUPLICATE	----
					Client sampling date / time	01-Jun-2023 12:22	01-Jun-2023 11:40	01-Jun-2023 10:34	01-Jun-2023 11:40	----
						CG2307273-001	CG2307273-002	CG2307273-003	CG2307273-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
Carbon tetrachloride	56-23-5	EC621B/WT	1.30	µg/m³		<1.26	<1.26	<1.26	<1.26	----
Carbon tetrachloride	56-23-5	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Chlorobenzene	108-90-7	EC621B/WT	0.92	µg/m³		<0.92	<0.92	<0.92	<0.92	----
Chlorobenzene	108-90-7	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Chloroethane	75-00-3	EC621B/WT	0.53	µg/m³		<0.53	<6.86	<0.53	<6.86	----
Chloroethane	75-00-3	E621B/WT	0.20	ppbv		<0.20	<2.60 DLQ	<0.20	<2.60 DLQ	----
Chloroform	67-66-3	EC621B/WT	0.98	µg/m³		<0.98	<0.98	20.8	<0.98	----
Chloroform	67-66-3	E621B/WT	0.20	ppbv		<0.20	<0.20	4.25	<0.20	----
Chloromethane	74-87-3	EC621B/WT	0.41	µg/m³		3.53	<0.41	1.26	<0.41	----
Chloromethane	74-87-3	E621B/WT	0.20	ppbv		1.71 AI	<0.20	0.61	<0.20	----
Cyclohexane	110-82-7	EC621B/WT	0.69	µg/m³		<0.69	54.0	8.67	52.3	----
Cyclohexane	110-82-7	E621B/WT	0.20	ppbv		<0.20	15.7	2.52	15.2	----
Dibromochloromethane	124-48-1	EC621B/WT	1.7	µg/m³		<1.7	<1.7	<1.7	<1.7	----
Dibromochloromethane	124-48-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dibromoethane, 1,2-	106-93-4	EC621B/WT	1.5	µg/m³		<1.5	<1.5	<1.5	<1.5	----
Dibromoethane, 1,2-	106-93-4	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichlorobenzene, 1,2-	95-50-1	EC621B/WT	1.2	µg/m³		<1.2	<1.2	<1.2	<1.2	----
Dichlorobenzene, 1,2-	95-50-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichlorobenzene, 1,3-	541-73-1	EC621B/WT	1.2	µg/m³		<1.2	<1.2	<1.2	<1.2	----
Dichlorobenzene, 1,3-	541-73-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichlorobenzene, 1,4-	106-46-7	EC621B/WT	1.2	µg/m³		<1.2	<1.2	<1.2	<1.2	----
Dichlorobenzene, 1,4-	106-46-7	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichlorodifluoromethane	75-71-8	EC621B/WT	1.0	µg/m³		2.3	14.3	2.6	10.8	----
Dichlorodifluoromethane	75-71-8	E621B/WT	0.20	ppbv		0.47	2.90	0.52	2.18	----
Dichloroethane, 1,1-	75-34-3	EC621B/WT	0.81	µg/m³		<0.81	<0.81	<0.81	<0.81	----
Dichloroethane, 1,1-	75-34-3	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichloroethane, 1,2-	107-06-2	EC621B/WT	0.81	µg/m³		<0.81	<0.81	<0.81	<0.81	----
Dichloroethane, 1,2-	107-06-2	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichloroethylene, 1,1-	75-35-4	EC621B/WT	0.79	µg/m³		<0.79	<0.79	<0.79	<0.79	----
Dichloroethylene, 1,1-	75-35-4	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	VW-02	VW-03	VW-06	DUPLICATE	----
					Client sampling date / time	01-Jun-2023 12:22	01-Jun-2023 11:40	01-Jun-2023 10:34	01-Jun-2023 11:40	----
						CG2307273-001	CG2307273-002	CG2307273-003	CG2307273-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
Dichloroethylene, cis-1,2-	156-59-2	EC621B/WT	0.79	µg/m³		<0.79	1820	<0.79	2000	----
Dichloroethylene, cis-1,2-	156-59-2	E621B/WT	0.20	ppbv		<0.20	460	<0.20	504	----
Dichloroethylene, trans-1,2-	156-60-5	EC621B/WT	0.79	µg/m³		<0.79	156	<0.79	163	----
Dichloroethylene, trans-1,2-	156-60-5	E621B/WT	0.20	ppbv		<0.20	39.3	<0.20	41.2	----
Dichloromethane	75-09-2	EC621B/WT	0.69	µg/m³		1.15	0.73	<0.69	<0.69	----
Dichloromethane	75-09-2	E621B/WT	0.20	ppbv		0.33	0.21	<0.20	<0.20	----
Dichloropropane, 1,2-	78-87-5	EC621B/WT	0.9	µg/m³		<0.9	<0.9	<0.9	<0.9	----
Dichloropropane, 1,2-	78-87-5	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichloropropylene, cis+trans-1,3-	542-75-6	EC621B/WT	1.3	µg/m³		<1.8	<1.8	<1.8	<1.8	----
Dichloropropylene, cis+trans-1,3-	542-75-6	E621B/WT	0.30	ppbv		<0.30	<0.30	<0.30	<0.30	----
Dichloropropylene, cis-1,3-	10061-01-5	EC621B/WT	0.9	µg/m³		<0.9	<0.9	<0.9	<0.9	----
Dichloropropylene, cis-1,3-	10061-01-5	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichloropropylene, trans-1,3-	10061-02-6	EC621B/WT	0.9	µg/m³		<0.9	<0.9	<0.9	<0.9	----
Dichloropropylene, trans-1,3-	10061-02-6	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	EC621B/WT	1.4	µg/m³		<1.4	26.8	<1.4	20.5	----
Dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B/WT	0.20	ppbv		<0.20	3.83	<0.20	2.93	----
Dioxane, 1,4-	123-91-1	EC621B/WT	0.72	µg/m³		<0.72	<0.72	<0.72	<0.72	----
Dioxane, 1,4-	123-91-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Ethyl acetate	141-78-6	EC621B/WT	0.72	µg/m³		7.57	<2.09	<1.37	<2.09	----
Ethyl acetate	141-78-6	E621B/WT	0.20	ppbv		2.10	<0.58 DLQ	<0.38 DLQ	<0.58 DLQ	----
Ethylbenzene	100-41-4	EC621B/WT	0.43	µg/m³		<0.43	0.56	0.52	<0.43	----
Ethylbenzene	100-41-4	E621B/WT	0.10	ppbv		<0.10	0.13	0.12	<0.10	----
Ethyltoluene, 4-	622-96-8	EC621B/WT	1.0	µg/m³		<1.0	<1.0	<1.0	<1.0	----
Ethyltoluene, 4-	622-96-8	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Heptane, n-	142-82-5	EC621B/WT	0.82	µg/m³		<0.82	13.1	<0.82	12.4	----
Heptane, n-	142-82-5	E621B/WT	0.20	ppbv		<0.20	3.20	<0.20	3.02	----
Hexachlorobutadiene	87-68-3	EC621B/WT	2.1	µg/m³		<2.1	<2.1	<2.1	<2.1	----
Hexachlorobutadiene	87-68-3	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Hexane, n-	110-54-3	EC621B/WT	0.70	µg/m³		1.09	28.4	2.04	27.1	----
Hexane, n-	110-54-3	E621B/WT	0.20	ppbv		0.31	8.05	0.58	7.69	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	VW-02	VW-03	VW-06	DUPLICATE	----
					Client sampling date / time	01-Jun-2023 12:22	01-Jun-2023 11:40	01-Jun-2023 10:34	01-Jun-2023 11:40	----
						CG2307273-001	CG2307273-002	CG2307273-003	CG2307273-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
Hexanone, 2-	591-78-6	EC621B/WT	4.10	µg/m³		<4.10	<5.74	<4.10	<5.74	----
Hexanone, 2-	591-78-6	E621B/WT	1.0	ppbv		<1.0	<1.4 DLQ	<1.0	<1.4 DLQ	----
Isopropylbenzene	98-82-8	EC621B/WT	1.0	µg/m³		<1.0	<1.0	4.3	<1.0	----
Isopropylbenzene	98-82-8	E621B/WT	0.20	ppbv		<0.20	<0.20	0.87	<0.20	----
Methyl ethyl ketone [MEK]	78-93-3	EC621B/WT	0.59	µg/m³		2.03	<0.59	1.39	<0.59	----
Methyl ethyl ketone [MEK]	78-93-3	E621B/WT	0.20	ppbv		0.69	<0.20	0.47	<0.20	----
Methyl isobutyl ketone [MIBK]	108-10-1	EC621B/WT	0.82	µg/m³		<0.82	<5.16	<4.10	<5.24	----
Methyl isobutyl ketone [MIBK]	108-10-1	E621B/WT	0.20	ppbv		<0.20	<1.26 DLQ	<1.00 DLQ	<1.28 DLQ	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	EC621B/WT	0.72	µg/m³		<0.72	<0.72	<0.72	<0.72	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Naphthalene	91-20-3	EC621B/WT	0.52	µg/m³		<0.52	<0.52	<0.52	<0.52	----
Naphthalene	91-20-3	E621B/WT	0.10	ppbv		<0.10	<0.10	<0.10	<0.10	----
Propylene	115-07-1	EC621B/WT	0.34	µg/m³		<13.8	<104	<38.2	<119	----
Propylene	115-07-1	E621B/WT	0.20	ppbv		<8.00 DLQ	<60.2 DLQ	<22.2 DLQ	<69.0 DLQ	----
Styrene	100-42-5	EC621B/WT	0.85	µg/m³		<0.85	<0.85	<0.85	<0.85	----
Styrene	100-42-5	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Tetrachloroethane, 1,1,2,2-	79-34-5	EC621B/WT	1.4	µg/m³		<1.4	<1.4	<1.4	<1.4	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Tetrachloroethylene	127-18-4	EC621B/WT	1.4	µg/m³		<1.4	<1.4	<1.4	<1.4	----
Tetrachloroethylene	127-18-4	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Tetrahydrofuran	109-99-9	EC621B/WT	0.59	µg/m³		7.49	5.78	<0.59	2.00	----
Tetrahydrofuran	109-99-9	E621B/WT	0.20	ppbv		2.54	1.96	<0.20	0.68	----
Toluene	108-88-3	EC621B/WT	0.38	µg/m³		0.75	6.90	1.02	6.10	----
Toluene	108-88-3	E621B/WT	0.10	ppbv		0.20	1.83	0.27	1.62	----
Trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	EC621B/WT	1.5	µg/m³		<1.5	<1.5	<1.5	<1.5	----
Trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Trichlorobenzene, 1,2,4-	120-82-1	EC621B/WT	1.5	µg/m³		<1.5	<1.5	<1.5	<1.5	----
Trichlorobenzene, 1,2,4-	120-82-1	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	VW-02	VW-03	VW-06	DUPLICATE	----
					Client sampling date / time	01-Jun-2023 12:22	01-Jun-2023 11:40	01-Jun-2023 10:34	01-Jun-2023 11:40	----
						CG2307273-001	CG2307273-002	CG2307273-003	CG2307273-004	--------
						Result	Result	Result	Result	----
Volatile Organic Compounds										
Trichloroethane, 1,1,1-	71-55-6	EC621B/WT	1.1	µg/m³		<1.1	<1.1	<1.1	<1.1	----
Trichloroethane, 1,1,1-	71-55-6	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Trichloroethane, 1,1,2-	79-00-5	EC621B/WT	1.1	µg/m³		<1.1	<1.1	<1.1	<1.1	----
Trichloroethane, 1,1,2-	79-00-5	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Trichloroethylene	79-01-6	EC621B/WT	1.1	µg/m³		<1.1	<1.1	<1.1	<1.1	----
Trichloroethylene	79-01-6	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Trichlorofluoromethane	75-69-4	EC621B/WT	1.1	µg/m³		1.1	<1.1	2.0	<1.1	----
Trichlorofluoromethane	75-69-4	E621B/WT	0.20	ppbv		0.20	<0.20	0.36	<0.20	----
Trimethylbenzene, 1,2,4-	95-63-6	EC621B/WT	1.0	µg/m³		<1.0	1.2	<1.0	<1.0	----
Trimethylbenzene, 1,2,4-	95-63-6	E621B/WT	0.20	ppbv		<0.20	0.25	<0.20	<0.20	----
Trimethylbenzene, 1,3,5-	108-67-8	EC621B/WT	1.0	µg/m³		<1.0	1.1	<1.0	<1.0	----
Trimethylbenzene, 1,3,5-	108-67-8	E621B/WT	0.20	ppbv		<0.20	0.22	<0.20	<0.20	----
Trimethylpentane, 2,2,4-	540-84-1	EC621B/WT	0.9	µg/m³		<0.9	<21.5	<2.5	<20.6	----
Trimethylpentane, 2,2,4-	540-84-1	E621B/WT	0.20	ppbv		<0.20	<4.60 DLQ	<0.54 DLQ	<4.40 DLQ	----
Vinyl acetate	108-05-4	EC621B/WT	1.8	µg/m³		<1.8	<19.7	<3.4	<19.5	----
Vinyl acetate	108-05-4	E621B/WT	0.50	ppbv		<0.50	<5.60 DLQ	<0.96 DLQ	<5.55 DLQ	----
Vinyl bromide	593-60-2	EC621B/WT	0.9	µg/m³		<0.9	<0.9	<0.9	<0.9	----
Vinyl bromide	593-60-2	E621B/WT	0.20	ppbv		<0.20	<0.20	<0.20	<0.20	----
Vinyl chloride	75-01-4	EC621B/WT	0.51	µg/m³		<0.51	4010	<0.51	3760	----
Vinyl chloride	75-01-4	E621B/WT	0.20	ppbv		<0.20	1570	<0.20	1470	----
Xylene, m+p-	179601-23-1	EC621B/WT	0.87	µg/m³		<0.87	3.43	1.39	1.04	----
Xylene, m+p-	179601-23-1	E621B/WT	0.20	ppbv		<0.20	0.79	0.32	0.24	----
Xylene, o-	95-47-6	EC621B/WT	0.43	µg/m³		<0.43	1.30	0.65	0.87	----
Xylene, o-	95-47-6	E621B/WT	0.10	ppbv		<0.10	0.30	0.15	0.20	----
Xylenes, total	1330-20-7	EC621B/WT	1.3	µg/m³		<1.3	4.7	2.0	1.9	----
Xylenes, total	1330-20-7	E621B/WT	0.30	ppbv		<0.30	1.09	0.47	0.44	----
BTEX, total	----	EC621B/WT	1.2	µg/m³		5.8	23.7	10.7	18.9	----
BTEX, total	----	E621B/WT	0.30	ppbv		1.79	6.66	3.08	5.48	----
Hydrocarbons										
Aliphatic (C10-C12)	----	E593C/WT	15	µg/m³		22	339	66	351	----

Analytical Results

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

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	VW-02	VW-03	VW-06	DUPLICATE	----
					Client sampling date / time	01-Jun-2023 12:22	01-Jun-2023 11:40	01-Jun-2023 10:34	01-Jun-2023 11:40	----
						CG2307273-001	CG2307273-002	CG2307273-003	CG2307273-004	--------
						Result	Result	Result	Result	----
Hydrocarbons										
Aliphatic (C12-C16)	----	E593C/WT	30	µg/m³		<30	150	<30	157	----
Aliphatic (C6-C8)	----	E593C/WT	15	µg/m³		19	479	226	456	----
Aliphatic (C8-C10)	----	E593C/WT	15	µg/m³		29	362	201	368	----
Aromatic (C10-C12)	----	E593C/WT	15	µg/m³		<15	<15	<15	<15	----
Aromatic (C12-C16)	----	E593C/WT	30	µg/m³		<30	<30	<30	<30	----
Aromatic (C6-C8)	----	E593C/WT	15	µg/m³		<15	17	<15	15	----
Aromatic (C8-C10)	----	E593C/WT	15	µg/m³		<15	16	<15	<15	----
F1 (C6-C10)	----	E593A/WT	15	µg/m³		53	816	404	782	----
F1-BTEX	----	EC592A/WT	15	µg/m³		47	792	393	763	----
F2 (C10-C16)	----	E593A/WT	15	µg/m³		30	530	72	551	----
F2-Naphthalene	----	EC593D/WT	15	µg/m³		30	530	72	551	----
TVOC (C10-C12)	----	E593C/WT	15	µg/m³		22	339	66	351	----
TVOC (C12-C16)	----	E593C/WT	30	µg/m³		<30	150	<30	157	----
TVOC (C6-C8)	----	E593C/WT	15	µg/m³		19	496	226	471	----
TVOC (C8-C10)	----	E593C/WT	15	µg/m³		29	378	201	368	----
Hydrocarbons Surrogates										
Bromofluorobenzene, 4-	460-00-4	E593C/WT	1	%		101	113	115	111	----
Volatile Organic Compounds Surrogates										
Bromofluorobenzene, 4-	460-00-4	E621B/WT	0.20	%		90.3	96.2	92.9	98.1	----

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

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2307273**	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, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-03.005	Date Samples Received	: 04-Jun-2023 12:36
PO	: SWM.SWOP04071-03.005	Issue Date	: 16-Jun-2023 14:34
C-O-C number	: CORD RDC VWs		
Sampler	: Ryan Miller		
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.
- Laboratory Control Sample (LCS) 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
Laboratory Control Sample (LCS) Recoveries								
Hydrocarbons	QC-980620-002	----	Aromatic (C12-C16)	----	E593C	157 % LCS-H	50.0-150%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
LCS-H	*Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.*

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 DUPLICATE	EF001	01-Jun-2023	----	----	----		08-Jun-2023	----	----	
Field Tests : Air Canister Information										
Canister VW-02	EF001	01-Jun-2023	----	----	----		08-Jun-2023	----	----	
Field Tests : Air Canister Information										
Canister VW-03	EF001	01-Jun-2023	----	----	----		08-Jun-2023	----	----	
Field Tests : Air Canister Information										
Canister VW-06	EF001	01-Jun-2023	----	----	----		08-Jun-2023	----	----	
Hydrocarbons : TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)										
Canister DUPLICATE	E593C	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Hydrocarbons : TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)										
Canister VW-02	E593C	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Hydrocarbons : TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)										
Canister VW-03	E593C	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓

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
Hydrocarbons : TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)										
Canister VW-06	E593C	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Hydrocarbons : TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)										
Canister DUPLICATE	E593A	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Hydrocarbons : TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)										
Canister VW-02	E593A	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Hydrocarbons : TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)										
Canister VW-03	E593A	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Hydrocarbons : TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)										
Canister VW-06	E593A	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Permanent Gases : Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)										
Canister DUPLICATE	E629B-H	01-Jun-2023	----	----	----		07-Jun-2023	30 days	6 days	✓
Permanent Gases : Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)										
Canister VW-02	E629B-H	01-Jun-2023	----	----	----		07-Jun-2023	30 days	6 days	✓
Permanent Gases : Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)										
Canister VW-03	E629B-H	01-Jun-2023	----	----	----		07-Jun-2023	30 days	6 days	✓
Permanent Gases : Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)										
Canister VW-06	E629B-H	01-Jun-2023	----	----	----		07-Jun-2023	30 days	6 days	✓

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
Volatile Organic Compounds : VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)										
Canister DUPLICATE	E621B	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Volatile Organic Compounds : VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)										
Canister VW-02	E621B	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Volatile Organic Compounds : VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)										
Canister VW-03	E621B	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 days	✓
Volatile Organic Compounds : VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)										
Canister VW-06	E621B	01-Jun-2023	----	----	----		09-Jun-2023	30 days	8 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	975764	1	10	10.0	5.0	✓
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C	980620	1	4	25.0	5.0	✓
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A	980619	1	4	25.0	5.0	✓
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B	980621	1	4	25.0	5.0	✓
Laboratory Control Samples (LCS)							
Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)	E629B-H	975764	1	10	10.0	5.0	✓
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C	980620	1	4	25.0	5.0	✓
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A	980619	1	4	25.0	5.0	✓
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B	980621	1	4	25.0	5.0	✓
Method Blanks (MB)							
Air Canister Information	EF001	978210	1	16	6.2	5.0	✓
Permanent Gases (Methane, CO2, CO, N2, and O2) in Air (Routine Level, %)	E629B-H	975764	1	10	10.0	5.0	✓
TVOC (C6-C16) Fractionation in Canisters or Bags by GC-MS (ug/m3)	E593C	980620	1	4	25.0	5.0	✓
TVOC (F1, F2) in Canisters or Bags by GC-MS (µg/m3)	E593A	980619	1	4	25.0	5.0	✓
VOCs (TO-15 List) in Air by Canister or Bag by GC-MS (ppbV)	E621B	980621	1	4	25.0	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	: **CG2307273**	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.SWOP04071-03.005	Date Samples Received	: 04-Jun-2023 12:36
PO	: SWM.SWOP04071-03.005	Date Analysis Commenced	: 07-Jun-2023
C-O-C number	: CORD RDC VWs	Issue Date	: 16-Jun-2023 14:34
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	: 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
- 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
Simon Campsall	Analyst	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: 975764)											
CG2307273-001	VW-02	Carbon dioxide	124-38-9	E629B-H	0.050	%	0.548	0.555	1.30%	20%	----
		Carbon monoxide	630-08-0	E629B-H	0.050	%	<0.050	0.060	0.010	Diff <2x LOR	----
		Methane	74-82-8	E629B-H	0.050	%	<0.050	<0.050	0	Diff <2x LOR	----
		Nitrogen	7727-37-9	E629B-H	1.0	%	78.8	79.5	0.982%	20%	----
		Oxygen	7782-44-7	E629B-H	0.10	%	20.4	20.6	0.967%	20%	----
Volatile Organic Compounds (QC Lot: 980621)											
CG2307273-001	VW-02	Acetone	67-64-1	E621B	2.5	ppbv	7.0	7.0	0.05	Diff <2x LOR	----
		Allyl chloride	107-05-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Benzene	71-43-2	E621B	0.10	ppbv	1.59	1.64	3.26%	30%	----
		Benzyl chloride	100-44-7	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Bromodichloromethane	75-27-4	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Bromoform	75-25-2	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Bromomethane	74-83-9	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Butadiene, 1,3-	106-99-0	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Carbon disulfide	75-15-0	E621B	0.50	ppbv	2.58	2.63	0.04	Diff <2x LOR	----
		Carbon tetrachloride	56-23-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Chlorobenzene	108-90-7	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Chloroethane	75-00-3	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Chloroform	67-66-3	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Chloromethane	74-87-3	E621B	0.20	ppbv	1.71	1.76	2.92%	30%	----
		Cyclohexane	110-82-7	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dibromochloromethane	124-48-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dibromoethane, 1,2-	106-93-4	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichlorobenzene, 1,2-	95-50-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichlorobenzene, 1,3-	541-73-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichlorobenzene, 1,4-	106-46-7	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichlorodifluoromethane	75-71-8	E621B	0.20	ppbv	0.47	0.49	0.02	Diff <2x LOR	----
		Dichloroethane, 1,1-	75-34-3	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichloroethane, 1,2-	107-06-2	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichloroethylene, 1,1-	75-35-4	E621B	0.20	ppbv	<0.20	<0.20	0.0002	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: 980621) - continued											
CG2307273-001	VW-02	Dichloroethylene, cis-1,2-	156-59-2	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichloroethylene, trans-1,2-	156-60-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichloromethane	75-09-2	E621B	0.20	ppbv	0.33	0.34	0.009	Diff <2x LOR	----
		Dichloropropane, 1,2-	78-87-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichloropropylene, cis+trans-1,3-	542-75-6	E621B	0.3	ppbv	<0.30	<0.30	0	Diff <2x LOR	----
		Dichloropropylene, cis-1,3-	10061-01-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichloropropylene, trans-1,3-	10061-02-6	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Dioxane, 1,4-	123-91-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Ethyl acetate	141-78-6	E621B	0.20	ppbv	2.10	2.30	8.66%	30%	----
		Ethylbenzene	100-41-4	E621B	0.10	ppbv	<0.10	<0.10	0.0001	Diff <2x LOR	----
		Ethyltoluene, 4-	622-96-8	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Heptane, n-	142-82-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Hexachlorobutadiene	87-68-3	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Hexane, n-	110-54-3	E621B	0.20	ppbv	0.31	0.28	0.03	Diff <2x LOR	----
		Hexanone, 2-	591-78-6	E621B	1.0	ppbv	<1.0	<1.0	0.001	Diff <2x LOR	----
		Isopropylbenzene	98-82-8	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Methyl ethyl ketone [MEK]	78-93-3	E621B	0.20	ppbv	0.69	0.69	0.002	Diff <2x LOR	----
		Methyl isobutyl ketone [MIBK]	108-10-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Methyl-tert-butyl ether [MTBE]	1634-04-4	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Naphthalene	91-20-3	E621B	0.10	ppbv	<0.10	<0.10	0.0001	Diff <2x LOR	----
		Propylene	115-07-1	E621B	8.20	ppbv	<8.00	<8.20	0.20	Diff <2x LOR	----
		Styrene	100-42-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Tetrachloroethylene	127-18-4	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Tetrahydrofuran	109-99-9	E621B	0.20	ppbv	2.54	2.60	2.55%	30%	----
		Toluene	108-88-3	E621B	0.10	ppbv	0.20	0.19	0.002	Diff <2x LOR	----
		Trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trichlorobenzene, 1,2,4-	120-82-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trichloroethane, 1,1,1-	71-55-6	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trichloroethane, 1,1,2-	79-00-5	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trichloroethylene	79-01-6	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trichlorofluoromethane	75-69-4	E621B	0.20	ppbv	0.20	0.20	0.004	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: 980621) - continued											
CG2307273-001	VW-02	Trimethylbenzene, 1,2,4-	95-63-6	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trimethylbenzene, 1,3,5-	108-67-8	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Trimethylpentane, 2,2,4-	540-84-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Vinyl acetate	108-05-4	E621B	0.50	ppbv	<0.50	<0.50	0.0006	Diff <2x LOR	----
		Vinyl bromide	593-60-2	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Vinyl chloride	75-01-4	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Xylene, m+p-	179601-23-1	E621B	0.20	ppbv	<0.20	<0.20	0.0002	Diff <2x LOR	----
		Xylene, o-	95-47-6	E621B	0.10	ppbv	<0.10	<0.10	0.0001	Diff <2x LOR	----
Hydrocarbons (QC Lot: 980619)											
CG2307273-001	VW-02	F1 (C6-C10)	----	E593A	15	µg/m³	53	50	4	Diff <2x LOR	----
		F2 (C10-C16)	----	E593A	15	µg/m³	30	29	0.6	Diff <2x LOR	----
Hydrocarbons (QC Lot: 980620)											
CG2307273-001	VW-02	Aromatic (C10-C12)	----	E593C	15	µg/m³	<15	<15	0	Diff <2x LOR	----
		Aromatic (C12-C16)	----	E593C	30	µg/m³	<30	<30	0	Diff <2x LOR	----
		Aromatic (C6-C8)	----	E593C	15	µg/m³	<15	<15	0	Diff <2x LOR	----
		Aromatic (C8-C10)	----	E593C	15	µg/m³	<15	<15	0	Diff <2x LOR	----
		TVOC (C10-C12)	----	E593C	15	µg/m³	22	22	0.7	Diff <2x LOR	----
		TVOC (C12-C16)	----	E593C	30	µg/m³	<30	<30	0	Diff <2x LOR	----
		TVOC (C6-C8)	----	E593C	15	µg/m³	19	19	0.6	Diff <2x LOR	----
		TVOC (C8-C10)	----	E593C	15	µg/m³	29	25	4	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: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Field Tests (QCLot: 978210)						
Pressure on receipt	----	EF001	0.1	Inches Hg	-29.8	----
Permanent Gases (QCLot: 975764)						
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	----
Nitrogen	7727-37-9	E629B-H	1	%	<1.0	----
Oxygen	7782-44-7	E629B-H	0.1	%	<0.10	----
Volatile Organic Compounds (QCLot: 980621)						
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	<0.10	----
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	<0.20	----
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	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 980621) - continued						
Dichloroethylene, cis-1,2-	156-59-2	E621B	0.2	ppbv	<0.20	----
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	<0.20	----
Hexachlorobutadiene	87-68-3	E621B	0.2	ppbv	<0.20	----
Hexane, n-	110-54-3	E621B	0.2	ppbv	<0.20	----
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	<0.10	----
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	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 980621) - continued						
Vinyl acetate	108-05-4	E621B	0.5	ppbv	<0.50	----
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: 980619)						
F1 (C6-C10)	----	E593A	15	µg/m³	<15	----
F2 (C10-C16)	----	E593A	15	µg/m³	<15	----
Hydrocarbons (QCLot: 980620)						
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	----

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: 975764)									
Carbon dioxide	124-38-9	E629B-H	0.05	%	4.982 %	95.1	70.0	130	----
Carbon monoxide	630-08-0	E629B-H	0.05	%	0.747 %	97.9	70.0	130	----
Methane	74-82-8	E629B-H	0.05	%	14.95 %	99.0	70.0	130	----
Nitrogen	7727-37-9	E629B-H	1	%	50.414 %	97.6	70.0	130	----
Oxygen	7782-44-7	E629B-H	0.1	%	7.407 %	97.0	70.0	130	----
Volatile Organic Compounds (QCLot: 980621)									
Acetone	67-64-1	E621B	1	ppbv	1.06 ppbv	113	70.0	130	----
Allyl chloride	107-05-1	E621B	0.2	ppbv	1.04 ppbv	102	70.0	130	----
Benzene	71-43-2	E621B	0.1	ppbv	1.06 ppbv	99.2	70.0	130	----
Benzyl chloride	100-44-7	E621B	0.2	ppbv	1.06 ppbv	90.6	70.0	130	----
Bromodichloromethane	75-27-4	E621B	0.2	ppbv	1.02 ppbv	103	70.0	130	----
Bromoform	75-25-2	E621B	0.2	ppbv	1.06 ppbv	93.0	70.0	130	----
Bromomethane	74-83-9	E621B	0.2	ppbv	1.04 ppbv	94.4	70.0	130	----
Butadiene, 1,3-	106-99-0	E621B	0.2	ppbv	1.06 ppbv	92.6	70.0	130	----
Carbon disulfide	75-15-0	E621B	0.5	ppbv	1.06 ppbv	102	70.0	130	----
Carbon tetrachloride	56-23-5	E621B	0.2	ppbv	1.06 ppbv	100	70.0	130	----
Chlorobenzene	108-90-7	E621B	0.2	ppbv	1.07 ppbv	94.6	70.0	130	----
Chloroethane	75-00-3	E621B	0.2	ppbv	1.01 ppbv	101	70.0	130	----
Chloroform	67-66-3	E621B	0.2	ppbv	1.05 ppbv	102	70.0	130	----
Chloromethane	74-87-3	E621B	0.2	ppbv	1.01 ppbv	104	70.0	130	----
Cyclohexane	110-82-7	E621B	0.2	ppbv	1.06 ppbv	95.7	70.0	130	----
Dibromochloromethane	124-48-1	E621B	0.2	ppbv	1.07 ppbv	95.9	70.0	130	----
Dibromoethane, 1,2-	106-93-4	E621B	0.2	ppbv	1.08 ppbv	90.5	70.0	130	----
Dichlorobenzene, 1,2-	95-50-1	E621B	0.2	ppbv	1.06 ppbv	85.0	70.0	130	----
Dichlorobenzene, 1,3-	541-73-1	E621B	0.2	ppbv	1.06 ppbv	91.0	70.0	130	----
Dichlorobenzene, 1,4-	106-46-7	E621B	0.2	ppbv	1.05 ppbv	87.7	70.0	130	----
Dichlorodifluoromethane	75-71-8	E621B	0.2	ppbv	1.02 ppbv	101	70.0	130	----
Dichloroethane, 1,1-	75-34-3	E621B	0.2	ppbv	1.04 ppbv	98.6	70.0	130	----
Dichloroethane, 1,2-	107-06-2	E621B	0.2	ppbv	1.04 ppbv	102	70.0	130	----
Dichloroethylene, 1,1-	75-35-4	E621B	0.2	ppbv	1.04 ppbv	98.8	70.0	130	----
Dichloroethylene, cis-1,2-	156-59-2	E621B	0.2	ppbv	1.06 ppbv	99.7	70.0	130	----
Dichloroethylene, trans-1,2-	156-60-5	E621B	0.2	ppbv	1.06 ppbv	96.0	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: 980621) - continued									
Dichloromethane	75-09-2	E621B	0.2	ppbv	1.04 ppbv	97.5	70.0	130	----
Dichloropropane, 1,2-	78-87-5	E621B	0.2	ppbv	1.05 ppbv	99.0	70.0	130	----
Dichloropropylene, cis-1,3-	10061-01-5	E621B	0.2	ppbv	1.05 ppbv	96.7	70.0	130	----
Dichloropropylene, trans-1,3-	10061-02-6	E621B	0.2	ppbv	1.07 ppbv	91.3	70.0	130	----
Dichlorotetrafluoroethane, 1,2- [Freon 114]	76-14-2	E621B	0.2	ppbv	0.97 ppbv	105	70.0	130	----
Dioxane, 1,4-	123-91-1	E621B	0.2	ppbv	1.07 ppbv	85.3	70.0	130	----
Ethyl acetate	141-78-6	E621B	0.2	ppbv	1.05 ppbv	97.8	70.0	130	----
Ethylbenzene	100-41-4	E621B	0.1	ppbv	1.09 ppbv	91.5	70.0	130	----
Ethyltoluene, 4-	622-96-8	E621B	0.2	ppbv	1.06 ppbv	96.5	70.0	130	----
Heptane, n-	142-82-5	E621B	0.2	ppbv	1.06 ppbv	99.6	70.0	130	----
Hexachlorobutadiene	87-68-3	E621B	0.2	ppbv	1.09 ppbv	85.5	70.0	130	----
Hexane, n-	110-54-3	E621B	0.2	ppbv	1.07 ppbv	98.3	70.0	130	----
Hexanone, 2-	591-78-6	E621B	1	ppbv	1.09 ppbv	87.0	70.0	130	----
Isopropylbenzene	98-82-8	E621B	0.2	ppbv	1.04 ppbv	92.9	70.0	130	----
Methyl ethyl ketone [MEK]	78-93-3	E621B	0.2	ppbv	1.07 ppbv	102	70.0	130	----
Methyl isobutyl ketone [MIBK]	108-10-1	E621B	0.2	ppbv	1.07 ppbv	93.0	70.0	130	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E621B	0.2	ppbv	1.07 ppbv	97.4	70.0	130	----
Naphthalene	91-20-3	E621B	0.1	ppbv	1.12 ppbv	86.5	70.0	130	----
Propylene	115-07-1	E621B	0.2	ppbv	1.08 ppbv	104	70.0	130	----
Styrene	100-42-5	E621B	0.2	ppbv	1.06 ppbv	90.5	70.0	130	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E621B	0.2	ppbv	1.07 ppbv	92.9	70.0	130	----
Tetrachloroethylene	127-18-4	E621B	0.2	ppbv	1.04 ppbv	102	70.0	130	----
Tetrahydrofuran	109-99-9	E621B	0.2	ppbv	1.04 ppbv	96.1	70.0	130	----
Toluene	108-88-3	E621B	0.1	ppbv	1.09 ppbv	101	70.0	130	----
Trichloro-1,2,2-trifluoroethane, 1,1,2- [Freon 113]	76-13-1	E621B	0.2	ppbv	1.03 ppbv	101	70.0	130	----
Trichlorobenzene, 1,2,4-	120-82-1	E621B	0.2	ppbv	1.07 ppbv	87.9	70.0	130	----
Trichloroethane, 1,1,1-	71-55-6	E621B	0.2	ppbv	1.05 ppbv	98.4	70.0	130	----
Trichloroethane, 1,1,2-	79-00-5	E621B	0.2	ppbv	1.08 ppbv	97.6	70.0	130	----
Trichloroethylene	79-01-6	E621B	0.2	ppbv	1.08 ppbv	97.7	70.0	130	----
Trichlorofluoromethane	75-69-4	E621B	0.2	ppbv	1.07 ppbv	93.7	70.0	130	----
Trimethylbenzene, 1,2,4-	95-63-6	E621B	0.2	ppbv	1.07 ppbv	96.5	70.0	130	----
Trimethylbenzene, 1,3,5-	108-67-8	E621B	0.2	ppbv	1.06 ppbv	94.0	70.0	130	----
Trimethylpentane, 2,2,4-	540-84-1	E621B	0.2	ppbv	1.06 ppbv	99.3	70.0	130	----
Vinyl acetate	108-05-4	E621B	0.5	ppbv	1.1 ppbv	104	70.0	130	----
Vinyl bromide	593-60-2	E621B	0.2	ppbv	1.04 ppbv	96.3	70.0	130	----
Vinyl chloride	75-01-4	E621B	0.2	ppbv	1.01 ppbv	103	70.0	130	----

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Volatile Organic Compounds (QCLot: 980621) - continued									
Xylene, m+p-	179601-23-1	E621B	0.2	ppbv	2.12 ppbv	103	70.0	130	----
Xylene, o-	95-47-6	E621B	0.1	ppbv	1.07 ppbv	99.5	70.0	130	----
Hydrocarbons (QCLot: 980619)									
F1 (C6-C10)	----	E593A	15	µg/m³	815 µg/m³	93.4	50.0	150	----
Hydrocarbons (QCLot: 980620)									
Aromatic (C10-C12)	----	E593C	15	µg/m³	60.75 µg/m³	104	50.0	150	----
Aromatic (C12-C16)	----	E593C	30	µg/m³	60.07 µg/m³	# 157	50.0	150	LCS-H
Aromatic (C6-C8)	----	E593C	15	µg/m³	60.06 µg/m³	89.4	50.0	150	----
Aromatic (C8-C10)	----	E593C	15	µg/m³	59.58 µg/m³	99.6	50.0	150	----
TVOC (C10-C12)	----	E593C	15	µg/m³	121.28 µg/m³	105	50.0	150	----
TVOC (C12-C16)	----	E593C	30	µg/m³	120.29 µg/m³	150	50.0	150	----
TVOC (C6-C8)	----	E593C	15	µg/m³	119.87 µg/m³	93.1	50.0	150	----
TVOC (C8-C10)	----	E593C	15	µg/m³	119 µg/m³	104	50.0	150	----

Qualifiers

Qualifier	Description
LCS-H	*Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.*

Batch Proof Report

Batch Proof ID: 221127.226
Canister ID: 01400-0370
Analysis Date: 9-Dec-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	97.45	%

Batch Proof Report

Batch Proof ID: 230507.106
Canister ID: 01400-0532
Analysis Date: 25-May-23

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	99.94	%

Environmental Division
Calgary
Work Order Reference
CG2307273

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 RDC VWs

Page

Telephone : +1 403 407 1800

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.SWOP04071-03.005		
Address:		PO/AFE:	SWM.SWOP04071-03.005		
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)	EP592	S621E - Aliphatic and Aromatic	S629B - Methane, CO2, CO, N	Hazardous?	Highly Contaminated?	Number of Containers
	VW-01 Blinded	01-06-23	—	Air	~~X~~	~~X~~	~~X~~			
1	VW-02		12:22	Air	X	X	X			1
2	VW-03		11:40	Air	X	X	X			1
	~~VW-04~~ Not Sampled			Air	~~X~~	~~X~~	~~X~~			
3	VW-06		10:34	Air	X	X	X			1
4	Duplicate		11:40	Air	X	X	X			1

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:	June 3/23	Date & Time: June 3/23	Received By:		Date & Time:			Temperature	Samples Received in Good Condition? Y / N (if no provided details)
Relinquished By:	Ryan Miller	Date & Time: 17:00	Received By:		Date & Time:	06/04 8:00		12.5	

Environmental Division
Calgary
Work Order Reference
CG2307273

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

APPENDIX G

HISTORICAL ANALYTICAL RESULTS

Table 1
Groundwater Monitoring and Soil Vapour Well Elevations

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval		
				Bottom	Top	
GW-01	5.6	883.693	884.788	878.093	883.193	5.1
GW-02	12.0	883.679	884.674	871.679	883.279	11.6
GW-03	6.1	877.577	878.182	871.477	876.977	5.5
MW-01	4.6	876.982	877.785	872.382	874.482	2.1
MW-02	4.6	877.851	878.281	873.251	875.351	2.1
MW-03	10.7	877.169	878.135	866.469	869.569	3.1
MW-04	8.7	876.013	876.986	867.313	870.413	3.1
MW-05	7.5	872.454	873.306	864.954	868.054	3.1
MW-06	9.2	877.914	878.754	868.714	871.814	3.1
MW-07	6.1	877.413	878.174	871.313	875.913	4.6
VW-01	2.6	877.333	- -	874.733	875.033	0.3
VW-02	4.3	877.190	- -	872.890	873.190	0.3
VW-03	2.7	872.690	- -	869.990	870.290	0.3
VW-04	2.4	877.445	- -	875.045	875.345	0.3
VW-05	2.4	877.724	- -	875.324	875.624	0.3
TH-01	NA	877.319	- -	- -	- -	- -
TH-05	NA	877.163	- -	- -	- -	- -
TH-09	NA	877.869	- -	- -	- -	- -
TH-10	NA	876.835	- -	- -	- -	- -
TH-11	NA	878.046	- -	- -	- -	- -
TH-12	NA	877.927	- -	- -	- -	- -
TH-13	NA	877.941	- -	- -	- -	- -
TH-14	NA	878.119	- -	- -	- -	- -
TH-15	NA	878.554	- -	- -	- -	- -
TH-16	NA	877.755	- -	- -	- -	- -
TH-17	NA	876.876	- -	- -	- -	- -
TH-18	NA	877.253	- -	- -	- -	- -
TH-19	NA	878.104	- -	- -	- -	- -
TH-20	NA	876.195	- -	- -	- -	- -

Notes:

1) Geodetic elevations are determined from multiple datums, ASCM Nos. 269191, 376673 and 384792. Refer to ASCM Information in Appendix A.
2) GW - soil vapour well installed by others.
3) MW - groundwater monitoring well. MW-01 to MW-06 installed Dec. 1999 by others. MW-07 installed Jun. 2013.
4) VW - soil vapour well installed Jun 2013.
3) TH - testhole, no instrumentation installed .
4) - - no applicable elevation.

Table 2
Site Monitoring Results

Test Location	Elevation		Groundwater Elevation (m)		Headspace Vapour				Notes
	Ground (m)	Top of Pipe (m)	08/13-14/2013		08/13-14/2013				
					Combustible	Volatile	Combustile	Volatile	
GW-01	883.693	884.788	damaged		410	ND			Unable to remove slip cap
GW-02	883.679	884.674	ND		- -	- -			
GW-03	877.577	878.182	875.913		80	ND			cap missing, aerated
MW-01	876.982	877.785	damaged		- -	- -			blockage
MW-02	877.851	878.281	damaged		- -	- -			unable to remove slip cap
MW-03	877.169	878.135	872.281		2,450	89			
MW-04	876.013	876.986	869.991		45	4			
MW-05	872.454	873.306	870.386		230	ND			
MW-06	877.914	878.754	875.122		ND	ND			
MW-07	877.413	878.174	874.658		ND	ND			
VW-01	877.333	NA	NA		- -	- -			Screen submerged in water
VW-02	877.190	NA	NA		- -	- -			Screen submerged in water
VW-03	872.690	NA	NA		480	1			instrument alarm <19% O_2
VW-04	877.445	NA	NA		50	1			instrument alarm <19% O_2
VW-05	877.724	NA	NA		- -	- -			Screen submerged in water

Notes:

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

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

Parameter	Detection Limit	Soil Bag			Class II Landfill Acceptance Criteria
		1 of 3	2 of 3	3 of 3	
pH	0.10	8.56	8.14	8.28	2-12.5
Flash Point (°C)	30.0	>75	>75	>75	>61
Paint Filter Test	-	PASS	PASS	PASS	PASS
Total Organic Carbon	0.10	NT	NT	1.04	- -
TCLP Hydrocarbons					
Benzene	0.0050	ND	ND	ND	0.5
Toluene	0.0050	ND	ND	ND	0.5
Ethylbenzene	0.0050	ND	ND	ND	0.5
Xylenes	0.0050	ND	0.0194	ND	0.5
TCLP Metals					
Antimony (Sb)	5.0	ND	ND	ND	500
Arsenic (As)	0.20	ND	ND	ND	5
Barium (Ba)	5.0	ND	ND	ND	100
Beryllium (Be)	0.50	ND	ND	ND	5
Boron (B)	5.0	ND	ND	ND	500
Cadmium (Cd)	0.050	ND	ND	ND	1
Chromium (Cr)	0.50	ND	ND	ND	5
Cobalt (Co)	5.0	ND	ND	ND	100
Copper (Cu)	5.0	ND	ND	ND	100
Iron (Fe)	5.0	ND	ND	ND	1,000
Lead (Pb)	0.50	ND	ND	ND	5
Mercury (Hg)	0.010	ND	ND	ND	0.2
Nickel (Ni)	0.50	ND	ND	ND	5
Selenium (Se)	0.20	ND	ND	ND	1
Silver (Ag)	0.50	ND	ND	ND	5
Thallium (Tl)	0.50	ND	ND	ND	5
Uranium (U)	1.0	ND	ND	ND	2
Vanadium (V)	5.0	ND	ND	ND	100
Zinc (Zn)	5.0	ND	ND	ND	500
Zirconium (Zr)	5.0	ND	ND	ND	500

Notes:

1) Class II Landfill Acceptance Criteria - per Table 2, Part 4 Schedule to the Alberta User Guide for Waste Managers 3/95. Applicable waste screening for The City of Red Deer Class II Waste Managment Facility.
2) Units in mg/L, unless otherwise stated.
3) ND - Not Detected, less than the limit of method detection.
4) NT - Not Tested.
5) Soil bags were sampled on Monday, June 24, 2013 and Saturday, June 29, 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

Parameter	Unit	Detection Limit	TH-10 @ 3.0 m	TH-19 @ 4.9 m	TH-20 @ 8.8 m	Tier 1 Guideline
			06/29/2013	07/10/2013		
Chloride (Cl)	mg/kg	41958	146	38	47	- -
Nitrate-N	mg/kg	0.53 - 0.73	ND	ND	ND	- -
Nitrite-N	mg/kg	0.53 - 0.73	ND	ND	ND	- -
Total Metals						
Antimony (Sb)	mg/kg	0.20	0.55	0.44	0.63	20
Arsenic (As)	mg/kg	0.20	7.40	6.55	8.38	17
Barium (Ba)	mg/kg	5.0	273	164	295	500
Beryllium (Be)	mg/kg	1.0	ND	ND	ND	5
Cadmium (Cd)	mg/kg	0.50	ND	ND	ND	10
Chromium (Cr)	mg/kg	0.50	26.6	18.3	26.9	64
Cobalt (Co)	mg/kg	1.0	11.5	7.9	8.5	20
Copper (Cu)	mg/kg	2.0	28.3	16.0	21.1	63
Lead (Pb)	mg/kg	5.0	20.1	9.0	12.8	140
Mercury (Hg)	mg/kg	0.050	0.059	ND	0.054	6.6
Molybdenum (Mo)	mg/kg	1.0	1.0	ND	1.4	4
Nickel (Ni)	mg/kg	2.0	33.0	22.6	27.9	50
Selenium (Se)	mg/kg	0.50	ND	0.74	ND	1.0
Silver (Ag)	mg/kg	1.0	ND	ND	ND	20
Thallium (Tl)	mg/kg	0.50	ND	ND	ND	1.0
Tin (Sn)	mg/kg	2.0	ND	ND	ND	5
Uranium (U)	mg/kg	2.0	ND	ND	ND	23
Vanadium (V)	mg/kg	1.0	42.5	32.0	45.8	130
Zinc (Zn)	mg/kg	10	82	60	78	200
Hexavalent Chromium	mg/kg	0.10	ND	ND	ND	0.4
Boron (B), Hot Water Ext.	mg/kg	0.10	0.49	0.26	0.51	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

Parameter	Detection Limit	TH-10 @ 3.0 m	TH-19 @ 4.9 m	TH-20 @ 8.8 m	Tier 1 Guideline
		06/29/2013	07/10/2013		
Hydrocarbons					
F1 (C_6-C_{10})	10	**47**	ND	ND	24
F2 (C_{10}-C_{16})	25	ND	ND	ND	130
F3 (C_{16}-C_{34})	50	159	ND	ND	300
F4 (C_{34}-C_{50})	50	ND	ND	ND	2,800
Total Hydrocarbons (C_6-C_{50})	50	206	ND	ND	--
Volatile Organic Compounds					
Benzene	0.0050	0.0058	ND	ND	0.073
Bromobenzene	0.010	ND	ND	ND	--
Bromochloromethane	0.010	ND	ND	ND	--
Bromodichloromethane	0.010	ND	ND	ND	--
Bromoform	0.010	ND	ND	ND	--
Bromomethane	0.10	ND	ND	ND	--
n-Butylbenzene	0.010 - 0.05	ND	ND	ND	--
sec-Butylbenzene	0.010 - 0.20	ND	ND	ND	--
tert-Butylbenzene	0.010	ND	ND	ND	--
Carbon tetrachloride	0.010	ND	ND	ND	0.00056
Chlorobenzene	0.010	ND	ND	ND	0.018
Dibromochloromethane	0.010	ND	ND	ND	0.27
Chloroethane	0.10	ND	ND	ND	--
Chloroform	0.010	**0.062**	ND	ND	0.001
Chloromethane	0.10	ND	ND	ND	--
2-Chlorotoluene	0.010 - 0.75	ND	ND	ND	--
4-Chlorotoluene	0.010	ND	ND	ND	--
1,2-Dibromo-3-chloropropane	0.010	ND	ND	ND	--
1,2-Dibromoethane	0.010	ND	ND	ND	--
Dibromomethane	0.010	ND	ND	ND	--
1,2-Dichlorobenzene	0.010	ND	ND	ND	0.18
1,3-Dichlorobenzene	0.010	ND	ND	ND	--
1,4-Dichlorobenzene	0.010	ND	ND	ND	0.098
Dichlorodifluoromethane	0.010	ND	ND	ND	--
1,1-Dichloroethane	0.010	ND	ND	ND	--
1,2-Dichloroethane	0.010	ND	0.087	ND	--
1,1-Dichloroethene	0.010	ND	ND	ND	0.021
cis-1,2-Dichloroethene	0.010	0.231	0.207	1.04	--
trans-1,2-Dichloroethene	0.010	ND	ND	0.048	--
Methylene chloride	0.010	**0.101**	0.012	0.015	0.095
1,2-Dichloropropane	0.010	ND	ND	ND	--
1,3-Dichloropropane	0.010	ND	ND	ND	--
2,2-Dichloropropane	0.010	ND	ND	ND	--
1,1-Dichloropropene	0.010	ND	ND	ND	--
cis-1,3-Dichloropropene	0.010	ND	ND	ND	--
trans-1,3-Dichloropropene	0.010	ND	ND	ND	--
Ethylbenzene	0.015	**1.04**	ND	ND	0.21
Hexachlorobutadiene	0.010	ND	ND	ND	0.0067
Isopropylbenzene	0.010	0.214	ND	ND	--
p-Isopropyltoluene	0.010	0.813	ND	ND	--
n-Propylbenzene	0.010	0.858	ND	ND	--
Styrene	0.010 - 0.050	ND	ND	ND	0.80
1,1,1,2-Tetrachloroethane	0.010	ND	ND	ND	--
1,1,2,2-Tetrachloroethane	0.050 - 0.50	ND	ND	ND	--
Tetrachloroethene	0.010	ND	ND	ND	0.16
Toluene	0.050	0.048	ND	ND	0.49
1,2,3-Trichlorobenzene	0.010	ND	ND	ND	0.26
1,2,4-Trichlorobenzene	0.010	ND	ND	ND	0.23
1,1,1-Trichloroethane	0.010	ND	ND	ND	--
1,1,2-Trichloroethane	0.010	ND	ND	ND	--
Trichloroethene	0.010	ND	ND	ND	0.012
Trichlorofluoromethane	0.010	ND	ND	ND	--
1,2,3-Trichloropropane	0.020 - 0.10	ND	ND	ND	--
1,2,4-Trimethylbenzene	0.010	7.72	ND	0.015	--
1,3,5-Trimethylbenzene	0.010	2.01	ND	ND	--
Vinyl chloride	0.20	ND	ND	ND	0.00034
Xylenes	0.10	7.28	ND	ND	12

Notes:

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

Table 4A
Groundwater Indices at Time of Sampling

Monitoring Well	pH	Electrical Conductivity (µS/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Total Dissolved Solid (mg/L)	Redox Potential (±mV)
GW-01	- -	- -	- -	- -	- -	- -
GW-02	- -	-	- -	- -	- -	- -
GW-03	7.81	868	9	1.69	812.50	+9.1
MW-01	- -	- -	- -	- -	- -	- -
MW-02	- -	- -	- -	- -	- -	- -
MW-03	7.58	2,103	8.6	2.08	2,002.00	-104.0
MW-04	7.46	3,209	8.8	2.23	3,016.00	-100.6
MW-05	7.67	1,786	8.2	1.3	1,657.50	-98.6
MW-06	- -	- -	- -	- -	- -	- -
MW-07	7.49	841	8.3	4.69	799.50	+39.9

Notes:

1) Groundwater indices measured by YSI Pro Plus multi-meter.
2) GW-03, MW-04 and MW-05 sampled on Wednesday, August 14, 2013
3) MW-03 sampled on Wednesday, August 14 and Friday, August 16, 2013
4) MW-07 sampled on Tuesday, August 13, 2013
5) - - Not Monitored, well not selected for sampling groundwater.

Table 4B
Analytical Results - Groundwater - General Water Quality

Parameter	Unit	Detection Limit	GW-03	MW-03	MW-04	MW-05	MW-07	Tier 1 Guideline
			08/14/2013	08/16/2013	08/14/2013		08/13/2013	
General Water Quality								
Biochemical Oxygen Demand	mg/L	2.0 - 10	ND	14	35	41	ND	- -
Total Chemical Oxygen Demand	mg/L	5.0	35	110	240	220	25	- -
Conductivity	µS/cm	1.0	1,300	1,000	4,900	2,600	1,300	- -
pH	Unitless	0.1	7.48	7.76	7.11	6.92	7.54	6.5 - 8.5
Total Organic Carbon (C)	mg/L	0.50 - 10	9.4	21	68	58	10	- -
Dissolved Cadmium (Cd)	µg/L	0.0050 - 0.025	0.048	ND	ND	ND	0.032	- -
Total Cadmium (Cd)	µg/L	0.0050 - 0.013	**0.37**	**11**	**0.10**	**0.59**	**1.7**	0.060*
Alkalinity ($CaCO_3$)	mg/L	0.50	620	530	1,700	1,100	610	- -
Bicarbonate (HCO_3)	mg/L	0.50	750	650	2,000	1,400	750	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	ND	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	ND	ND	ND	- -
Sulphate (SO_4)	mg/L	1.0	66	ND	ND	ND	170	- -
Chloride (Cl)	mg/L	1.0 - 5.0	45	19	770	200	16	- -
Total Ammonia (N)	mg/L	0.050 - 2.5	ND	1.3	**22**	**77**	ND	1.37*
Total Phosphorus (P)	mg/L	0.015 - 0.30	0.74	24	0.65	0.6	1.3	- -
Total Nitrogen (N)	mg/L	0.050	5.2	15	23	73	1.3	- -
Total Kjeldahl Nitrogen	mg/L	0.050 - 2.5	1.2	15	23	73	1.2	- -
Nitrite (N)	mg/L	0.0030 - 0.015	0.025	0.0086	ND	ND	ND	- -
Nitrate (N)	mg/L	0.0030 - 0.015	3.9	0.036	0.065	0.055	0.072	- -
Nitrate plus Nitrite (N)	mg/L	0.0030 - 0.015	3.9	0.044	0.065	0.055	0.072	- -
Trace Organics								
Acetic Acid	mg/L	50	ND	NT	ND	ND	ND	- -
Formic Acid	mg/L	50	ND	NT	ND	ND	ND	- -
Propionic Acid	mg/L	50	ND	NT	ND	ND	ND	- -
Adsorbable Organic Halogens	mg/L	0.004 - 0.01	0.083	NT	1.22	2.41	0.012	- -

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 are referenced
3) ND - Not Detected, less than the limit of method detection.
4) NT - Not Tested.
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds thereferenced Alberta Tier 1 Guidelines.
7) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4C
Analytical Results - Groundwater - Metals

Parameter	Detection Limit	GW-03	MW-03	MW-04	MW-05	MW-07	Tier 1 Guideline
		08/14/2013	08/16/2013	08/14/2013		08/13/2013	
Total Metals							
Aluminum (Al)	0.0030 - 0.0075	**3.8**	**120**	**0.20**	**2.0**	**25**	0.1*
Antimony (Sb)	0.00060 - 0.0015	0.00081	ND	ND	ND	0.0015	0.006
Arsenic (As)	0.00020 - 0.00050	**0.0057**	**0.37**	**0.048**	**0.0077**	**0.074**	0.005
Barium (Ba)	0.010 - 0.10	0.32	**11**	**1.7**	0.87	**1.4**	1
Beryllium (Be)	0.0010 - 0.0025	ND	0.015	ND	ND	0.0036	--
Boron (B)	0.020	0.19	0.11	0.37	0.40	0.041	1.5
Calcium (Ca)	0.30 - 3.0	180	1,200	210	160	250	--
Chromium (Cr)	0.0010 - 0.0025	**0.0087**	**0.47**	**0.0027**	**0.0069**	**0.071**	0.001*
Cobalt (Co)	0.00030 - 0.00075	0.0086	0.23	0.0052	0.011	0.065	--
Copper (Cu)	0.00020 - 0.0010	**0.012**	**0.68**	0.0023	**0.0077**	**0.12**	0.003*
Iron (Fe)	0.060 - 0.60	**15**	**740**	**54**	**68**	**12**	0.3
Lead (Pb)	0.00020 - 0.0010	**0.0048**	**0.34**	0.0016	**0.092**	**0.081**	0.004*
Lithium (Li)	0.020	0.17	0.33	0.057	0.033	0.085	--
Magnesium (Mg)	0.20	92	320	280	130	120	--
Manganese (Mn)	0.0040	**2.2**	**13**	**0.34**	**0.56**	**2.5**	0.05
Molybdenum (Mo)	0.00020 - 0.0010	0.0019	0.027	0.0016	0.0020	0.0042	--
Nickel (Ni)	0.00050 - 0.0025	0.027	**0.66**	0.046	0.028	**0.15**	0.11*
Phosphorus (P)	0.10	0.50	15	0.72	0.78	0.71	--
Potassium (K)	0.30	3.7	34	10	35	11	--
Selenium (Se)	0.00020 - 0.0010	0.00047	**0.0049**	ND	ND	**0.0022**	0.001
Silicon (Si)	0.10 - 1.0	16	200	24	21	25	--
Silver (Ag)	0.00010 - 0.00050	ND	**0.0042**	ND	ND	**0.00075**	0.0001*
Sodium (Na)	0.50	72	54	470	120	27	--
Strontium (Sr)	0.020	1.3	2.2	3.0	1.7	1.1	--
Sulphur (S)	0.20	21	22	3.5	2.2	53	--
Thallium (Tl)	0.00020 - 0.0010	0.00025	0.0019	ND	ND	0.00052	--
Tin (Sn)	0.0010 - 0.0050	0.0010	0.0043	ND	0.031	0.0014	--
Titanium (Ti)	0.0010 - 0.0050	0.23	1.1	0.0076	0.053	0.44	--
Uranium (U)	0.00010 - 0.00050	**0.094**	**0.022**	ND	0.0017	0.017	0.02
Vanadium (V)	0.0010 - 0.0050	0.015	0.57	0.0033	0.0071	0.13	--
Zinc (Zn)	0.0030 - 0.015	0.027	**1.7**	0.017	**0.081**	**0.48**	0.03
Dissolved Metals							
Aluminum (Al)	0.0030 - 0.015	ND	ND	ND	ND	ND	--
Antimony (Sb)	0.00060 - 0.0030	ND	ND	ND	ND	ND	--
Arsenic (As)	0.00020 - 0.0010	0.00037	0.014	0.044	0.0043	0.00031	--
Barium (Ba)	0.010	0.13	1.5	1.4	0.78	0.29	--
Beryllium (Be)	0.0010 - 0.0050	ND	ND	ND	ND	ND	--
Boron (B)	0.020	0.094	0.048	0.38	0.39	0.030	--
Calcium (Ca)	0.30	120	120	200	150	160	--
Chromium (Cr)	0.0010 - 0.0050	ND	ND	ND	ND	ND	--
Cobalt (Co)	0.00030 - 0.0015	ND	0.0031	0.0042	0.0085	ND	--
Copper (Cu)	0.00020 - 0.0010	0.0044	0.0024	ND	ND	0.0023	--
Iron (Fe)	0.060	ND	1.9	40	56	0.17	--
Lead (Pb)	0.00020 - 0.0010	ND	ND	ND	ND	ND	--
Lithium (Li)	0.020	0.13	ND	0.058	0.031	0.059	--
Magnesium (Mg)	0.20	63	45	260	120	90	--
Manganese (Mn)	0.0040	0.0041	1.0	0.30	0.36	0.0084	--
Molybdenum (Mo)	0.00020 - 0.0010	0.00089	0.0055	0.0016	ND	0.00088	--
Nickel (Ni)	0.00050 - 0.0025	0.0017	0.0044	0.044	0.020	0.0015	--
Phosphorus (P)	0.10	ND	ND	0.35	0.45	ND	--
Potassium (K)	0.30	2.1	6.8	9.5	31	8.5	--
Selenium (Se)	0.00020 - 0.0010	0.00032	ND	ND	ND	0.00061	--
Silicon (Si)	0.10	7.2	7.8	21	16	8.1	--
Silver (Ag)	0.00010 - 0.00050	ND	ND	ND	ND	ND	--
Sodium (Na)	0.50	56	51	450	110	25	--
Strontium (Sr)	0.020	1.1	0.74	2.9	1.7	0.88	--
Sulphur (S)	0.20	17	0.78	2.9	1.6	49	--
Thallium (Tl)	0.00020 - 0.0010	ND	ND	ND	ND	ND	--
Tin (Sn)	0.0010 - 0.0050	ND	ND	ND	0.0078	ND	--
Titanium (Ti)	0.0010 - 0.0050	ND	ND	ND	ND	ND	--
Uranium (U)	0.00010 - 0.00050	0.086	0.00092	ND	ND	0.014	--
Vanadium (V)	0.0010 - 0.0050	ND	ND	ND	ND	ND	--
Zinc (Zn)	0.0030 - 0.015	0.0035	ND	ND	ND	0.0054	--

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 B.

Table 4D
Analytical Results - Groundwater - VOCs

Parameters	Detection Limit	GW-03	MW-03	MW-04	MW-05	MW-07	Tier 1 Guideline
		08/14/2013	08/16/2013	08/14/2013		08/13/2013	
Volatile Organic Compounds							
Benzene	0.00040	ND	ND	**0.011**	**0.037**	ND	0.005
Toluene	0.00040	ND	ND	0.0033	**0.040**	ND	0.024
Ethylbenzene	0.00040	ND	ND	0.0015	**0.046**	ND	0.0024
Xylenes (Total)	0.00080	ND	ND	0.0062	0.260	ND	0.3
F1 (C_6-C_{10})	0.10	ND	ND	0.12	**1.4**	ND	0.81
F2 (C_{10}-C_{16})	0.10	ND	0.15	ND	**2.3**	ND	1.1
Total Trihalomethanes	0.0020	ND	ND	ND	ND	ND	0.1
Bromodichloromethane	0.00050	ND	ND	ND	ND	ND	- -
Bromoform	0.00050	ND	ND	ND	ND	ND	- -
Bromomethane	0.0020	ND	ND	ND	ND	ND	- -
Carbon tetrachloride	0.00050	ND	ND	ND	ND	ND	0.00056
Chlorobenzene	0.00050	ND	ND	ND	0.00097	ND	0.0013
Chlorodibromomethane	0.0010	ND	ND	ND	ND	ND	- -
Chloroethane	0.0010	ND	ND	0.045	0.0055	ND	- -
Chloroform	0.00050	ND	ND	ND	ND	ND	0.0018
Chloromethane	0.0020	ND	ND	ND	ND	ND	- -
1,2-dibromoethane	0.00050	ND	ND	ND	ND	ND	- -
1,2-dichlorobenzene	0.00050	ND	ND	**0.0025**	**0.0067**	ND	0.0007
1,3-dichlorobenzene	0.00050	ND	ND	ND	ND	ND	- -
1,4-dichlorobenzene	0.00050 - 0.00055	ND	ND	ND	**0.002**	ND	0.001
1,1-dichloroethane	0.00050	ND	ND	ND	ND	ND	- -
1,2-dichloroethane	0.00050	ND	ND	**0.0094**	ND	ND	0.005
1,1-dichloroethene	0.00050	ND	ND	ND	ND	ND	0.014
cis-1,2-dichloroethene	0.00050 - 0.010	ND	0.0017	1.7	3.0	ND	- -
trans-1,2-dichloroethene	0.00050	ND	ND	ND	ND	ND	- -
Dichloromethane	0.0020	ND	ND	0.0078	ND	ND	0.05
1,2-dichloropropane	0.00050 - 0.0010	ND	ND	ND	ND	ND	- -
cis-1,3-dichloropropene	0.00050	ND	ND	ND	ND	ND	- -
trans-1,3-dichloropropene	0.00050	ND	ND	ND	ND	ND	- -
Methyl methacrylate	0.00050	ND	ND	ND	ND	ND	0.47
Methyl-tert-butylether (MTBE)	0.00050	ND	ND	ND	ND	ND	0.015
Styrene	0.00050	ND	ND	ND	ND	ND	0.072
1,1,1,2-tetrachloroethane	0.0020	ND	ND	ND	ND	ND	- -
1,1,2,2-tetrachloroethane	0.0020	ND	ND	ND	ND	ND	- -
Tetrachloroethene	0.00050	ND	ND	ND	ND	ND	0.03
1,2,3-trichlorobenzene	0.0010	ND	ND	ND	ND	ND	0.008
1,2,4-trichlorobenzene	0.0010	ND	ND	ND	ND	ND	0.015
1,3,5-trichlorobenzene	0.00050	ND	ND	ND	ND	ND	0.014
1,1,1-trichloroethane	0.00050	ND	ND	ND	ND	ND	- -
1,1,2-trichloroethane	0.00050	ND	ND	ND	ND	ND	- -
Trichloroethene	0.00050	ND	ND	0.00077	0.00062	ND	0.005
Trichlorofluoromethane	0.00050	ND	ND	ND	ND	ND	- -
1,2,4-trimethylbenzene	0.00050	ND	ND	0.00059	0.089	ND	- -
1,3,5-trimethylbenzene	0.00050	ND	ND	ND	0.017	ND	- -
Vinyl chloride	0.00050	ND	ND	**0.011**	**0.47**	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 Field 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	2.6	1,317	943.3	- -	- -	- -
VW-02	25	30	4.3	2,164	943.3	- -	- -	- -
VW-03	25	30	2.7	1,388	943.3	6	15.04	15.03
VW-04	25	30	2.4	1,317	943.3	6	15.05	15.04
VW-05	25	30	2.4	1,231	943.3	- -	- -	- -

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 performed on Tuesday, August 13, 2013.
5) VW-01, VW-02 and VW-05 not sampled due to submerged screen.

Table 5B
Analytical Results - Soil Vapour - General Indices

Parameters	Units	Detection Limit	VW-01	VW-02	VW-03	VW-04	VW-05
Gauge Pressure							
Following sampling	psi	- -	NT	NT	-5.0	-5.0	NT
Reported by laboratory	psi	- -	NT	NT	-4.0	-3.0	NT
Fixed Gases							
Oxygen	% v/v	0.2	NT	NT	8.0	20.7	NT
Nitrogen	% v/v	0.2	NT	NT	71.8	77	NT
Carbon Monoxide	% v/v	0.2	NT	NT	ND	ND	NT
Methane	% v/v	0.2	NT	NT	5.2	ND	NT
Carbon Dioxide	% v/v	0.2	NT	NT	15.1	2.3	NT

Notes:

1) Soil vapour sample collected on Thursday, August 13, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) NT - Not Tested.
4) - - No value established in the detection limit.
5) VW-01, VW-02 and VW-05 not sampled due to submerged screen.
6) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5C
Analytical Results - Soil Vapour - VOCs

Parameters	Units	Detection Limit	VW-03	VW-04
			08/13/2013	
Hydrocarbon Fractions				
Aliphatic >C_5-C_6	µg/m^3	5.0	176	15.7
Aliphatic >C_6-C_8	µg/m^3	5.0	231	59.7
Aliphatic >C_8-C_{10}	µg/m^3	5.0	68.4	36.6
Aliphatic >C_{10}-C_{12}	µg/m^3	5.0	226	95.0
Aliphatic >C_{12}-C_{16}	µg/m^3	5.0	58.6	25.3
Aromatic >C_7–C_8 (TEX Excluded)	µg/m^3	5.0	ND	ND
Aromatic >C_8-C_{10}	µg/m^3	5.0	50.7	23.9
Aromatic >C_{10}-C_{12}	µg/m^3	5.0	62.5	22.7
Aromatic >C_{12}-C_{16}	µg/m^3	5.0	ND	ND
Select Volatile Gases				
Acetylene	ppm	0.19 - 0.22	ND	ND
Ethane	ppm	0.19 - 0.22	0.38	ND
Ethylene	ppm	0.19 - 0.22	ND	ND
Methane	ppm	4.4	- -	58
n-Butane	ppm	0.38 - 0.44	ND	ND
n-Pentane	ppm	0.19 - 0.22	ND	ND
Propane	ppm	0.19 - 0.22	0.19	ND
Propene	ppm	0.19 - 0.22	ND	ND
Propyne	ppm	0.38 - 0.44	ND	ND
Volatile Organic Compounds				
Benzene	ppbv	0.18	0.69	0.65
Toluene	ppbv	0.20	2.81	2.91
Ethylbenzene	ppbv	0.20	1.31	0.96
Xylene (Total)	ppbv	0.60	8.12	4.63
Dichlorodifluoromethane (FREON 12)	ppbv	0.20	2.82	1.15
1,2-Dichlorotetrafluoroethane	ppbv	0.17	11.0	ND
Chloromethane	ppbv	0.30	3.09	1.50
Vinyl Chloride	ppbv	0.18	3.01	0.83
Chloroethane	ppbv	0.30	0.52	ND
1,3-Butadiene	ppbv	0.50	ND	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.20	ND	0.59
Ethanol (ethyl alcohol)	ppbv	2.3 - 4.6	143	101
Trichlorotrifluoroethane	ppbv	0.15	ND	ND
2-propanol	ppbv	3.0	3.5	ND
2-Propanone	ppbv	0.80	25.8	21.1
Methyl Ethyl Ketone (2-Butanone)	ppbv	3.0	ND	3.5
Methyl Isobutyl Ketone	ppbv	3.2	ND	ND
Methyl Butyl Ketone (2-Hexanone)	ppbv	2.0	ND	ND
Methyl t-butyl ether (MTBE)	ppbv	0.20	ND	ND
Ethyl Acetate	ppbv	2.2	ND	ND
1,1-Dichloroethylene	ppbv	0.25	ND	ND
cis-1,2-Dichloroethylene	ppbv	0.19	1.37	0.59
trans-1,2-Dichloroethylene	ppbv	0.20	ND	ND
Methylene Chloride(Dichloromethane)	ppbv	0.80	0.97	ND
Chloroform	ppbv	0.15	ND	ND
Carbon Tetrachloride	ppbv	0.30	ND	ND
1,1-Dichloroethane	ppbv	0.20	ND	ND
1,2-Dichloroethane	ppbv	0.20	ND	ND
Ethylene Dibromide	ppbv	0.17	ND	ND
1,1,1-Trichloroethane	ppbv	0.30	ND	ND
1,1,2-Trichloroethane	ppbv	0.15	ND	ND
1,1,2,2-Tetrachloroethane	ppbv	0.20	ND	ND
cis-1,3-Dichloropropene	ppbv	0.18	ND	ND
trans-1,3-Dichloropropene	ppbv	0.17	ND	1.91
1,2-Dichloropropane	ppbv	0.40	ND	ND
Bromomethane	ppbv	0.18	ND	ND
Bromoform	ppbv	0.20	ND	ND
Bromodichloromethane	ppbv	0.20	ND	ND
Dibromochloromethane	ppbv	0.20	ND	ND
Trichloroethylene	ppbv	0.30	ND	ND
Tetrachloroethylene	ppbv	0.20	ND	ND
Styrene	ppbv	0.20	0.20	ND
4-ethyltoluene	ppbv	2.2	ND	ND
1,3,5-Trimethylbenzene	ppbv	0.50	1.38	0.54
1,2,4-Trimethylbenzene	ppbv	0.50	2.29	1.08
Chlorobenzene	ppbv	0.20	ND	ND
Benzyl chloride	ppbv	1.0	ND	ND
1,3-Dichlorobenzene	ppbv	0.40	ND	ND
1,4-Dichlorobenzene	ppbv	0.40	ND	ND
1,2-Dichlorobenzene	ppbv	0.40	ND	ND
1,2,4-Trichlorobenzene	ppbv	2.0	ND	ND
Hexachlorobutadiene	ppbv	3.0	ND	ND
Hexane	ppbv	0.30	13.8	1.83
Heptane	ppbv	0.30	2.78	1.31
Cyclohexane	ppbv	0.20	11.9	2.21
Tetrahydrofuran	ppbv	0.40	ND	ND
1,4-Dioxane	ppbv	2.0	ND	ND
Vinyl Bromide	ppbv	0.20	ND	ND
Propene	ppbv	0.30	ND	11.6
2,2,4-Trimethylpentane	ppbv	0.20	5.11	1.00
Carbon Disulfide	ppbv	0.50	1.79	37.0
Vinyl Acetate	ppbv	0.20	ND	ND

Notes:

1) Results are from sampling performed on Thursday, August 13, 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
Analytical Results - Soil Vapour - Siloxanes

Parameter	Detection Limit		VW-03		VW-04	
			08/13/2013			
	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm
Trimethylsilyl Fluoride	- -		ND	ND	ND	ND
Tetramethylsilane	0.0001	0.0001	ND	ND	ND	ND
Methoxytrimethylsilane	0.0029 - 0.0030	0.0007	ND	ND	ND	ND
Ethoxytrimethylsilane	0.0028 - 0.0029	0.0006	ND	ND	ND	ND
Trimethylsilanol	- -	- -	0.0142	0.0038	0.0102	0.0028
Isopropoxytrimethylsilane	0.0012	0.0002	ND	ND	ND	ND
Trimethoxymethyl Silane #	- -	- -	ND	ND	ND	ND
Hexamethyl Disiloxane - L2	0.0001	0.0001	ND	ND	ND	ND
Propoxytrimethylsilane	0.0032 - 0.0033	0.0006	ND	ND	ND	ND
1-Methylbutoxytrimethylsilane *	- -	- -	ND	ND	ND	ND
Butoxytrimethylsilane *	- -	- -	ND	ND	ND	ND
Trimethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	- -	0.0317	0.0035	0.0135	0.0015
Octamethyl Trisiloxane - L3	0.0002	0.0001	ND	ND	ND	ND
Triethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND
Triethoxyethyl Silane #	- -	- -	ND	ND	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	- -	0.0276	0.0023	0.0172	0.0014
Decamethyl Tetrasiloxane - L4	0.0003	0.0001	ND	ND	ND	ND
Tetraethylsilicate #	- -	- -	ND	ND	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	- -	0.0357	0.0024	0.0246	0.0016
Dodecamethyl Pentasiloxane - L5	0.0028	0.0002	ND	ND	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	- -	- -	0.2163	0.0119	0.1685	0.0093
Sum			0.3396	0.0263	0.2476	0.0189

Notes:

1) Soil vapour samples collected on Thursday, August 13, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit.
4) V=200 mL, where V is volume of air/gas sampled.
5) * - Semiquanititative (response factor set at 5).
6) # - Unstable, poor detectability, commercial standards tested.
7) For further information, the reader should refer to the laboratory report in Appendix A.