2019 Soil Monitoring Program
Clean Harbors Ryley Industrial Waste Management Facility
EPEA Approval No. 10348-03-00
SE 09-050-17 W4M

PRESENTED TO

Clean Harbors Canada, Inc.

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Tetra Tech Canada Inc.
14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
Tel 780.451.2121 Fax 780.454.5688

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Clean Harbors Canada. Inc. 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 Clean Harbors Canada. Inc., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Clean Harbors Canada Inc. (Clean Harbors) to conduct the 2019 Soil Monitoring Program (SMP) at the Clean Harbors Ryley Industrial Waste Management Facility located in SE 09-050-17 W4M, near Ryley, Alberta (Figure 1). The objective of the soil monitoring program was to sample soils in areas of concern for compliance purposes in accordance with Alberta Environment and Parks (AEP) Approval No. 10348-03-00 (the Approval), the Tetra Tech 2019 Soil Monitoring Program Proposal[1] and Deficiency Response Letter[2], and the 2009 AEP Soil Monitoring Directive[3] (the Directive).

Authorization to implement the 2019 Soil Monitoring Program as described in the Tetra Tech Proposal and Response Letter was provided to Clean Harbors by AEP in a letter dated July 2, 2019[4].

Tetra Tech collected soil samples at twenty-seven (27) assessment points around the Ryley Facility in 2019. Fieldwork was conducted in accordance with the monitoring data and laboratory testing requirements described in the Approval.

Four previous soil monitoring programs were conducted by Tetra Tech in 1996[5], 2001[6], 2009[7], and 2014[8], and one previous soil management program was completed by Tetra Tech with PAH delineation in 2017[9] and remediation and confirmatory sampling in 2018[10]. Results of these programs are further discussed in the Section 2.2.

1.1 Scope of Work

The scope of work completed included the following:

- Coordinated fieldwork with Clean Harbors personnel;
- Completed a Tetra Tech safe work form to identify and mitigate on site hazards, with worker review and signoff;
- Conducted an Alberta One-Call, and supervised one private locate to identify any underground utilities;
- Collected soil samples from 27 sampling locations and submitted them to an accredited laboratory, Element Edmonton, for analysis;
- Collected eight field duplicate samples and submitted them to Element for analysis, as part of the quality assurance/quality control (QA/QC) standards;
- Evaluated laboratory data;

[1] Tetra Tech Canada Inc. 2019. 2019 Soil Monitoring Program Proposal, Clean Harbors Ryley Facility, AEPEA Approval No. 10348-03-00, SE-09-050-17 W4M. File: SWM.SWOP04076-01.

[2] Tetra Tech Canada Inc. 2019. Response to Deficiency Letter, 2019 Soil Monitoring Program Proposal, Clean Harbors Canada, Inc., Ryley Industrial Waste Management Facility, AEPEA Approval No. 10348-03-00. File: SWM.SWOP04076-01.

[3] Government of Alberta. 2009. Soil Monitoring Directive 2009. ISBN: 978-0-7785-8121-5 (On-line Edition).

[4] Alberta Environment and Parks. 2019. Authorization of Soil Monitoring Program Proposal, Clean Harbors Canada, Inc. Ryley Industrial Waste Management Facility, *Environmental Protection and Enhancement Act* Approval No. 10348-03-00. Letter dated April 19, 2017.

[5] EBA Engineering Consultants Ltd. 1997. 1996 Soil Monitoring Program. Laidlaw Ryley. File: 0105-12380.

[6] EBA Engineering Consultants Ltd. 2002. 2001 Soil Monitoring Report, Safety-Kleen Ryley Facility. File: 0105-00-14423.001.

[7] EBA Engineering Consultants Ltd. 2010. 2009 Soil Monitoring Report. Clean Harbors Class I Waste Management Facility, AEPEA Approval No. 103348-02-00, SE-09-050-17 W4M, Ryley, Alberta. File: E22101333.

[8] Tetra Tech EBA Inc. 2015. 2014 Soil Monitoring Program, Clean Harbors Ryley Industrial Waste Management Facility, EPEA Approval 10348-02-00. File: E22203073.

[9] Tetra Tech Canada Inc. 2018. Soil Management Program, 2017 Cell 4 Soil Sampling, Clean Harbors Ryley Industrial Waste Management Facility, EPEA Approval 10348-02-00, SE-09-050-17 W4M. File: SWM.SWOP03758.

[10] Tetra Tech Canada Inc. 2019. Soil Management Program, 2018 Cell 4 Remediation Report, Clean Harbors Ryley Industrial Waste Management Facility, AEPEA Approval No. 10348-03-00, SE-09-050-17 W4M. File: SWM.SWOP03798.

- Prepared this soil monitoring report summarizing field activities, interpretation of laboratory results from soil sampling, and provided recommendations for any non-conformance issues; and
- Completed a Record of Site Condition report.

Deviations from the 2019 SMP Proposal included the analysis of additional samples from selected boreholes in order to achieve vertical delineation of identified guideline exceedences.

2.0 REGIONAL AND SITE CHARACTERISTICS

2.1 Site Description

The Clean Harbors Ryley facility is located just north of the town of Ryley, Alberta, within the southeast quarter of Section 9, Township 50, Range 17, West of the Fourth Meridian (Figure 1).

The facility is an Alberta Class I landfill, storage, and disposal facility, licensed to accept various hazardous waste liquids and solids for disposal and/or transfer to authorized treatment or disposal facilities in accordance with the Environmental Protection and Enhancement Act (EPEA).

2.1.1 Vegetation and Land Use

The surrounding land use is agricultural. Native vegetation in the area mainly consists of dominantly aspen with some balsam poplar and white birch with grasses and shrubs in the understory (Figure 2).

2.1.2 Surficial Geology

Surficial geology around the Clean Harbors facility is fine loamy to fine clayey till, containing less than 5% coarse fragments, and is weakly calcareous and weakly saline, with the till layer ranging from 4 to 8 m in thickness (Figure 4).

The underlying bedrock is composed of sandstone, mudstones, and siltstones containing concretionary ironstone beds of the Bearpaw and Horseshoe Canyon formations. The Bearpaw formation is dominant and is characterized by marine deposited shales and clayey sandstone (Figure 2).

2.1.3 Topography and Drainage

Topography is undulating to gently rolling. Soils are predominantly well drained, with localized areas of poorly drained soils (Figures 3 and 7).

The northwest corner of the facility is a local topographic high point for surface water. Perimeter ditches have been constructed around the waste cells to collect surface water and allow perimeter drainage to the retention pond, located on the east side of the facility. Surface water from the northwest corner drains south, through a perimeter ditch that collects water from the west base of Cells 2 and 3A. At the southwest corner of Cell 3A, the ditch turns east to collect perimeter drainage along the south toes of Cells 3A, 3B, 3C, 3D, and 3E, respectively. Surface water then drains east into the retention pond. All surface water runoff is collected and not discharged off site until it meets surface water quality discharge requirements. Surface water from outside of the facility is diverted from flowing into the facility (Figure 5).

A ditch on the northern edge of the facility is sloped downward to the east along the north base of Cells 1 and 2 and conveys surface water into a second perimeter ditch constructed around Cell 4 to collect and direct surface drainage water east into the retention pond. The perimeter ditch around Cell 4 also conveys surface water from the Cell 1 leachate tank area to the water retention pond on the east side of the facility (Figure 5).

2.1.4 Surface Water and Groundwater

There is one water well located on the facility behind the south end of the office building which is currently not in use due to low water yields. The closest waterbody to this facility is a lagoon area in the same quarter section as the facility area. Surface waterbodies in the area include numerous creeks, lakes, ponds, and sloughs in the surrounding sections.

Regional groundwater flow is inferred to generally follow the surface topography in the area. Local groundwater flow direction at the site is characterized generally by radial flow away from Cells 3B and 3C.

Groundwater flow diagrams for the site are taken from the 2019[11] Groundwater Monitoring Program report. Figures 6a through 6d show groundwater flow directions in four geologic units beneath the site including surficial material, upper sandstone, clay shale, and lower bedrock. The contours on each of these maps were created using wells screened across a similar unit, within a general depth range. The groundwater elevations measured in 2019 were generally consistent with historical groundwater elevations.

- Figure 6a shows the 2019 groundwater elevation contour map for the clay till (surficial) unit. Groundwater in this unit flows to the east based on the 2019 groundwater elevations, although historical groundwater flow has been more to the northeast. It is likely that groundwater flow through this unit is discontinuous across the facility due to the depth of the landfill cells and above and below ground infrastructure. Based on the 2019 groundwater monitoring information, groundwater elevation in the surficial materials is an average 1.79 m below ground level.
- Figure 6b shows the 2019 groundwater elevation contour map for the upper sandstone unit. This unit is likely laterally continuous in wells across the facility. Groundwater in this unit appears to be split through the centre of the facility. Groundwater flow direction, in the eastern half of the facility, is to the east and also to the southeast and northeast from the northeastern and southeastern portions of the site, respectively, towards monitoring well MW31A. In the western half of the facility, the groundwater flows to the west-northwest. There is little to no hydraulic gradient under Cell 3C. Changes in groundwater flow direction compared to previous years have been observed, indicating that the groundwater flow conditions and recharge may be shifting as a result of construction activities on Cell 4.
- Figure 6c shows the 2019 groundwater elevation contour map for the clay shale unit. This material is laterally continuous in wells across the facility. Historically the groundwater flow direction has been to the east under Cells 3C, 3D, and 3E, however in 2019 there was little to no hydraulic gradient on the east side of the facility. This is due to an increase of approximately 0.4 m in groundwater elevation in 2019 as compared to 2018 at MW32A, located to the east of the site. On the west side of the facility, groundwater flow is to the southwest in the southwestern corner and northwest in the northwestern corner of the facility. Overall the groundwater flow direction in this unit is consistent with historical flow directions.
- Figure 6d shows the 2018 deep groundwater flow direction, based on 2018 groundwater elevations monitored in four monitoring wells installed in the Belly River Formation. Only two wells were monitored in 2019 and an updated deep groundwater elevation contour map could not be created, however the 2019 groundwater elevations for monitoring wells 15MW35-Deep and 15MW36-Deep were comparable to the 2018 elevations. The groundwater flow in this zone in 2018 was interpreted to flow to the northeast and is overall in agreement with regional hydrogeological data.

[11] Tetra Tech Canada Inc. 2020. 2019 Groundwater Monitoring Program, Class 1 Waste Management Facility, Ryley, Alberta. Tetra Tech File: SWM.SWOP04117-01. Report in progress.

2.1.5 Soils

Undisturbed upland soils around the facility are composed predominantly of Black Solodized Solonetz (Camrose soil series) developed in fine loamy textured tills[12]. These soils are naturally saline and sodic (Figure 7). Published soil series data[13] relating to salinity is provided in Table A.

Table A: Published Soils Data for Camrose Soil Series

Horizon	Depth (m)	pH	Electrical Conductivity (dS/m)	Sodium Absorption Ratio
Ap (Topsoil)	0.0-0.18	5.4-6.5	0.4-6.8	2.6-9.3
Bnt/Bntgj	0.18-0.36	7.0-7.5	0.5-6.9	6.3-40.4
Csk/Cskgj	0.36-1.8	7.8-8.2	0.8-12.9	7.3-35.1

2.2 Site History

The facility currently includes eight landfill cells. Facility operations were initiated in 1992. Landfill Cells 1, 2, 3A, 3B, and 3C are no longer active. Cells 1, 2, 3A, and 3B were capped in 1999, 2010, 2013, and 2013 respectively. Capping of Cell 3C is currently in progress. Cells 3D and 3E are currently active, but no longer accepting waste until the tipping pad located in Cell 3D is decommissioned. Construction of Cell 4 was completed in 2019. An access road, run-on diversion ditch, and run-off control ditch were constructed in 2012 along the south side of the facility. A water retention pond was constructed east of landfill Cell 3E in 2014.

Building facilities at the site include those required for waste transfer and vehicle maintenance, lab, and administration buildings. The building area is completely paved with the exception of two small grassed areas and one small gravelled area. Surface runoff waters from the paved areas are collected in the clay-lined surface water retention pond and tested before discharge. On occasion, minor adjustments for total suspected solids (TSS) and chemical oxygen demand (COD) have been required prior to discharge. In the drainage area to the south a now abandoned sewage lagoon was operated by the Village of Ryley from 1951 to 1985. The landfill cells are double lined with leak detection systems. Wash water from building drains and leachate from the landfill cells is collected in leachate holding tanks and disposed of off-site through deep well injection. The ground surface outside of the landfill cells is covered in gravel, grass, or trees. The Cells were designed to accept hazardous wastes.

The types of materials typically disposed in the landfill cells include[14]:

- Filters from gas plants
- Solids and debris from petrochemical and mining operations
- Hydrocarbon-contaminated soil from gas plants, refineries, and service stations
- Catalyst from petroleum processing such as vanadium pentoxide
- Treated wood from site clean-up

[12] Howitt, R.W. 1988. Alberta Soil Survey Report No. 47, Soil Survey of the County of Beaver, Alberta.

[13] Pedocan Land Evaluation Ltd., 1993. Soil Series Information for Reclamation Planning in Alberta. Alberta Conservation and Reclamation Council Report No. RRTAC 93-7. ISBN 0-7732-6041-2.

[14] Axys Environmental Consulting Ltd. 1995. An Assessment of Environmental and Socio-economic Impacts associated with an Amendment to the License to Operate for Laidlaw Environmental Services' Hazardous Waste Facility Near Ryley, Alberta.

- Shot blast waste from industrial clean-up
- Activated carbon from petroleum processing
- Plant demolition waste
- Fibreglass insulation from manufacturing, site clean-ups
- Sulphur-contaminated soil from gas plants
- Spent flammable solvents
- Metal-contaminated soil from industrial clean-ups

Newalta Corporation, who operated this site in 1990 to 1991, had a pesticide container storage area in the current location of Cell 2. Laidlaw Environmental Services Ltd. (later Safety-Kleen, now Clean Harbors) decommissioned this storage area at the start of their operations[15].

Previous soil monitoring programs were completed in 1996, 2001, 2009, and 2014. During the 2001 monitoring event, a sample from the surface water retention pond was found to be above applicable guidelines for lindane and molybdenum. A delineation sampling event took place in 2002[16], two of the delineation samples also exceeded for lindane, though it was concluded that since the lindane impacts were localized and slightly above applicable guidelines, no remediation of impacts was required.

During the 2009 monitoring event, three boreholes had samples exceeding applicable guidelines for various parameters. Ethylbenzene, polyaromatic hydrocarbons (PAHs), and various metal concentrations exceeding guidelines were identified in borehole 09-6 east of the retention pond; PAHs were identified in borehole 09-10 northeast of landfill Cell 1, and a minor selenium exceedance was identified in borehole 09-11 west of the landfill Cell 3A. Borehole 09-6 was within a lined area and contained, and further delineation was not required. The selenium exceedance in borehole 09-11 was marginal and likely naturally occurring, requiring no delineation. The minor exceedances for PAHs in borehole 09-10 were recommended for further investigation during the next soil monitoring event to determine if impacts are present, as the PAH concentrations recorded did not correspond with hydrocarbon concentrations detected. Electrical conductivity (EC) values marginally exceeding background and published soils data were also encountered in samples to the west (09-11) and south (09-12 and 09-13) of the landfill cells. However, the majority of the soils encountered fall within the “unsuitable” category under the Salt Contamination and Remediation Guidelines (SCARG) due to the naturally occurring salinity, including the samples exceeding for EC in these areas.

During the 2014 monitoring event, PAH and petroleum hydrocarbon (PHC) fraction F3 concentrations greater than the referenced guidelines were detected in surface soils of areas predominantly near landfill cells, and/or lined areas where waste processing equipment/vehicles were operating. These areas included: the gravelled area west of process building, west of the facilities area, north of the run-on diversion ditch (south of Cell 3C), old surface water detention pond/lugger area, north of Landfill Cell 3D, near the Landfill Cell 1 leachate holding tank and north of the waste container storage area. Similarly, metal concentrations greater than the referenced guidelines were detected adjacent to the old surface water detention pond/lugger area, west of the facilities area where waste processing equipment/vehicles were operating, and in the gravelled area west of the process building. The identified exceedances were restricted to the surface samples collected on site, and annual groundwater monitoring programs have failed to detect any impact on groundwater.

[15] Hardy BBT Limited. 1991. Pesticide Contaminant Site Investigation. Prepared for Laidlaw Environmental Services Ltd. December 1991.
[16] EBA Engineering Consultants Ltd. March 2003. Summary of 2002 Follow-up Soil Sampling at Ryley, Alberta Facility. Clean Harbors Inc. File: 5100146.

The detected concentrations of PAHs, PHCs, and most metals were considered likely to be associated with dust from landfill cells or waste tracking from vehicles that entered landfill cells, a likely effect of the landfill operation up to 2012. In 2012, Clean Harbors implemented improved dust management strategies, and eliminated vehicle contact with waste through the construction of a tipping pad, substantially reducing the potential for airborne and contact source introduction of PAHs. Selenium and hot water-soluble boron exceedances identified along the east and west sides of the facility were considered naturally occurring and no further investigation was recommended. The observed exceedances were only slightly above the referenced guideline values, the boron concentrations were comparable to typical background concentrations, and the selenium concentration was relatively unchanged from previous sampling events.

Exceedances of salinity (chloride) were considered comparable to typical background control concentrations, consistent with native undisturbed soils. Consequently, Tetra Tech recommended that no further investigation or delineation of salinity (chlorides) would be required.

In 2017, Tetra Tech prepared a Soil Management Program (SMaP) Proposal for the Ryley Facility. The 2017 SMaP recommended the assessment and delineation of PAHs in the proposed Cell 4 construction area, remediation of salinity, metals, PHC, and PAH parameters during decommissioning of the old surface water detention pond followed by confirmatory sampling, delineation of metals and PAH parameters in the gravelled area west of the process building, delineation of salinity, metals, and PAH parameters west of the facilities area, and delineation of PAH parameters north of the surface water drainage ditch located along the south edge of Cell 3C. The proposed SMaP was approved by AEP in September 2017.

In November 2017, assessment and delineation of PAHs in the proposed Cell 4 construction area was completed, including one delineation sample (17-10A-A) located west of borehole 14-10A (northwest of the proposed Cell 4) where PAH guideline exceedances were identified in 2014. Four sample locations within the Cell 4 footprint area had PAH parameters exceeding the 2016 Alberta Tier 1 guidelines. Delineation borehole 17-10A-A was below referenced guidelines for all PAH parameters analyzed.

In 2018, remediation and confirmatory sampling was completed in the Cell 4 footprint construction area, including borehole 14-10 areas (PAHs), the old surface water detention pond (borehole 14-6, metals, hydrocarbons, and PAHs), the drainage ditch north of Cell 3D (borehole 14-8, PAHs) and west of the facilities area (borehole 14-4, salinity, metals, and PAHs). Confirmatory sample results indicated that all PAH parameters analyzed were below the 2016 Alberta Tier 1 guidelines within the Cell 4 construction area. (Final confirmatory sampling for PAH parameters was not completed in 2018 in one location north of Cell 4 due to safety concerns amid ongoing Cell 4 construction activities.) All salinity, hydrocarbon and PAH parameters analyzed were below the Alberta Tier 1 guidelines within the decommissioned and remediated old surface water detention pond area. Arsenic, nickel, and selenium concentrations in the confirmatory samples analyzed were slightly above the 2016 Tier 1 agricultural guidelines but were within the range of natural variability observed within Alberta for these metals and the observed concentrations were well below the 2016 Tier 1 industrial guidelines. The material with metal exceedances was left in place and Cell 4 constructed. Confirmatory sample results indicated that all metals and PAH parameters analyzed from the remediation excavation west of the facilities area were below the 2016 Tier 1 guidelines. Salinity analysis of the confirmatory samples indicated EC and chloride concentrations greater than the typical background concentrations for the Ryley Facility.

2.3 Areas of Concern

The Directive contains a list of facility areas that should be considered for soil monitoring. This list is provided in Table 1 with a description of each area at the Clean Harbors facility. Most areas are protected from potential impact by adequate engineered controls including housing, impermeable (paved) surfaces, or liners (landfill area). Therefore, the only areas which require sampling are drainage areas from these protected areas.

Sampling locations (Figures 9a and 9b) have been updated relative to the historical sampling program and are summarized in Table 2. Two background sample locations were added north of the facility area. Historical background sample locations were not resampled, but the data has been used for comparative purposes in 2019. The exception to this is background control locations 14-1 and 14-2, which were sampled and analyzed for saturated paste boron, in accordance with the Alberta Tier 1 method change implemented in 2016. Four delineation sample points were added around borehole 19-3 as per the approved 2017 SMaP. Five delineation sampling locations were added around location 19-4 west of the facilities area where remediation was completed in 2018. Delineation of PAH parameters around boreholes 19-3 and 19-5, previously approved in the 2017 SMaP, was deleted from the 2019 SMP. A review of the 2019 Alberta Tier 1 guidelines[17] indicated that all PAH parameters analyzed in 2014 at these locations are below the current guidelines, and further delineation was not warranted. Delineation of PAH parameters around borehole 19-10, previously approved in the 2017 SMaP, was also deleted from the 2019 SMP. Remediation and confirmatory sampling completed in 2018 has indicated that all PAH parameters analyzed were below the 2016 Alberta Tier 1 guidelines in the borehole 19-10 area, and further delineation was not warranted.

The general strategy used to select sampling locations was based on the following information:

- Analytical results from previous soil and groundwater monitoring/management programs as conducted
- Visual surface staining observed
- Areas where potential leaks or spills may have occurred since 2014
- Facility areas
- Storage areas
- Building areas
- Drainage, discharge, and surface water collection areas
- Landfill cell areas

Analysis for each location was selected based on the area use as well as the associated chemicals used in each of the areas.

[17] Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 198 pp.

3.0 METHODS

3.1 Soil Assessment

3.1.1 Assessment Locations

Soils were inspected at 27 locations in 2019, including delineation sampling points (Figures 9a and 9b). A breakdown of the sampling locations and rational, based on facility operations and previous sampling events, is provided in Table 2.

Two boreholes (19-6 and 19-8) were relocated relative to the 2014 sample locations.

Borehole 14-6 was located on the edge of the old surface water retention pond. The pond was decommissioned, and Cell 4 constructed in 2018. Consequently, borehole 19-6 was relocated to north of Cell 4.

Borehole 14-8 was located adjacent to a drainage ditch north of Cell 3D. The ditch was decommissioned, and Cell 4 constructed in 2018. Consequently, borehole 19-8 was also relocated to north of Cell 4.

3.1.2 Safe Work Procedures

Standard personal-protective equipment (hard hat, steel-toed boots, safety glasses, and fire-retardant coveralls) and nitrile gloves were used when handling soil.

All personnel on site had copies of safety certification (Ground Disturbance Level II, H_2S Alive, Transportation of Dangerous Goods, Workplace Hazardous Material Information System and Standard Level First Aid) and had signed off on Clean Harbors safety policy.

Prior to performing the fieldwork, a Tetra Tech Work Hazard Assessment and Pre-Job Meetings were completed. An Alberta One-Call and a private utility locate were conducted prior to ground disturbance activities. Ground disturbance information is included in Appendix C.

3.1.3 Assessment Methods

The soil sampling locations were staked out and locations recorded using a global positioning system (GPS). Tetra Tech arranged and completed the Alberta One-Call notification. The soil sampling program met all Clean Harbors' contractor safety program requirements.

Sample locations were sampled with a shovel and a 2" diameter Dutch Soil Auger to a target depth of 1 m. All equipment was cleaned before it was taken on site. Between sample locations, any extraneous soil was mechanically removed then rinsed off the equipment using potable water. Equipment was then washed in distilled water with Liquinox™, followed by a distilled water rinse 1, and a final distilled water rinse 2.

Disturbed soil samples were collected at 0-15 cm, 15-30 cm, 30-60 cm, and 60-100 cm depth increments, adjusted as needed to ensure different material types (i.e., fill and native materials) are not mixed together in a sample. Undisturbed soils (control sample locations) were sampled by horizon down to 100 cm.

Soils inspected at each location were described using the Canadian System of Soil Classification (CSSC)[18] with additional statements on soil staining and odour where appropriate.

[18] Soil Classification Working Group. 1998. CSSC. Research Branch, Agriculture and Agri-Food Canada Publication 1646. 3rd Ed. NRC-CNRC Research Press. Ottawa, Ontario.

Field duplicates were collected, according to Clean Harbors, Tetra Tech and the Approvals' standard sample QA/QC programs. Eight duplicate soil samples were submitted for analysis.

Field screening for volatile fuel vapours was conducted on all soil samples collected using an RKI Eagle. Samples for headspace vapour screening were placed into plastic bags, sealed and allowed to volatilise. Vapour concentrations were then measured in parts per million (ppm) and recorded in the field log. Borehole logs with field screening results are available in Appendix D.

Field collection and preservation of samples was completed as per the Canadian Council of Ministers of the Environment (CCME) 2016 Guidance Manual of Environmental Site Characterization, Volume 4[19] and/or the table of Exceptions and Clarifications to CCME Analytical Methods published by AEP[20]. At least 500 g of soil was collected into a plastic bag for inorganic analysis. For volatiles analysis, soil was collected in laboratory supplied containers and field preserved with methanol. For other organic analysis, soil was collected in 125 mL jars with Teflon™-lined lids. These samples were tightly packed to have minimum headspace. The samples for volatile and/or organic analysis were kept on ice in a cooler (between 0°C and 6°C) during storage and transported to the laboratory for analysis.

3.2 Laboratory Methods

Laboratory methods for analysis followed the procedures based on Alberta Tier 1 Soil and Groundwater Remediation Guidelines[21] or as approved in the Directive.

For sampling locations that had been sampled in previous monitoring events, analysis was staged by analyzing the top depth (0-15 cm) for particular constituents of concern, as per the Directive, unless evidence of impacts were detected (screened/viewed) at the time of sampling. Where indicated, based on previous sampling results, vertical delineation samples were also analyzed.

The laboratory analysis completed for each sampling location and depth is broken down in Table 3. The analytical methods for each parameter are provided with the laboratory analytical reports.

3.3 Comparative Guidelines

Laboratory analytical data is evaluated and compared against background data and Alberta Tier 1 Soil Remediation Guidelines, based on current and future end land use, as proposed in the Soil Monitoring Program Proposal.

Due to the Ryley facility's proximity to adjacent agricultural land, analytical results are compared to Alberta Tier 1 Soil Remediation Guidelines for agricultural land use, fine-textured soil for most parameters. Where applicable, analytical results are also compared to Alberta Tier 1 Soil Remediation Guidelines for industrial land use, fine-textured soil, because the site is currently used for industrial purposes. EC and SAR are compared to unrestricted land use guidelines for topsoil and subsoil.

[19] Canadian Council of Ministers of the Environment. 2016. Guidance Manual of Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volume 4: Analytical Methods. ISBN: 978-1-77202-032-8 PDF.

[20] Alberta Environment and Parks. 2016. Adoption of CCME Analytical Methods Manual in Alberta, Table 1. Received via email, November 17, 2016.

[21] Alberta Environment and Sustainable Resource Development (ESRD). 2014. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 195 pp.

4.0 SOIL MONITORING RESULTS

Laboratory analytical results are summarized on Tables 4 to 9 and 11. Laboratory analytical reports are provided as Appendix E. The parameters included in each table are outlined below.

Table 4: Salinity, Sulphur, CEC, TOC, Nitrates, Metals, and Texture (percent sand, silt, and clay)

Table 5: Hydrocarbons, PAHs, VOCs, and Grain Size (75 µm)

Table 6: PCBs, Pesticides, and Grain Size (75 µm)

Table 7: Herbicides and Grain Size (75 µm)

Table 8: Metals (Borehole 19-3 Delineation Sampling)

Table 9: Salinity (Borehole 19-4 Delineation Sampling)

Table 11: Quality Assurance / Quality Control Samples

4.1 Background Control Boreholes

Four background control locations were sampled as part of the 2019 Soil Monitoring Program.

Sample points 14-1 and 14-2, previously sampled in 2014, were resampled in 2019 and analyzed for saturated paste boron in accordance with the Alberta Tier 1 method change implemented in 2016.

Sample points 19-1 and 19-2, located off-site north of the facility, were added and analyzed for baseline parameters to accommodate future expansion plans and in order to ensure a minimum of four background control samples with saturated paste boron results.

Samples from boreholes 19-1 and 19-2 were analyzed for potential parameters of concern that may be associated with site activities to determine background concentrations. Soil samples from all depths were analyzed for salinity (pH, EC, SAR, and soluble salts), total sulphur, cation exchange capacity (CEC), total organic carbon content (TOC), nitrates, metals, percent sand, silt, and clay (texture), and grain size (75 µm). The topsoil samples from each borehole was also analyzed for PAHs.

The topsoil samples had pH values below the reference guideline range of 6-8.5 but were comparable to the published soils data for the Camrose soil series (Table A), and are considered to be representative of natural background conditions for the area. All other background control sample concentrations were below referenced guideline values for all parameters analyzed (Tables 4 and 5).

Topsoil EC results ranged from 0.31 dS/m to 0.75 dS/m, indicating ‘good’ quality topsoil. The maximum subsoil EC value was 12.5 dS/m at sample point 19-2 (45-60 cm), indicating ‘unsuitable’ subsoil quality. The background EC values observed in sample points 19-1 and 19-2 are consistent with the published soils data for the Camrose soil series (Table A) and are considered to be representative of natural background conditions for the area.

Topsoil SAR results ranged from 5.1 to 9.4, indicating ‘fair’ to ‘poor’ quality topsoil. The maximum subsoil SAR value was 28 at sample point 19-1 (15-30 cm), indicating ‘unsuitable’ subsoil quality. The background SAR values observed in sample points 19-1 and 19-2 are consistent with the published soils data for the Camrose soil series (Table A) and are considered to be representative of natural background conditions for the area.

The maximum chloride concentration observed in the 2019 background control sample points was 37 mg/kg in sample point 19-1 (15-30 cm).

4.2 Historical Background Control Boreholes

Historical control data for salinity, sulphur, CEC, TOC, organic matter, nitrates, metals, grain size, and texture parameters from previous soil monitoring events in 1996, 2001, 2009 and 2014 is provided in Table 10. Historical background control sample locations are shown on Figure 8.

Sample point 96-S1 was located southwest of Cells 1 and 2 and represented, at the time, an off-site control. Sample points 96-S3, 96-S4, and 09-1 were located approximately 300 to 400 m south of the facility and represent off-site controls. Sample points 96-S2 and 09-2 were located in the current locations of Cells 3C, 3D, and 3E, and represented on-site controls. Sample point 14-1 was located approximately 50 m north of the facility area as an off-site control, and sample point 14-2 was located south of the run-on diversion ditch near the south boundary fence as an on-site control.

Several topsoil and upper subsoil background samples have had pH values below the reference guideline range of 6-8.5 but were comparable to the published soils data for the Camrose soil series (Table A) and are considered to be representative of natural background conditions for the area. All other background control sample concentrations were below referenced guideline values for all parameters analyzed, with the exception of lead.

One control sample from the 1996 soil monitoring program (96-S1 35-65 cm) had a reported lead concentration of 100 mg/kg, double the 2019 Tier 1 agricultural guideline value of 45 mg/kg and greater than the 2019 Tier 1 industrial guideline value of 89 mg/kg. Subsequent follow-up sampling in 2002 reported a lead concentration of 11 mg/kg in the same location.

Topsoil EC values ranged from 0.24 dS/m to 7.38 dS/m, indicating ‘good’ to ‘poor’ quality topsoil. Subsoil EC values ranged from 0.19 dS/m to 10.8 dS/m, indicating ‘good’ to ‘unsuitable’ subsoil quality. The historical background EC values observed are consistent with the published soils data for the Camrose soil series (Table A) and are considered to be representative of natural background conditions for the area.

Topsoil SAR results ranged from 1.1 to 14.7, indicating ‘good’ to ‘unsuitable’ quality topsoil. Subsoil SAR values ranged from 3.4 to 37.2, indicating ‘good’ to ‘unsuitable’ subsoil quality. The historical background SAR values observed are consistent with the published soils data for the Camrose soil series (Table A) and are considered to be representative of natural background conditions for the area.

The historical chloride concentrations observed in the off-site background control sample points ranged from <1 mg/kg (14-1 23-45 cm) to 61 mg/kg (14-1 60-100 cm). The on-site historical background locations had chloride concentrations ranging from 1 mg/kg (14-2 60-85 cm) to 276 mg/kg (09-2 0-15 cm).

Based on the historical background control sampling results and the 2019 background control results, background chloride concentrations are typically less than 100 mg/kg (maximum off-site reported concentration 61 mg/kg). While background control chloride concentrations greater than 100 mg/kg have been reported, they are not typical and likely represent an anomaly.

4.3 Graveled Area West of the Process Building

Samples were obtained from a small area west of the process building (19-3, 19-3A, 19-3B, 19-3C, 19-3D). Boreholes 19-3A to 19-3D were advanced to assess and delineate metals guideline exceedances noted in 2014. Materials encountered included an intermittent layer of replaced topsoil admixed with subsoil over fill over till. Vapour readings did not exceed 5 ppm.

Samples submitted from borehole 19-3 were analyzed for any of the following parameters: salinity, metals, texture, hydrocarbons, PAHs, grain size, PCBs, nitrates, herbicides, and pesticides. Samples submitted from delineation boreholes 19-3A to 19-3D were analyzed for metals. Delineation sample results are summarized in Table 8.

The topsoil sample (0-15 cm) from borehole 19-3 exceeded Tier 1 agricultural guidelines for molybdenum. All other analyzed parameters from borehole 19-3 had concentrations below referenced guidelines or within regional / published soil data for all samples analyzed.

The surface sample (0-15 cm) from delineation borehole 19-3A exceeded Tier 1 agricultural guidelines for cadmium, chromium, lead, molybdenum, nickel, and zinc. The nickel and zinc concentrations also exceeded Tier 1 industrial guidelines. The underlying 15-30 cm depth sample was below referenced guidelines for all parameters analyzed.

The surface sample (0-15 cm) from delineation borehole 19-3B exceeded Tier 1 agricultural guidelines for cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, tin, and zinc. The nickel and zinc concentrations also exceeded Tier 1 industrial guidelines. The subsoil sample (15-30 cm) exceeded the Tier 1 agricultural guideline for molybdenum. The underlying 30-60 cm depth sample was below referenced guidelines for all parameters analyzed.

No guideline exceedences were identified in delineation borehole 19-3C.

The surface sample (0-15 cm) from delineation borehole 19-3D exceeded Tier 1 agricultural guidelines for cadmium, chromium, copper, lead, molybdenum, nickel, vanadium, and zinc. The chromium, copper, nickel, vanadium, and zinc concentrations also exceeded Tier 1 industrial guidelines. The underlying 15-30 cm depth sample was below referenced guidelines for all parameters analyzed.

All other metal parameters analyzed from delineation boreholes 19-3A to 19-3D were below referenced guidelines.

4.4 West of the Facilities Area

Samples were collected in a drainage ditch (19-4, 19-4A, 19-4B, 19-4C, 19-4D, 19-4E) west of the facilities area. This drainage ditch flows into the earthen ditch west of the surface water retention pond. The east adjacent paved area is currently used for the storage of trucks, equipment, and miscellaneous construction material while the west side of the drainage ditch consists of the ramp up to the tipping pad in Cell 3D. Boreholes 19-4A to 19-4E were advanced to assess and delineate the salinity concentrations above typical background concentrations noted in 2014. Materials in this area consisted of replaced topsoil admixed with subsoil over fill over till. Vapour readings did not exceed 10 ppm.

Samples submitted from borehole 19-4 were analyzed for any of the following parameters: salinity, metals, texture, total and elemental sulfur, hydrocarbons, PAHs, grain size, and PCBs. Samples submitted from delineation boreholes 19-4A to 19-4E were analyzed for salinity. Delineation sample results are summarized in Table 9.

The chloride concentrations in surficial and subsoil samples (0-15 cm and 15-30 cm) from sample point 19-4 were greater than typical background concentrations. All other samples analyzed from borehole 19-4 were below referenced guidelines or within regional / published soil data for all parameters analyzed.

Samples from boreholes 19-4A (0-15 cm, 15-30 cm, and 30-60 cm), 19-4C (15-30 cm, 30-60 cm, and 60-100 cm), 19-4D (30-60 cm), and 19-4E (0-15 cm and 15-30 cm) exceeded typical background concentrations for chloride. One replaced topsoil sample (19-4E 0-15 cm) had an EC value of 7.81 dS/m, slightly above but equivalent to the maximum background control value of 7.38 dS/m (‘unsuitable’ topsoil quality). All other samples analyzed from boreholes 19-4A to 19-4E were below referenced guidelines or within regional / published soil data for all other parameters analyzed.

4.5 North of Run-on Diversion Ditch

Samples were collected from an area south of cell 3C near the end of a drainage ditch (19-5) used to collect surface water. Materials in this area consisted of replaced topsoil over fill over till. All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for any of the following parameters: salinity, metals, texture, hydrocarbons, PAHs, grain size, herbicides, and pesticides.

All analyzed parameters for this location were below referenced guidelines or within regional / published soil data.

4.6 North of Cell 4

Samples were collected from the access road side slope north of Cell 4 (19-6). Borehole 19-6 was relocated from the 2014 sampling location in the surface water pond/lugger area after the pond was decommissioned in 2018 as part of Cell 4 construction. Materials in this area consisted of fill. All vapour readings were 0 ppm.

Samples from this location were submitted for any of the following analyses: salinity, metals, texture, hydrocarbons, PAHs, grain size, pesticides, and herbicides.

The surficial sample (0-15 cm) exceeded Tier 1 agricultural guidelines for cadmium, lead, molybdenum, nickel, zinc, naphthalene, and phenanthrene. The zinc, naphthalene, and phenanthrene concentrations also exceeded the Tier 1 industrial guidelines.

The 15-30 cm sample exceeded Tier 1 agricultural guidelines for molybdenum and zinc. The zinc concentration also exceeded the Tier 1 industrial guideline.

The 30-60 cm sample exceeded Tier 1 agricultural guidelines for cadmium, lead, molybdenum, nickel, zinc, and naphthalene. The zinc and naphthalene concentrations also exceeded the Tier 1 industrial guidelines. The chloride concentration in the 30-60 cm sample was also slightly above typical background concentrations.

The 60-100 cm sample exceeded the Tier 1 agricultural guideline for naphthalene. The naphthalene concentration also exceeded the Tier 1 industrial guideline.

All other parameters analyzed were below referenced guidelines or within regional / published soil data.

4.7 Earthen Ditch Along Surface Water Drainage Canal

Samples were collected from the earthen ditch drainage channel west of the surface water retention pond (19-7), near the southwest corner of the facilities area. Materials consisted of admixed topsoil and clay fill over till. Vapour readings did not exceed 65 ppm.

The samples from this location were submitted for the following analyses: salinity, metals, texture, hydrocarbons, PAHs, grain size, pesticides, and herbicides.

Chloride concentrations exceeded typical background concentrations in all samples analyzed, but the EC and SAR values were consistent with natural background values observed in the control samples. All other parameters analyzed from this location were below referenced guidelines or within regional / published soil data.

4.8 North of Cell 4

Samples were collected from the access road side slope north of Cell 4 (19-8). Borehole 19-8 was relocated from the 2014 sampling location adjacent to the drainage ditch north of Cell 3D after the ditch was decommissioned in 2018 as part of Cell 4 construction. Materials in this area consisted of fill. All vapour readings were 0 ppm

Samples from this location were submitted for any of the following analyses: salinity, metals, texture, hydrocarbons, PAHs, grain size, pesticides, and herbicides.

The surficial sample (0-15 cm) exceeded Tier 1 agricultural guidelines for molybdenum, zinc, naphthalene, and phenanthrene. The naphthalene and phenanthrene concentrations also exceeded the Tier 1 industrial guidelines.

The 15-30 cm sample exceeded Tier 1 agricultural guidelines for molybdenum, zinc, and naphthalene. The naphthalene concentration also exceeded the Tier 1 industrial guideline.

The 30-60 cm sample exceeded Tier 1 agricultural guidelines for molybdenum and zinc. The chloride concentration in the 30-60 cm sample was also greater than typical background concentrations.

All other parameters analyzed were below referenced guidelines or within regional/published soil data.

4.9 Leachate Holding Tank

Samples were obtained from an area north of Cell 3B in between Cells 1 and 4 (19-9) just north of the aboveground leachate holding tank area. Materials encountered included clay fill material placed during construction of Cell 4 over clay fill material remaining in place following remediation in 2018. Vapour readings did not exceed 85 ppm.

Samples submitted from this location were analyzed for any of the following parameters: salinity, total and elemental sulphur, metals, texture, CEC, TOC, nitrates, hydrocarbons, PAHs, grain size, PCBs, and solvents.

All analyzed parameters were below referenced guidelines or within regional / published soil data.

4.10 Northwest Corner of Cell 4

Samples were obtained from an area northwest of landfill Cell 4 (19-10) where an asphalt road travelling to Cell 1 was once located. Materials encountered included replaced topsoil over fill. All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for any of the following parameters: salinity, total and elemental sulphur, metals, texture, hydrocarbons, PAHs, grain size, PCBs, and solvents.

All analyzed parameters were below referenced guidelines or within regional/published soil data.

4.11 West of the Landfill Cell 3A

Samples were obtained from an area west (19-11) of the landfill cells. Materials encountered included topsoil overlying undisturbed Bnt, BC, and Cksa horizons. All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for any of the following parameters: salinity, total and elemental sulphur, metals, texture, hydrocarbons, PAHs, solvents, grain size, and PCBs.

One sample (30-60 cm) had a pH value of 5.8, slightly outside of the referenced guideline range of 6-8.5, and a selenium concentration of 1.1 mg/kg, slightly above the Alberta Tier 1 guideline value of 1 mg/kg. The reported pH value and selenium concentration are consistent with historical results for this sampling location and likely represent naturally occurring conditions. All other parameters analyzed were below referenced guidelines or within regional/published soil data.

4.12 South of the Landfill Cells

Samples were obtained from an area south (19-12) of the landfill cells. Materials encountered included clay fill over native till. All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for any of the following parameters: salinity, nitrates, elemental and total sulfur, metals, texture, hydrocarbons, PAHs, solvents, grain size, and PCBs.

The surface sample from borehole 19-12 consisted of fill material (till), and had an 'unsuitable' EC value of 8.11 dS/m, only slightly greater than the maximum topsoil control value of 7.38 dS/m, but consistent with natural background values for till at the facility (maximum subsoil EC value of 12.5 dS/m in off-site background control 19-2 45-60 cm). The observed EC value is consistent with naturally saline subsoils, and likely represents naturally occurring conditions.

All other samples submitted from this area were below referenced guidelines or within regional / published soil data for analyzed parameters.

4.13 Southwest of the Landfill Cells

Samples were obtained from an area west of groundwater monitoring well MW22A and southwest of Cell 3A (19-13) to investigate nitrate values in the soil in this area. Materials encountered included clay fill over undisturbed till. All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for salinity and nitrates.

All salinity values from this area were below referenced guidelines or within regional / published soil data for all samples analyzed. All nitrate concentrations were below laboratory detection limits.

4.14 Northwest Corner of Retention Pond

Samples were obtained from an area north of the water retention pond (19-14), along the east edge of the site. Materials encountered in this area included clay fill over undisturbed till (Cksa horizon). All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for salinity, metals, hydrocarbons, grain size, and PAHs.

The surface sample (0-15 cm) had an SAR value of 14.8, slightly greater than the maximum topsoil control value 14.7, but consistent with natural background values for till at the facility (maximum subsoil SAR value of 37.2 in off-site background control 14-1 25-35 cm). The observed SAR value is consistent with naturally sodic subsoils, and likely represents naturally occurring conditions.

All other parameters analyzed were below referenced guidelines or within regional/published soil data for all samples analyzed.

4.15 Between Access Road and Run-on Diversion Ditch

Samples were obtained from an area east of the landfill cells, and south of the new water retention pond (19-15). Materials encountered in this area included clay fill over till. All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for salinity, metals, PAHs, and grain size.

All parameters analyzed were below referenced guidelines or within regional / published soil data.

4.16 Northwest of Landfill Cell 2

Samples were obtained from an area northwest of the landfill cells (19-16). Materials encountered in this area included clay fill over undisturbed till (BCk and Cksa horizons) All vapour readings were 0 ppm.

Samples submitted from this location were analyzed for any of the following parameters: salinity, total and elemental sulphur, metals, texture, hydrocarbons, PAHs, solvents, grain size, PCBs, pesticides, and herbicides.

All analyzed parameters were below referenced guidelines or within regional/published soil data.

4.17 Quality Assurance / Quality Control Samples

To evaluate field sampling reproducibility, duplicate soil samples were collected during the 2019 sampling event. Eight samples were submitted for analysis (Table 11).

Laboratory testing reproducibility for each sample-duplicate pair was evaluated using the relative percentage difference (RPD) method, involving calculation of RPD when both sample-duplicate concentrations were greater than, or equal to, the laboratory method detection limit (MDL), as shown in Equation 1.

Equation 1

$$\%RPD = \left(\frac{\left| Sample - Duplicate \right|}{\overline{X}} \right) * 100$$

where:

Sample is the original sample concentration;
Duplicate is the duplicate sample concentration; and
$\overline{X}$ is the average concentration of a sample and its duplicate.

Due to the inherent heterogeneity of soil samples, duplicate soil results were considered as having passed the QA/QC reproducibility procedure if the RPD was less than or equal to 50%, indicating a close correlation between the sample-duplicate pair. In poor precision situations (e.g., RPD >50%), the results cannot be distinguished as to whether it is due to the non-homogenous nature of the samples or poor sampling method or laboratory technique. Therefore, RPD is usually used for flagging data for further review, rather than for taking corrective action.

RPD values were not calculated if one or both of the sample-duplicate concentrations were less than the MDL. In these cases, duplicate soil samples were still considered as having passed the QA/QC reproducibility procedure if the sample-duplicate concentration difference was less than five times the MDL value.

The RPD calculations are summarized in Table 11, which indicated all but ten parameters passed the QA/QC reproducibility procedure. In duplicate #5 (borehole 19-16 0-15 cm), four parameters (calcium, sulfate, pyrene, and carcinogenic PAHs [as B(a)P TPE]) failed the RPD test. In duplicate #6 (borehole 19-3 0-15 cm), eight parameters (EC, sodium, sulfate, beryllium, cadmium, lead, molybdenum, and zinc) failed the RPD test.

For salinity parameters, six duplicate pair samples were analyzed with only two samples failing the reproducibility procedure for one or more of EC, calcium, sodium, and sulphate. In each case, the duplicate sample concentration varied from 2-4x the concentration of the original sample. The original and duplicate concentrations are consistent with typical background concentrations, there are no guidelines for calcium, sodium, and sulphate in soil and the EC values were well below natural background values for this site, and since all other salinity values passed the QA/QC reproducibility procedure, having these four parameters fail the reproducibility procedure is not considered significant.

For metals parameters, three duplicate pairs were analyzed with only one sample failing the reproducibility procedure for five of 21 metal analysed (beryllium, cadmium, lead, molybdenum, and zinc). For cadmium, lead, and zinc, the original sample concentration was approximately 2x the duplicate sample concentration. For beryllium, the duplicate sample concentration was approximately 2x the original sample concentration. Since all values are consistent with typical background concentrations and well below referenced guideline values, having these parameters fail the reproducibility procedure in one of three samples is not considered significant.

For molybdenum, the original sample concentration was approximately 2x the duplicate sample concentration. Since the original sample concentration exceeded the Tier 1 agricultural guideline, having this parameter fail the reproducibility procedure could be considered significant. The source of the discrepancy is uncertain, however, since several samples collected in close proximity and at the same time (boreholes 19-3A, 19-3B, and 19-3D) also had molybdenum concentrations exceeding the Tier 1 agricultural guideline. Since no soil management decisions will be based on having this one parameter fail the reproducibility procedure, and molybdenum passed the reproducibility procedure in the other duplicate pairs analyzed, no further investigation is warranted.

For PAH parameters, two duplicate pairs were analyzed with only one sample failing the reproducibility procedure for pyrene and B(a)P TPE. For each parameter, the duplicate sample concentration was 2-4x the concentration of the original sample. The pyrene concentrations were at or slightly above the detection limit, while the B(a)P TPE concentrations more than five times the detection limit. Since all concentrations were well below the referenced guidelines, however, having these two parameters fail the reproducibility procedure is not considered significant.

5.0 DISCUSSION

Boreholes and sample depths with parameters exceeding referenced guidelines and/or typical background concentrations including regional / published soil data are shown on Figure 9.

Two background control samples (19-1 0-13 cm and 19-2 0-18 cm) and one investigation sample (19-11 30-60 cm) had pH values outside the referenced guideline range of 6-8.5. The background control samples were surficial samples and the observed pH values are comparable to the published soils data for the Camrose soil series (Table A), and are considered to be representative of natural background conditions for the area. The investigation sample (19-11 30-60 cm) had pH values of 5.8, only slightly below the referenced guideline. The sample represents undisturbed subsoil in the cultivated field west of Cell 3A and likely represents natural background conditions for the area. Tetra Tech feels that no further investigation or delineation is required at this time.

Topsoil EC values on site ranged from 0.45 dS/m to 7.81 dS/m, indicating ‘good’ to ‘poor’ quality topsoil. Background topsoil EC values range from 0.24 dS/m to 7.38 dS/m, indicating ‘good’ to ‘poor’ quality topsoil as natural background conditions. All topsoil samples were rated as ‘good’ to poor’, similar to natural background values.

One surface soil sample (19-12 0-15 cm) consisted of fill material (till) and had an EC value of 8.11 dS/m, consistent with natural background control values for subsoil till. No further investigation or delineation of topsoil/surface soil EC is required at this time.

Topsoil SAR values ranged from 0.7 to 15.2 indicating 'good' to 'unsuitable' quality topsoil, consistent with natural background topsoil SAR values (range 1.1 to 14.7). Eight surface samples (19-6, 19-8, 19-9, and 19-12 to 19-16), consisting of fill material (till), had 'poor' to 'unsuitable' SAR values of 8.2 to 18.2. These values are consistent with natural background control values for subsoil till, however, and no further investigation or delineation of topsoil/surface soil SAR is required at this time.

Subsoil EC and SAR values ranged from 'good' to 'unsuitable' subsoil quality, consistent with natural background control values and regional / published soil data. No further investigation or delineation of subsoil EC or SAR values is required at this time.

PAH concentrations exceeding referenced guidelines were noted in the surface and subsoil samples from the access road side slopes north of Cell 4 (19-6 and 19-8). Twelve other boreholes around the facility, including the on-site background controls (19-1 and 19-2), had samples analyzed for PAHs. The PAH concentrations in all of these samples were below or at laboratory detection limits for all PAH parameters analyzed, indicating that although there are PAHs above referenced guidelines on the Clean Harbors Ryley facility, they are restricted to the access road construction area north of Cell 4. In 2018, during construction of Cell 4, PAH impacted material in the access road areas around boreholes 19-6 and 19-8 was removed but follow up confirmatory sampling was not completed due to safety concerns amid ongoing Cell 4 construction activities. Based on the 2019 SMP results, it is likely that not all of the PAH impacted material was removed and additional assessment and/or delineation is warranted.

Metal concentrations above referenced guidelines and typical background concentrations were identified in three locations (19-3, 19-6, and 19-8). The metal concentrations above referenced guidelines in boreholes 19-6 and 19-8 north of Cell 4 are at the same sample depths as the PAH guideline exceedences discussed above and may be related to site activities. In both locations, vertical delineation of the metal exceedences was achieved with the 60-100 cm depth samples. Additional assessment and/or horizontal delineation in conjunction with the PAHs is warranted however.

Metal concentrations above referenced guidelines in the gravelled area west of the process building (19-3) had previously been identified. Four delineation boreholes (19-3A to 19-3D) indicated multiple metals exceedences to the north, east, and west of borehole 19-3. In all gravelled area sample locations, the exceedences were limited to the surface 0-15 cm depth samples except borehole 19-3B. The borehole 19-3B 15-30 cm sample exceeded for molybdenum only, and the underlying 30-60 cm depth sample was below referenced guidelines and typical background concentrations for all metal parameters analyzed. Vertical delineation of the 2014 metal exceedances has been achieved and the analytical results indicate that the majority of the surface materials within the graveled area likely exceed referenced guidelines for one or more metal parameters. Additional monitoring and management activities are warranted.

The 2014 SMP identified that a selenium concentration greater than referenced guidelines in borehole 14-11 (20-30 cm) likely represented naturally occurring concentrations. One sample analyzed from the 2019 borehole 19-11 (30-60 cm) had a selenium concentration of 1.1 mg/kg, similar to the 2014 concentration of 1.3 mg/kg. All other metal parameters analyzed in samples from borehole 19-11 (located in the same area as the 2014 borehole) were below referenced guidelines, supporting the 2014 conclusions. Tetra Tech feels that no further investigation or delineation is required at this time.

Hot water soluble (HWS) boron slightly exceeded the HWS boron guideline of 2 mg/kg in borehole 14-11 (20-30 cm) and 14-15 (15-30 cm) in 2014, and the observed concentrations were interpreted to be naturally occurring. All saturated paste extract boron concentrations in samples analyzed from the 2019 boreholes 19-11 and 19-15 ranged from below detection limit to 0.13 mg/L, well below the saturated paste boron guideline of 3.3 mg/L, supporting the previous interpretation that the observed boron concentrations are naturally occurring.

During the 2014 soil monitoring event, chloride, metal, and PAH concentrations above referenced guidelines and typical background concentrations were identified in borehole 14-4, west of the facilities area. Remediation of this area was completed in 2018 in conjunction with construction of a run-off control ditch during construction of Cell 4. Confirmatory sampling of the remediation excavation indicated that all PAH and metals parameters analyzed were below the 2019 Alberta Tier 1 guidelines. Confirmatory sampling results indicated EC and chloride concentrations greater than typical background control concentrations, however, and delineation boreholes 19-4A to 19-4E were advanced north and south along the drainage ditch away from 19-4 to evaluate the extent of the elevated EC and chloride concentrations and to determine whether or not the 2014 and 2018 concentrations may be naturally occurring.

The elevated chlorides associated with sample point 14-4 were found in the 0-8 cm and 15-30 cm samples, from replaced topsoil and fill materials. The 2018 confirmatory samples were collected from fill and/or till material after remediation was completed but before final contouring of the ditch and topsoil replacement was completed. Chloride concentrations in sample 19-4 and delineation samples 19-4A to 19-4E ranged from 34 mg/kg to 269 mg/kg. Concentrations greater than typical background concentrations were identified in five of the six boreholes located in the drainage ditch. The 2019 chloride concentrations were comparable to the 2014 and 2018 chloride concentrations. All EC and SAR concentrations were consistent with natural background control values and regional / published soil data for all drainage ditch samples analyzed.

Chloride concentrations in samples analyzed from boreholes 19-6 (30-60 cm), 19-7 (all depths), and 19-8 (30-60 cm) also exceeded typical background concentrations. Similar to samples from the 19-4 and 19-4A to 19-4E delineation samples, all EC and SAR concentrations were consistent with natural background control values and regional / published soil data. The chloride concentrations in boreholes 19-6 and 19-8 were only slightly above typical background concentrations, and all other samples from these two boreholes were below typical background values. Tetra Tech feels that no further investigation or delineation of chlorides in the area north of Cell 4 is required at this time.

The chloride concentrations in the drainage ditch boreholes adjacent to the facilities area (19-4, 19-4A to 19-4E, and 19-7) appear to be consistently greater than typical background conditions, but EC and SAR concentrations in these boreholes are consistent with natural background control values and regional / published soil data for all drainage ditch samples analyzed. Chloride concentrations above typical background concentrations were also identified in the nearby on-site background control 09-2, which was consistent with a groundwater discharge location in a landscape having naturally saline parent materials. Since all EC and SAR concentrations in these boreholes are consistent with natural background control values and regional / published soil data, Tetra Tech feels that no further investigation or delineation is required at this time, but further monitoring and delineation should be completed during the next soil monitoring event.

6.0 CONCLUSIONS

Three samples had pH values outside the referenced guideline range of 6-8.5, including two background control samples. The observed exceedances were in undisturbed or control areas and either consistent with published soils data for the Camrose soil series (Table A) or only slightly below the referenced guideline range and are considered to be representative of natural background conditions for the area. No further investigation or delineation is required at this time.

Topsoil EC values on site indicate ‘good’ to ‘poor’ quality topsoil, consistent with natural background conditions. No further investigation or delineation of topsoil / surface soil EC is required at this time.

Topsoil SAR values on site indicate ‘good’ to ‘unsuitable’ quality topsoil, consistent with natural background conditions. Eight surface samples, consisting of fill material (till), had ‘poor’ to ‘unsuitable’ SAR values of 8.2 to 18.2, consistent with natural background control values for subsoil till. No further investigation or delineation of topsoil/surface soil SAR is required at this time.

Subsoil EC and SAR values ranged from ‘good’ to ‘unsuitable’ subsoil quality, consistent with typical background control values and regional / published soil data. No further investigation or delineation of subsoil EC or SAR values is required at this time.

PAH concentrations (naphthalene and phenanthrene) exceeding referenced guidelines were noted in the surface and subsoil samples from the access road side slopes north of Cell 4 (19-6 and 19-8). PAH concentrations in twelve other boreholes around the facility were below or at laboratory detection limits for all PAH parameters analyzed, indicating that although there are PAH’s above referenced guidelines on the Clean Harbors Ryley facility, they are restricted to the access road construction area north of Cell 4. In 2018, during construction of Cell 4, PAH impacted material in the access road areas around boreholes 19-6 and 19-8 was removed but follow up confirmatory sampling was not completed due to safety concerns amid ongoing Cell 4 construction activities. Based on the 2019 SMP results, it is likely that not all of the PAH impacted material was removed and additional assessment and/or delineation is warranted.

Metal concentrations above referenced guidelines were also identified in boreholes 19-6 (cadmium, lead, molybdenum, nickel, and zinc) and 19-8 (molybdenum and zinc) north of Cell 4 at similar sample depths as the PAH guideline exceedences discussed above and may be related to site activities. In both locations, vertical delineation of the metal exceedences was achieved with the 60-100 cm depth samples. Additional assessment and/or delineation of metals in conjunction with the PAHs is warranted.

Chloride concentrations in the 30-60 cm samples analyzed from boreholes 19-6 and 19-8 also exceeded typical background chloride concentrations. All EC and SAR concentrations were consistent with natural background control values and regional / published soil data, the chloride concentrations were only slightly above typical background concentrations, and chloride concentrations in all other samples from these two boreholes were below typical background values. Tetra Tech feels that further investigation or delineation of chlorides in the area north of Cell 4 is not required.

Metal concentrations (cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, tin, vanadium, and zinc) above referenced guidelines were identified in one or more samples from the gravelled area west of the process building (borehole 19-3 and delineation boreholes 19-3A, 19-3B, and 19-3D). The exceedences are restricted to the surface samples only, and additional monitoring and management activities are warranted.

One minor selenium exceedance (1.1 mg/kg) in borehole 19-11 (30-60 cm) was consistent with historical concentrations (14-11 15-30 cm). All other selenium concentrations in borehole 19-11 were below referenced guidelines, supporting previous conclusions that the observed selenium concentrations likely represent naturally occurring conditions. No further investigation is required at this time.

Delineation boreholes 19-4A to 19-4E were advanced in the drainage ditch west of the facilities area around borehole 19-4 to evaluate elevated chloride concentrations reported in 2014 and 2018. Chloride concentrations in borehole 19-4 and delineation borehole 19-4A to 19-4E samples ranged from 34 mg/kg to 269 mg/kg and were comparable to the 2014 and 2018 chloride concentrations.

Borehole 19-7 was located in an earthen ditch west of the surface water retention pond, adjacent to the southwest corner of the facilities area. Chloride concentrations in borehole 19-7 ranged from 116 mg/kg to 329 mg/kg and were comparable to the 19-4 and 19-4A to 19-4E chloride concentrations.

All EC and SAR concentrations in borehole 19-4, 19-4A to 19-4E, and 19-7 samples analyzed were consistent with natural background control values and regional / published soil data, and Tetra Tech feels that no further investigation or delineation is required at this time, but further monitoring and delineation of chlorides should be completed during the next soil monitoring event.

All other samples analyzed had concentrations below referenced guidelines or within regional / published soil data and typical background concentrations for all parameters analyzed, including sulphur, CEC, TOC, nitrates, hydrocarbons, solvents, PCBs, pesticides, and herbicides.

7.0 LIMITATIONS OF LIABILITY

Conclusions presented herein are based on an authorized technical review and environmental investigation as described in Section 1.1. This report has been prepared for the use of Clean Harbors and their approved agents for the specific application described above. It has been prepared in accordance with generally accepted environmental engineering practices. No other warranty is made, either expressed or implied.

For further limitation, reference should be made to Tetra Tech’s Limitations on the Use of this Document in Appendix A

8.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.

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Prepared by:
Caroline Schiller
Junior Environmental Technologist
Environment & Water Practice
Direct Line: 587.460.3537
Caroline.Schiller@tetratech.com

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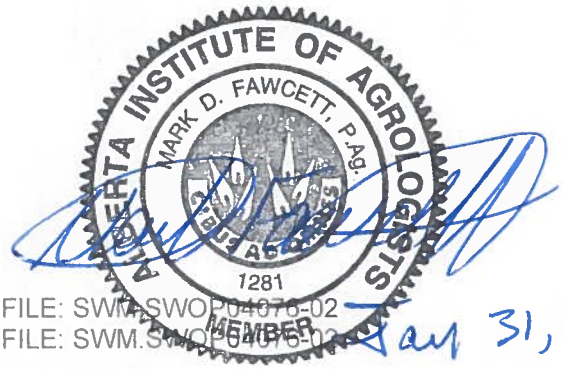
Reviewed by:
Brent Finnestad, B.Sc., A.I.T.
Project Manager
Environment & Water Practice
Direct Line: 587.460.3507
Brent.Finnestad@tetratech.com



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Jan 31, 2020

Reviewed by:
Mark D. Fawcett, P.Ag.
Senior Soil Scientist
Environment & Water Practice
Direct Line: 587.460.3505
Mark.Fawcett@tetratech.com

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TABLES

Table 1: 2019 Summary of Areas at Risk of Potential Impact

General Use Area[1]	Description of Activities for Each Area at Ryley Facility
Areas of Known Contamination	The landfill area contains multiple liners and a leachate collection system. During the 2014 Soil Monitoring event, guideline exceedences for chlorides, PAHs, PHC fraction F3, and metals were identified at boreholes 14-3, 14-4, 14-5, 14-6, 14-8, 14-9, 14-10, 14-10A, 14-11, and 14-15. Following remediation around boreholes 14-4, 14-6, 14-8, 14-10, and 14-10A in 2018 and a comparison of the 2014 analytical results to the 2019 Alberta Tier 1 guidelines, historical areas with guideline exceedences for chlorides and metals included boreholes 14-3, 14-4, 14-11, and 14-15 only. Materials with PAH, PHC fraction F3, and metals guideline exceedences in the vicinity of boreholes 14-4, 14-6, 14-9, 14-10, and 14-10A were excavated and landfilled in 2018 prior to construction of Cell 4.
Areas of known releases of contaminants	There have been no releases of contaminants outside of areas protected by engineered controls such as impermeable surfaces or liners. The detected concentrations of PAHs, PHCs and most metals were considered likely to be associated with dust from landfill cells or waste tracking from vehicles that entered landfill cells, a likely effect of the landfill operation up to 2012. In 2012, Clean Harbors implemented improved dust management strategies, and eliminated vehicle contact with waste through the construction of a tipping pad, substantially reducing the potential for airborne and contact source introduction of PAHs.
Areas of product, raw material, treatment chemical, catalyst, or waste storage	Product or chemical storage areas are paved or inside buildings. Landfill area (waste storage) has multiple liners and leachate collection system. Note that there is one above ground diesel tank within the lined landfill area.
Process areas	Most of the buildings area is paved except for two small grassed areas and one small gravel area. The landfill area has multiple liners and leachate collection system.
Chemical loading and unloading facilities, including loading docks	Loading and unloading areas in building area are paved. The landfill area has multiple liners and leachate collection system.
Storage areas for new and out of service equipment that may be a source of soil contamination (e.g., transformers, vehicles, compressors, etc.)	Storage area for equipment is paved.
Machinery servicing and maintenance areas	Machinery servicing and maintenance areas are paved.
Barrel storage areas	Barrel storage areas are paved.
Equipment (e.g., barrels, tanks, filters, vehicles, etc.) washing areas	Washing areas are inside a building and water is collected with landfill leachate which is disposed off site by deep well injection.
Unlined drainage ditches	Stormwater drainage off the building/paved area is an earthen ditch.
Any other areas where conditions or activities occur that area deemed to be a potential source of contamination	Grassed areas or gravelled areas in the building facilities area and by historical receiving station that may receive some drainage from these areas. Sediment pond that receives storm water drainage off the building area.

Notes:

[1] List derived from: Government of Alberta. May 2009. Soil Monitoring Directive. ISBN: 978-0-7785-8121-5 (On-line Edition).

Table 2: 2019 Borehole Locations and Analysis

Soil Sample Location	Description (Plant Use)	Facility Substances of Concern	Laboratory Analytical
14-1	North of the facility buildings area.	Off-site background control / baseline sample.	Boron (saturated paste).
14-2	South of the run-on diversion ditch near the south boundary fence	On-site background control / baseline sample.	Boron (saturated paste).
19-1	North of the facility buildings area.	Off-site background control / baseline sample.	Salinity (pH, EC, SAR, Cl), metals, cation exchange capacity, organic carbon content, texture, grain size, total sulfur, nitrates, and polycyclic aromatic hydrocarbons (PAHs).
19-2	North of Cell 2.	Off-site background control / baseline sample.	Salinity (pH, EC, SAR, Cl), metals, cation exchange capacity, organic carbon content, texture, grain size, total sulfur, nitrates, and PAHs.
19-3 (14-3) (09-3) (96-1)	Gravel area west of process building.	Fuel, lube oil, small quantities of laboratory chemicals.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, texture, grain size, nitrates, PAHs, PCBs, herbicides, and pesticides.
19-3A	Gravel area west of process building.	Delineation of 2014 metals guideline exceedences.	Metals.
19-3B	Gravel area west of process building.	Delineation of 2014 metals guideline exceedences.	Metals.
19-3C	Gravel area west of process building.	Delineation of 2014 metals guideline exceedences.	Metals.
19-3D	Gravel area west of process building.	Delineation of 2014 metals guideline exceedences.	Metals.
19-4 (14-4) (09-4) (96-2)	West of the facilities area.	Fuel, lube oil, small quantities of laboratory chemicals, landfill dust.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, PCBs, elemental and total sulfur.
19-4A	West of the facilities area	Delinieation of 2018 EC and Chloride exceedances.	Salinity (pH, EC, SAR, Cl).
19-4B	West of the facilities area	Delinieation of 2018 EC and Chloride exceedances.	Salinity (pH, EC, SAR, Cl).
19-4C	West of the facilities area	Delinieation of 2018 EC and Chloride exceedances.	Salinity (pH, EC, SAR, Cl).
19-4D	West of the facilities area	Delinieation of 2018 EC and Chloride exceedances.	Salinity (pH, EC, SAR, Cl).
19-4E	West of the facilities area	Delinieation of 2018 EC and Chloride exceedances.	Salinity (pH, EC, SAR, Cl).
19-5 (14-5) (09-5)	North of run-on diversion ditch, as close to end of original ditch as possible.	Fuel, lube oil, small quantities of laboratory chemicals, residual pesticides related to former pesticide storage located in Cell 2, landfill dust.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, herbicides and pesticides.
19-6 (14-6) (09-6) (01-1)	north of Cell 4 (relocated from decommissioned old surface water retention pond)	Fuel, lube oil, small quantities of laboratory chemicals, residual pesticides from decommissioned retention pond area, landfill dust.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, herbicides and pesticides.
19-7 (14-7) (09-7) (01-2)	Earthen ditch along the surface water retention pond drainage channel.	Fuel, lube oil, landfill dust, small quantities of laboratory chemicals.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, herbicides and pesticides.

Table 2: 2019 Borehole Locations and Analysis

Soil Sample Location	Description (Plant Use)	Facility Substances of Concern	Laboratory Analytical
19-8 (14-8) (09-8) (01-3)	north of Cell 4 (relocated from drainage ditch north of Cell 3D)	Fuel, lube oil, small quantities of laboratory chemicals, residual pesticides from decommissioned retention pond area, landfill dust.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, herbicides and pesticides.
14-9 (09-9)	Leachate holding tank area (between Cells 1, 3B, 3C, and 4).	Leachate from various landfill waste.	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, PCBs, solvents, elemental and total sulfur.
19-10 (14-10) (09-10)	Northwest corner of Cell 4.	Various landfill wastes (hydrocarbons, metals, catalysts, sulphur, and salt).	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, PCBs, elemental and total sulfur, and solvents.
19-11 (14-11) (09-11)	West of the landfill Cell 3A.	Various landfill wastes (hydrocarbons, metals, catalysts, sulphur, and salt).	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, PCBs, elemental and total sulfur, and solvents.
19-12 (14-12) (09-12)	South of the landfill cells.	Various landfill wastes (hydrocarbons, metals, catalysts, sulphur, nitrates, and salt).	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, texture, PAHs, PCBs, elemental and total sulfur, nitrates, and solvents.
19-13 (14-13) (09-13)	Southwest of the landfill cells.	Determine nitrates concentrations in soil near groundwater well with elevated nitrate concentrations in groundwater (salts and nitrates).	Salinity (pH, EC, SAR, Cl), metals, BTEX and PHCs, grain size, and PAHs.
19-14 (14-14)	Northwest corner of retention pond beside Cell 3E.	Various landfill wastes and dust (hydrocarbons, metals, and salt).	Salinity (pH, EC, SAR, Cl), metals, cation exchange capacity, total organic carbon, and nitrates.
19-15 (14-15)	Between the access road and run-on diversion ditch and south edge of retention pond.	Various landfill wastes and dust (hydrocarbons, metals, and salt).	Salinity (pH, EC, SAR, Cl), grain size, metals, and PAHs.
19-16 (14-16)	Northwest of landfill Cell 2.	Various landfill wastes.	Salinity (pH, EC, SAR, Cl), grain size, texture, metals, total and elemental sulfur, solvents, BTEX and PHCs, PAHs, PCBs, herbicides and pesticides.

Table 3: Laboratory Analysis Completed in 2019

Sampling Location	Facility Location	Sampling Depths (cm)	Laboratory Analysis															
			Salinity (pH, EC, SAR, Cl)	Boron (saturated paste)	Grain Size (75 µm sieve)	Texture (PSA)	Metals (Alberta Tier 1)	Total Sulfur	Elemental Sulfur	Cation Exchange Capacity	Total Oragnic Carbon	Solvents	Hydrocarbons (BTEX and PHC F1 to F4)	PAHs	PCBs	Nitrates	Herbicides	Pesticides
14-1	north of facility (off-site background control)	0-15		1														
		15-30		1														
		30-60		1														
		60-100		1														
14-2	south of the run-on diversion ditch near the south boundary fence (on-site background)	0-15		1														
		15-30		1														
		30-60		1														
		60-100		1														
19-1	north of facility (off-site background control)	0-13	1		1	1	1	1		1	1			1		1		
		15-30	1		1	1	1	1		1	1					1		
		45-60	1		1	1	1	1		1	1					1		
		60-100	1		1	1	1	1		1	1					1		
19-2	north of facility (off-site background control)	0-18	1		1	1	1	1		1	1			1		1		
		18-30	1		1	1	1	1		1	1					1		
		45-60	1		1	1	1	1		1	1					1		
		80-100	1		1	1	1	1		1	1					1		
19-3	gravel area west of process building	0-15	1		1	1	1						1	1	1	1	1	1
		15-30			1		1							1				
		30-60			1		1						1					
		60-100	1															
19-3A	gravel area west of process building, west of 17-3	0-15					1											
		15-30					1											
		35-60																
		60-100																
19-3B	gravel area west of process building, north of 17-3	0-15					1											
		15-30					1											
		35-60					1											
		60-100					1											
19-3C	gravel area west of process building, east of 17-3	0-15					1											
		15-30					1											
		35-60																
		60-100																

Table 3: Laboratory Analysis Completed in 2019

Sampling Location	Facility Location	Sampling Depths (cm)	Laboratory Analysis															
			Salinity (pH, EC, SAR, Cl)	Boron (saturated paste)	Grain Size (75 µm sieve)	Texture (PSA)	Metals (Alberta Tier 1)	Total Sulfur	Elemental Sulfur	Cation Exchange Capacity	Total Oragnic Carbon	Solvents	Hydrocarbons (BTEX and PHC F1 to F4)	PAHs	PCBs	Nitrates	Herbicides	Pesticides
19-3D	gravel area west of process building, south of 17-3	0-15					1											
		15-30					1											
		35-60																
		60-100																
19-4	west of the facilities area	0-15	1		1	1	1	1	1				1	1	1			
		15-30	1				1											
		30-60	1		1								1					
		60-100	1															
19-4A	west of the facilities area	0-15	1															
		15-30	1															
		30-60	1															
		60-100	1															
19-4B	west of the facilities area	0-15	1															
		15-30																
		30-60	1															
		60-100																
19-4C	west of the facilities area	0-15	1															
		15-30	1															
		30-60	1															
		60-100	1															
19-4D	west of the facilities area	0-15	1															
		15-30	1															
		30-60	1															
		60-100	1															
19-4E	west of the facilities area	0-15	1															
		15-30	1															
		30-60	1															
		60-100	1															
19-5	north of the surface water drainage ditch	0-15	1		1	1	1						1	1			1	1
		15-30																
		30-60	1															
		60-100																

Table 3: Laboratory Analysis Completed in 2019

Sampling Location	Facility Location	Sampling Depths (cm)	Laboratory Analysis															
			Salinity (pH, EC, SAR, Cl)	Boron (saturated paste)	Grain Size (75 µm sieve)	Texture (PSA)	Metals (Alberta Tier 1)	Total Sulfur	Elemental Sulfur	Cation Exchange Capacity	Total Oragnic Carbon	Solvents	Hydrocarbons (BTEX and PHC F1 to F4)	PAHs	PCBs	Nitrates	Herbicides	Pesticides
19-6	north of Cell 4 (relocated from decommissioned surface water retention pond)	0-15	1		1	1	1						1	1			1	1
		15-30	1				1							1				
		30-60	1				1							1				
		60-100	1				1							1				
19-7	earthen ditch along the surface water retention pond drainage canal	0-15	1		1	1	1						1	1			1	1
		15-30	1															
		30-60	1															
		60-100	1															
19-8	north of Cell 4 (relocated from drainage ditch north of Cell 3D)	0-15	1		1	1	1						1	1			1	1
		15-30	1		1		1							1				
		30-60	1				1							1				
		60-100	1				1							1				
19-9	leachate holding tank area	0-15	1		1	1	1	1	1	1	1	1	1	1	1	1		
		15-30																
		30-60	1															
		60-100																
19-10	northwest corner of proposed Cell 4	0-15	1		1	1	1	1	1			1	1	1	1			
		15-30												1				
		30-60	1															
		60-100																
19-11	west of landfill Cell 3A	0-15	1		1	1	1	1	1			1	1	1	1			
		15-30					1											
		30-60	1				1											
		60-100					1											
19-12	south of the landfill cells	0-15	1				1	1	1			1	1	1	1	1		
		15-30																
		30-60	1													1		
		60-100																
19-13	southwest of the landfill cells	0-15	1													1		
		15-30	1													1		
		30-60	1													1		
		60-100	1													1		

Table 3: Laboratory Analysis Completed in 2019

Sampling Location	Facility Location	Sampling Depths (cm)	Laboratory Analysis															
			Salinity (pH, EC, SAR, Cl)	Boron (saturated paste)	Grain Size (75 µm sieve)	Texture (PSA)	Metals (Alberta Tier 1)	Total Sulfur	Elemental Sulfur	Cation Exchange Capacity	Total Oragnic Carbon	Solvents	Hydrocarbons (BTEX and PHC F1 to F4)	PAHs	PCBs	Nitrates	Herbicides	Pesticides
19-14	northwest corner of retention pond beside Cell 3E	0-15	1		1		1						1	1				
		15-30	1															
		30-60	1				1											
		60-100	1															
19-15	between the access road and run-on diversion ditch south of retention pond	0-15	1		1		1							1				
		15-30	1				1											
		30-60					1											
		60-100	1															
19-16	northwest of landfill Cell 2	0-15	1		1	1	1	1	1			1	1	1	1			
		15-30																
		30-60	1															
		60-100															1	1
Duplicate 1			1		1		1							1				
Duplicate 2				1														
Duplicate 3				1														
Duplicate 4			1															
Duplicate 5			1		1	1	1	1	1			1	1	1	1			
Duplicate 6			1				1					1	1			1	1	1
Duplicate 7			1															
Duplicate 8			1															

Table 4: 2019 Soil Analytical Results: Salinity, Metals, and Other Parameters

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	14-1				14-2				19-1				19-2			
				0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-13	15-30	45-60	60-100	0-18	18-30	45-60	80-100
				09/24/19	09/24/19	09/24/19	09/24/19	09/25/19	09/25/19	09/25/19	09/25/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19
Material Type				Disturbed topsoil	Bntk	BCk	Cksa	Ah	Bnt	Csa1	Csa1	Ah	Bnt	Cksa1	Cksa2	Ah	Btnj	Cksa1	Ck
Field Texture				Clay Loam	Clay to Clay Loam	Clay	Clay	Clay Loam	Clay Loam	Clay	Clay	Loam	Clay	Clay Loam to Clay	Clay	Clay Loam	Clay	Sandy Clay Loam	Clay to Sandy Loam
Salinity																			
pH	pH Units	6-8.5	6-8.5	-	-	-	-	-	-	-	-	**4.6**	6.9	8.1	8.5	**5**	6.6	7.7	7.8
Electrical Conductivity (EC)	dS/m	NG	NG	-	-	-	-	-	-	-	-	0.31	2.73	11.1	9.77	0.75	3.11	12.5	8.29
Sodium Absorption Ratio (SAR)	N/A	NG	NG	-	-	-	-	-	-	-	-	5.1	28	22.9	20.7	9.4	27	27.9	19.5
Percent Saturation	%	NG	NG	68	62	60	107	69	74	56	56	85	126	71	95	64	74	54	78
Calcium	mg/kg	NG	NG	-	-	-	-	-	-	-	-	6	21	361	450	8.7	21	275	369
Magnesium	mg/kg	NG	NG	-	-	-	-	-	-	-	-	2.4	24	279	289	3	16	172	126
Sodium	mg/kg	NG	NG	-	-	-	-	-	-	-	-	54	883	2010	2230	101	582	1770	1510
Potassium	mg/kg	NG	NG	-	-	-	-	-	-	-	-	14	<13	13	16	1	<7	10	11
Chloride	mg/kg	NG	NG	-	-	-	-	-	-	-	-	12	37	27	10	6	14	14	4
Sulphate	mg/kg	NG	NG	-	-	-	-	-	-	-	-	56.4	1500	5910	6530	187	1140	4870	4330
Moisture	%	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other																			
Cation Exchange Capacity (CEC)	meq/100g	NG	NG	-	-	-	-	-	-	-	-	29.1	27	18	18	25	21	16	14
Nitrate (as NO3-N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate and Nitrite (as N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	<4	<6	<4	<5	<3	<4	5	<4
Sulphur (Total)	%	NG	NG	-	-	-	-	-	-	-	-	0.07	0.08	1.52	0.33	0.08	0.03	0.38	0.16
Sulphur (Elemental)	mg/kg	500	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon (TOC)	%			-	-	-	-	-	-	-	-	6.03	1.55	0.27	0.3	3.87	1.13	0.22	0.34
Metals																			
Antimony	mg/kg	20	40	-	-	-	-	-	-	-	-	<0.2	0.4	0.4	0.4	<0.2	0.2	0.4	0.4
Arsenic	mg/kg	17	26	-	-	-	-	-	-	-	-	4	6.2	5.8	5.6	4.2	5.8	6.1	4.8
Barium	mg/kg	750	2000	-	-	-	-	-	-	-	-	65	199	83	152	101	102	82	105
Beryllium	mg/kg	5	8	-	-	-	-	-	-	-	-	0.3	0.7	0.5	0.5	0.3	0.5	0.4	0.4
Boron (saturated paste)	mg/L	3.3	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.11	<0.5	<0.5	<0.5	0.14	<0.5	<0.5	<0.5
Cadmium	mg/kg	1.4	22	-	-	-	-	-	-	-	-	0.18	0.16	0.13	0.17	0.24	0.08	0.16	0.18
Chromium	mg/kg	64	87	-	-	-	-	-	-	-	-	9	19	15.4	15.6	10.4	19.7	15.4	15.8
Chromium (hexavalent)	mg/kg	0.4	1.4	-	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cobalt	mg/kg	20	300	-	-	-	-	-	-	-	-	3.5	8.8	7.2	7.2	5.9	8.1	6.7	6
Copper	mg/kg	63	91	-	-	-	-	-	-	-	-	11.6	15.3	14.5	13.7	9.3	10.1	13.6	11.7
Lead	mg/kg	70	600	-	-	-	-	-	-	-	-	7.3	7.2	6.8	7.1	8.1	6.6	5.7	5.7
Mercury	mg/kg	6.6	50	-	-	-	-	-	-	-	-	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	0.06	<0.05
Molybdenum	mg/kg	4	40	-	-	-	-	-	-	-	-	1.8	<1	<1	<1	<1	<1	<1	<1
Nickel	mg/kg	45	89	-	-	-	-	-	-	-	-	7.4	18.9	27.6	20.9	9.8	16.8	27.1	19.8
Selenium	mg/kg	1	2.9	-	-	-	-	-	-	-	-	<0.3	0.5	0.3	<0.3	0.5	1	<0.3	<0.3
Silver	mg/kg	20	40	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Thallium	mg/kg	1	1	-	-	-	-	-	-	-	-	0.09	0.15	0.17	0.14	0.1	0.14	0.14	0.12
Tin	mg/kg	5	300	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1
Uranium	mg/kg	23	300	-	-	-	-	-	-	-	-	0.7	2.3	1.1	1.3	1	1.4	0.7	0.9
Vanadium	mg/kg	130	130	-	-	-	-	-	-	-	-	23.5	28.5	20.7	20.2	22.6	27.7	22.5	19.3
Zinc	mg/kg	250	410	-	-	-	-	-	-	-	-	63	53	42	45	60	50	40	38
Soil Texture																			
Sand	%	NG	NG	-	-	-	-	-	-	-	-	45	38	47	42	44	39	58	47
Silt	%	NG	NG	-	-	-	-	-	-	-	-	49	22	27	30	42	31	17	27
Clay	%	NG	NG	-	-	-	-	-	-	-	-	6	40	26	28	14	30	25	26
Texture	N/A	NG	NG	-	-	-	-	-	-	-	-	Sandy Loam	Clay	Sandy Clay Loam	Clay Loam	Loam	Clay Loam	Sandy Clay Loam	Sandy Clay Loam
Laboratory Identification Number				1379359-1	1379359-2	1379359-3	1379359-4	1379633-1	1379633-2	1379633-3	1379633-4	1378374-1	1378374-2	1378374-3	1378374-4	1378374-5	1378374-6	1378374-8	1378374-10

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 fine textured soils under Agricultural and Industrial land use.

[2] AENV. 2001. Salt Contamination Assessment and Remediation Guidelines. Pub. No.: T/606. ISBN: 0-7785-1718-7 (On-Line Edition).

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

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"-" Not analyzed

N/A - Not Applicable

Parameters [2]	Rating Categories				Maximum Background
	Good	Fair	Poor	Unsuitable	
Topsoil					
EC (dS/m)	<2	2 to 4	4 to 8	>8	7.38
SAR	<4	4 to 8	8 to 12	>12	14.7
Subsoil					
EC (dS/m)	<3	3 to 5	5 to 10	>10	12.5
SAR	<4	4 to 8	8 to 12	>12	37.2

Table 4: 2019 Soil Analytical Results: Salinity, Metals, and Other Parameters

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-3				19-4				19-5		19-6				19-7			
				0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-15	30-60	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100
				10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19
Material Type				Replaced Topsoil	Fill	Till	Till	Replaced Topsoil	Fill	Fill	Till	Replaced Topsoil	Till	Fill	Fill	Fill	Fill	Admixed Topsoil and Fill	Fill	Fill	Till (Cksa)
Field Texture				Clay Loam	Clay	Clay	Clay	Loam	Clay	Clay	Clay	Clay Loam	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
Salinity																					
pH	pH Units	6-8.5	6-8.5	7.2	-	-	7.8	6.9	6.5	7.4	7.8	7.6	7.8	7.7	7.6	7.9	7.7	7.8	7.1	7.6	7.5
Electrical Conductivity (EC)	dS/m	NG	NG	0.64	-	-	2.27	5.7	5.43	4.72	6.05	1.2	7.92	2.58	1.86	1.83	2.58	2.26	1.43	1.8	7.01
Sodium Absorption Ratio (SAR)	N/A	NG	NG	4.1	-	-	23	9	11.8	8.7	10.8	8	19.1	8.2	8.2	7.6	14	6.5	4.7	6.3	13.1
Percent Saturation	%	NG	NG	63	64	64	74	61	61	62	55	76	110	70	70	58	66	56	45	71	98
Calcium	mg/kg	NG	NG	19.4	-	-	16	338	214	273	277	31.9	499	105	53.6	46.8	46	78.9	41.7	69.1	449
Magnesium	mg/kg	NG	NG	5.1	-	-	8.2	118	90.2	86.8	114	10	180	37	19.8	17.1	19	14	7.8	18.2	222
Sodium	mg/kg	NG	NG	62	-	-	392	591	636	509	632	177	2060	322	230	184	353	178	84	192	1350
Potassium	mg/kg	NG	NG	4	-	-	<7	<6	<6	9	9	3	<11	9	12	6	<7	<6	<1	3	14
Chloride	mg/kg	NG	NG	24	-	-	74	259	269	57	67	18	57	57	99	118	39	329	116	133	118
Sulphate	mg/kg	NG	NG	52.3	-	-	669	1810	1650	1900	2240	290	5940	703	358	334	743	130	87.1	378	4440
Moisture	%	NG	NG	14.4	-	14.4	-	14.2	-	15.1	-	26	-	21.8	-	-	-	16.9	-	-	-
Other																					
Cation Exchange Capacity (CEC)	meq/100g	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as NO3-N)	mg/kg	NG	NG	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate and Nitrite (as N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur (Total)	%	NG	NG	-	-	-	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur (Elemental)	mg/kg	500	500	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon (TOC)	%			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																					
Antimony	mg/kg	20	40	0.8	0.5	0.3	-	0.3	0.2	-	-	0.4	-	1.3	0.9	1.2	0.7	0.4	-	-	-
Arsenic	mg/kg	17	26	5.9	5.6	6.2	-	5.2	5.2	-	-	6.6	-	7.7	7.1	7.2	7.1	6.2	-	-	-
Barium	mg/kg	750	2000	138	273	199	-	143	147	-	-	174	-	189	187	176	202	131	-	-	-
Beryllium	mg/kg	5	8	0.3	0.4	0.6	-	0.5	0.4	-	-	0.5	-	0.5	0.4	0.5	0.5	0.5	-	-	-
Boron (saturated paste)	mg/L	3.3	5	0.17	0.2	<0.5	-	<0.5	<0.5	-	-	0.15	-	0.6	0.55	0.58	<0.5	<0.5	-	-	-
Cadmium	mg/kg	1.4	22	0.38	0.21	0.19	-	0.2	0.2	-	-	0.45	-	**1.62**	1.32	**1.79**	0.25	0.3	-	-	-
Chromium	mg/kg	64	87	25.6	26.2	15.8	-	15.7	13.8	-	-	15.8	-	44	33.2	43.3	16.8	15.2	-	-	-
Chromium (hexavalent)	mg/kg	0.4	1.4	0.05	<0.05	0.07	-	<0.05	<0.05	-	-	0.1	-	0.06	0.1	0.05	0.09	<0.05	-	-	-
Cobalt	mg/kg	20	300	6.6	6.9	7.6	-	6.1	6.5	-	-	7.1	-	9.4	16.4	9.4	10.6	7.9	-	-	-
Copper	mg/kg	63	91	17	14.3	15	-	12.7	12.4	-	-	37.1	-	46.9	35.3	44.4	16.4	14.8	-	-	-
Lead	mg/kg	70	600	16.4	9.5	6.7	-	7.2	7.4	-	-	15.3	-	**86.6**	69	**88.1**	11.2	12.1	-	-	-
Mercury	mg/kg	6.6	50	0.09	0.1	<0.05	-	<0.05	<0.05	-	-	0.1	-	0.13	0.09	0.1	<0.05	0.05	-	-	-
Molybdenum	mg/kg	4	40	**6.9**	2.5	1.1	-	<1	<1	-	-	1.9	-	**10**	**7.4**	**8.6**	<1	2.4	-	-	-
Nickel	mg/kg	45	89	32.9	33	22.6	-	18.2	15.4	-	-	20	-	**55**	40.7	**51.5**	23.2	20.6	-	-	-
Selenium	mg/kg	1	2.9	<0.3	<0.3	0.3	-	0.5	0.5	-	-	0.6	-	0.8	0.8	0.8	0.6	0.4	-	-	-
Silver	mg/kg	20	40	0.2	<0.1	<0.1	-	<0.1	<0.1	-	-	0.3	-	0.4	0.3	0.5	<0.1	0.1	-	-	-
Thallium	mg/kg	1	1	0.13	0.13	0.14	-	0.12	0.11	-	-	0.12	-	0.14	0.13	0.14	0.13	0.14	-	-	-
Tin	mg/kg	5	300	<1	<1	<1	-	<1	<1	-	-	3.6	-	2.8	2.2	3.2	<1	<1	-	-	-
Uranium	mg/kg	23	300	0.8	0.9	1	-	1	1	-	-	1.3	-	0.9	0.8	0.8	0.8	0.5	-	-	-
Vanadium	mg/kg	130	130	33.6	21.1	22.7	-	23.1	23	-	-	32.4	-	91.1	74.8	85	30.7	25	-	-	-
Zinc	mg/kg	250	410	116	61	48	-	55	60	-	-	110	-	**638**	**513**	**656**	82	91	-	-	-
Soil Texture																					
Sand	%	NG	NG	52	-	-	-	45	-	-	-	35	-	48	-	-	-	49	-	-	-
Silt	%	NG	NG	22	-	-	-	33	-	-	-	40	-	29	-	-	-	27	-	-	-
Clay	%	NG	NG	25	-	-	-	22	-	-	-	25	-	23	-	-	-	24	-	-	-
Texture	N/A	NG	NG	Sandy Clay Loam	-	-	-	Loam	-	-	-	Loam	-	Loam	-	-	-	Sandy Clay Loam	-	-	-
Laboratory Identification Number				1381283-1	1381283-2	1381283-3	1381283-4	1381283-21	1381283-22	1381283-23	1381283-24	1381283-45	1381283-47	1379633-5	1379633-6	1379633-7	1379633-8	1379633-25	1379633-26	1379633-27	1379633-28

Notes:

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"-" Not analyzed

N/A - Not Applicable

Parameters [2]	Rating Categories				Maximum Background
	Good	Fair	Poor	Unsuitable	
Topsoil					
EC (dS/m)	<2	2 to 4	4 to 8	>8	7.38
SAR	<4	4 to 8	8 to 12	>12	14.7
Subsoil					
EC (dS/m)	<3	3 to 5	5 to 10	>10	12.5
SAR	<4	4 to 8	8 to 12	>12	37.2

Table 4: 2019 Soil Analytical Results: Salinity, Metals, and Other Parameters

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-8				19-9		19-10		19-11				19-12		19-13			
				0-15	15-30	30-60	60-100	0-15	30-60	0-15	30-60	0-15	15-30	30-60	60-100	0-15	30-60	0-15	15-30	30-60	60-100
				09/25/19	09/25/19	09/25/19	09/25/19	09/19/19	09/19/19	09/25/19	09/25/19	09/24/19	09/24/19	09/24/19	09/24/19	09/24/19	09/24/19	09/24/19	09/24/19	09/24/19	09/24/19
Material Type				Fill	Fill	Fill	Fill	Fill	Fill	Replaced Topsoil	Fill	Topsoil	Bnt	BC	Cksa	Fill	Till (Ccasa)	Fill	Fill	Till	Till (Csa)
Field Texture				Clay	Clay	Clay	Clay	Clay	Clay	Clay Loam	Clay	Clay Loam	Clay to Clay Loam	Clay to Clay Loam	Clay	Clay	Clay	Clay	Clay	Clay	Clay
Salinity																					
pH	pH Units	6-8.5	6-8.5	7.8	7.7	7.9	6.9	7.7	7.7	7	7.7	7.5	-	**5.8**	-	6.9	6.8	7.8	7.9	7.3	7.8
Electrical Conductivity (EC)	dS/m	NG	NG	3.73	3.72	5.42	2.95	6.61	8.22	2.06	5.38	0.45	-	1.18	-	8.11	8.61	5.29	7.23	8.57	2.06
Sodium Absorption Ratio (SAR)	N/A	NG	NG	8.7	9.2	10.3	12	13.5	18	8.2	13.8	0.7	-	4.5	-	18.2	19.6	9.8	15.4	19.8	30
Percent Saturation	%	NG	NG	61	63	63	79	72	74	66	96	66	67	63	62	112	90	76	74	104	134
Calcium	mg/kg	NG	NG	176	160	258	74	359	382	61	271	38	-	48.5	-	528	420	380	369	461	10
Magnesium	mg/kg	NG	NG	59	55	96.6	41	118	132	25	104	10.1	-	13.7	-	179	156	85.5	122	187	6
Sodium	mg/kg	NG	NG	412	420	610	468	977	1380	246	1030	15	-	110	-	2010	1760	711	1160	2030	657
Potassium	mg/kg	NG	NG	8	11	13	<8	8	12	<7	14	12	-	3	-	22	15	22	15	30	<13
Chloride	mg/kg	NG	NG	61	72	145	81	31	89	5	27	6	-	4	-	27	9	12	17	45	11
Sulphate	mg/kg	NG	NG	1270	1200	1900	994	3170	4000	641	3000	44.4	-	344	-	5760	5130	2490	3560	5760	1140
Moisture	%	NG	NG	21.3	-	-	-	15.9	-	14.1	-	15	-	-	-	23.7	-	-	-	-	-
Other																					
Cation Exchange Capacity (CEC)	meq/100g	NG	NG	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as NO3-N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	<2	<2	<2	<2	<2	<2
Nitrate and Nitrite (as N)	mg/kg	NG	NG	-	-	-	-	<4	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur (Total)	%	NG	NG	-	-	-	-	0.23	-	0.04	-	0.01	-	-	-	1.39	-	-	-	-	-
Sulphur (Elemental)	mg/kg	500	500	-	-	-	-	<10	-	<10	-	<10	-	-	-	<10	-	-	-	-	-
Total Organic Carbon (TOC)	%			-	-	-	-	0.45	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																					
Antimony	mg/kg	20	40	0.8	0.8	0.7	<0.2	0.4	-	<0.2	-	0.5	0.2	0.5	0.4	0.5	-	-	-	-	-
Arsenic	mg/kg	17	26	6.4	6.7	5.7	3.4	5.9	-	5.2	-	7.1	6	9.6	7.2	8.8	-	-	-	-	-
Barium	mg/kg	750	2000	198	188	167	126	138	-	154	-	174	153	205	192	146	-	-	-	-	-
Beryllium	mg/kg	5	8	0.5	0.5	0.4	0.6	0.4	-	0.5	-	0.5	0.5	0.8	0.5	0.6	-	-	-	-	-
Boron (saturated paste)	mg/L	3.3	5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	0.09	0.12	0.13	<0.5	<0.5	-	-	-	-	-
Cadmium	mg/kg	1.4	22	1.04	1.02	0.87	0.31	0.21	-	0.24	-	0.28	0.23	0.15	0.19	0.21	-	-	-	-	-
Chromium	mg/kg	64	87	29.2	28.1	28.3	16.2	17.6	-	12.5	-	16.8	12.6	20	20	18	-	-	-	-	-
Chromium (hexavalent)	mg/kg	0.4	1.4	<0.05	<0.05	<0.05	0.08	<0.05	-	0.08	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-
Cobalt	mg/kg	20	300	8	9	7.6	4.5	8	-	9.8	-	8.4	7.9	10.5	8.6	11	-	-	-	-	-
Copper	mg/kg	63	91	31.9	33	27.9	11	15.8	-	12.3	-	20	12.5	17.9	18.7	26.9	-	-	-	-	-
Lead	mg/kg	70	600	52.6	52.5	45.6	8.2	7.8	-	8.2	-	14.1	8.6	10.8	8.1	12.5	-	-	-	-	-
Mercury	mg/kg	6.6	50	0.12	0.1	0.09	<0.05	<0.05	-	<0.05	-	0.05	<0.05	0.05	<0.05	0.06	-	-	-	-	-
Molybdenum	mg/kg	4	40	**6.5**	**7.2**	**4.6**	<1	<1	-	<1	-	1.4	1	<1	<1	1	-	-	-	-	-
Nickel	mg/kg	45	89	42.8	41.3	38.5	13.4	25	-	15.7	-	29.8	13	26.8	29.7	31.1	-	-	-	-	-
Selenium	mg/kg	1	2.9	0.6	0.6	0.5	0.5	<0.3	-	0.5	-	0.6	1	**1.1**	0.4	0.4	-	-	-	-	-
Silver	mg/kg	20	40	0.3	0.3	0.2	<0.1	<0.1	-	<0.1	-	0.1	<0.1	<0.1	<0.1	0.1	-	-	-	-	-
Thallium	mg/kg	1	1	0.13	0.12	0.11	0.14	0.14	-	0.12	-	0.14	0.12	0.17	0.16	0.14	-	-	-	-	-
Tin	mg/kg	5	300	1.8	1.7	1.5	<1	<1	-	<1	-	<1	<1	<1	<1	<1	-	-	-	-	-
Uranium	mg/kg	23	300	0.8	0.9	1	1.6	0.8	-	0.8	-	0.7	0.7	0.6	0.6	1.3	-	-	-	-	-
Vanadium	mg/kg	130	130	72.7	72	58.1	23.4	22.6	-	23	-	39.7	25	32.5	21.7	28.7	-	-	-	-	-
Zinc	mg/kg	250	410	**380**	**382**	**405**	76	55	-	64	-	107	62	70	54	87	-	-	-	-	-
Soil Texture																					
Sand	%	NG	NG	47	-	-	-	42	-	41	-	46	-	-	-	-	-	-	-	-	-
Silt	%	NG	NG	29	-	-	-	27	-	37	-	28	-	-	-	-	-	-	-	-	-
Clay	%	NG	NG	24	-	-	-	30	-	22	-	26	-	-	-	-	-	-	-	-	-
Texture	N/A	NG	NG	Loam	-	-	-	Clay Loam	-	Loam	-	Sandy Clay Loam	-	-	-	-	-	-	-	-	-
Laboratory Identification Number				1379633-9	1379633-10	1379633-11	1379633-12	1378374-11	1378374-13	1379633-13	1379633-15	1379359-5	1379359-6	1379359-7	1379359-8	1379359-9	1379359-11	1379359-13	1379359-14	1379359-15	1379359-16

Notes:

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Subsoil					
EC (dS/m)	<3	3 to 5	5 to 10	>10	12.5
SAR	<4	4 to 8	8 to 12	>12	37.2

TETRA TECH

Table 4: 2019 Soil Analytical Results: Salinity, Metals, and Other Parameters

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-14				19-15				19-16	
				0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-15	30-60
				09/24/19	09/24/19	09/24/19	09/24/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19
Material Type				Fill	Fill	Till (Csa)	Till (Csa)	Fill	Till (Cksa1)	Till (Cksa2)	Till (Cksa3)	Fill	Till (Cksa)
Field Texture				Clay	Clay	Clay	Clay	Clay Loam	Clay	Clay	Sandy Clay	Clay	Clay
Salinity													
pH	pH Units	6-8.5	6-8.5	7.7	7.8	8	7.9	7.2	7.7	-	8.2	7.6	7.8
Electrical Conductivity (EC)	dS/m	NG	NG	6.53	7.57	3.95	5.17	1.62	3.96	-	3.77	2.91	6.7
Sodium Absorption Ratio (SAR)	N/A	NG	NG	14.8	18.3	37	33	10.9	16.6	-	27	12	14.8
Percent Saturation	%	NG	NG	81	102	156	135	63	65	68	89	96	68
Calcium	mg/kg	NG	NG	339	449	57	120	28.8	91.5	-	37	117	237
Magnesium	mg/kg	NG	NG	104	123	10	18	10.2	31	-	23	34	137
Sodium	mg/kg	NG	NG	1090	1720	1510	1690	211	581	-	804	554	953
Potassium	mg/kg	NG	NG	9	20	20	25	4	<6	-	<9	11	18
Chloride	mg/kg	NG	NG	24	18	18	23	9	16	-	14	21	22
Sulphate	mg/kg	NG	NG	3220	4820	3050	3530	289	1270	-	1600	1370	2950
Moisture	%	NG	NG	18.5	-	-	-	-	-	-	-	21.6	-
Other													
Cation Exchange Capacity (CEC)	meq/100g	NG	NG	-	-	-	-	-	-	-	-	-	-
Nitrate (as NO3-N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-
Nitrate and Nitrite (as N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-
Sulphur (Total)	%	NG	NG	-	-	-	-	-	-	-	-	0.1	-
Sulphur (Elemental)	mg/kg	500	500	-	-	-	-	-	-	-	-	<10	-
Total Organic Carbon (TOC)	%			-	-	-	-	-	-	-	-	-	-
Metals													
Antimony	mg/kg	20	40	0.3	-	0.4	-	0.3	0.3	0.5	-	0.4	-
Arsenic	mg/kg	17	26	7.8	-	13.8	-	6.2	6.3	7.6	-	8.6	-
Barium	mg/kg	750	2000	161	-	158	-	139	137	170	-	153	-
Beryllium	mg/kg	5	8	0.6	-	0.8	-	0.5	0.5	0.6	-	0.5	-
Boron (saturated paste)	mg/L	3.3	5	<0.5	-	<0.5	-	0.15	<0.5	<0.5	-	<0.5	-
Cadmium	mg/kg	1.4	22	0.18	-	0.13	-	0.26	0.2	0.16	-	0.25	-
Chromium	mg/kg	64	87	14.9	-	11.4	-	13.3	12.6	17.3	-	13.2	-
Chromium (hexavalent)	mg/kg	0.4	1.4	<0.05	-	<0.05	-	<0.05	0.1	<0.05	-	0.07	-
Cobalt	mg/kg	20	300	8.8	-	9.7	-	7.1	6.6	8.4	-	7.7	-
Copper	mg/kg	63	91	15.3	-	19.8	-	14.4	13.9	16.4	-	16.4	-
Lead	mg/kg	70	600	8.1	-	10.6	-	10.4	9.3	7.8	-	12.4	-
Mercury	mg/kg	6.6	50	<0.05	-	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-
Molybdenum	mg/kg	4	40	<1	-	<1	-	2	1	<1	-	2.6	-
Nickel	mg/kg	45	89	19.6	-	25.4	-	17.2	17.1	25.3	-	20.6	-
Selenium	mg/kg	1	2.9	0.5	-	0.4	-	0.6	0.4	0.7	-	0.6	-
Silver	mg/kg	20	40	<0.1	-	0.1	-	<0.1	<0.1	<0.1	-	<0.1	-
Thallium	mg/kg	1	1	0.14	-	0.15	-	0.11	0.12	0.15	-	0.16	-
Tin	mg/kg	5	300	<1	-	<1	-	<1	<1	<1	-	<1	-
Uranium	mg/kg	23	300	0.9	-	1.4	-	1	0.8	0.8	-	1.1	-
Vanadium	mg/kg	130	130	27.8	-	19.5	-	30.5	25	27.2	-	24.1	-
Zinc	mg/kg	250	410	64	-	75	-	74	62	52	-	92	-
Soil Texture													
Sand	%	NG	NG	-	-	-	-	-	-	-	-	40	-
Silt	%	NG	NG	-	-	-	-	-	-	-	-	30	-
Clay	%	NG	NG	-	-	-	-	-	-	-	-	30	-
Texture	N/A	NG	NG	-	-	-	-	-	-	-	-	Clay Loam	-
Laboratory Identification Number				1379359-17	1379359-18	1379359-19	1379359-20	1379633-17	1379633-18	1379633-19	1379633-20	1379633-21	1379633-23

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 fine textured soils under Agricultural and Industrial land use.

[2] AENV. 2001. Salt Contamination Assessment and Remediation Guidelines. Pub. No.: T/606. ISBN: 0-7785-1718-7 (On-Line Edition).

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Parameters [2]	Rating Categories				Maximum Background
	Good	Fair	Poor	Unsuitable	
Topsoil					
EC (dS/m)	<2	2 to 4	4 to 8	>8	7.38
SAR	<4	4 to 8	8 to 12	>12	14.7
Subsoil					
EC (dS/m)	<3	3 to 5	5 to 10	>10	12.5
SAR	<4	4 to 8	8 to 12	>12	37.2

Table 5: 2019 Soil Analytical Results: Hydrocarbons, PAHs, VOCs, Grain Size

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-1				19-2				19-3			19-4		19-5
				0-13	15-30	45-60	60-100	0-18	18-30	45-60	80-100	0-15	15-30	30-60	0-15	30-60	0-15
				09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	09/19/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19
Hydrocarbons																	
Benzene	mg/kg	0.046	0.046	-	-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005
Toluene	mg/kg	0.52	0.52	-	-	-	-	-	-	-	-	<0.02	-	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	mg/kg	0.073	0.073	-	-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005
Xylenes Total	mg/kg	0.99	0.99	-	-	-	-	-	-	-	-	<0.03	-	<0.03	<0.03	<0.03	<0.03
F1 (C_6-C_{10}) - BTEX	mg/kg	210	320	-	-	-	-	-	-	-	-	<10	-	<10	<10	<10	<10
F2 (C_{10}-C_{16})	mg/kg	150	260	-	-	-	-	-	-	-	-	<25	-	<25	<25	<25	<25
F3 (C_{16}-C_{34})	mg/kg	1300	2500	-	-	-	-	-	-	-	-	<50	-	<50	<50	<50	140
F4 (C_{34}-C_{50})	mg/kg	5600	6600	-	-	-	-	-	-	-	-	<100	-	<100	<100	<100	128
F4G (C_{35}-C_{50+})	mg/kg	5600	6600	-	-	-	-	-	-	-	-	<100	-	<100	<100	<100	164
% C_{50+}	%	NG	NG	-	-	-	-	-	-	-	-	<5	-	<5	13.5	<5	8.2
Polycyclic Aromatic Hydrocarbons (PAHs)																	
Naphthalene	mg/kg	0.014	0.014	<0.01	-	-	-	<0.01	-	-	-	<0.01	<0.01	-	<0.01	-	<0.01
Acenaphthylene	mg/kg	NG	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Acenaphthene	mg/kg	0.33	0.33	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Fluorene	mg/kg	0.4	0.4	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Phenanthrene	mg/kg	0.11	0.11	<0.01	-	-	-	0.01	-	-	-	<0.01	<0.01	-	<0.01	-	0.01
Anthracene	mg/kg	1.3	1.3	<0.003	-	-	-	<0.003	-	-	-	<0.003	<0.003	-	<0.003	-	<0.003
Fluoranthene	mg/kg	15.4	180	<0.01	-	-	-	<0.01	-	-	-	<0.01	<0.01	-	<0.01	-	0.026
Pyrene	mg/kg	7.7	30000	<0.01	-	-	-	<0.01	-	-	-	<0.01	<0.01	-	<0.01	-	0.026
Benz(a)anthracene	mg/kg	6.2	NG	<0.01	-	-	-	<0.01	-	-	-	<0.01	<0.01	-	<0.01	-	0.02
Chrysene	mg/kg	6.2	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Benzo(b+j)fluoranthene	mg/kg	6.2	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Benzo(k)fluoranthene	mg/kg	6.2	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Benzo(a) pyrene	mg/kg	0.6	72	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	NG	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Dibenz(a,h)anthracene	mg/kg	NG	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Benzo(g,h,i)perylene	mg/kg	NG	NG	<0.05	-	-	-	<0.05	-	-	-	<0.05	<0.05	-	<0.05	-	<0.05
Index of Additive Cancer Risk-Coarse	N/A	1.0	1.0	<0.001	-	-	-	<0.001	-	-	-	<0.001	<0.001	-	<0.001	-	0.003
Index of Additive Cancer Risk-Fine	N/A	1.0	1.0	<0.001	-	-	-	<0.001	-	-	-	<0.001	<0.001	-	<0.001	-	0.005
Carcinogenic PAHs (as B(a)P TPE)	mg/kg	5.3	8.0	<0.001	-	-	-	<0.001	-	-	-	<0.001	<0.001	-	<0.001	-	0.016
Volatile Organic Compounds (VOCs)																	
Acetone	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	mg/kg	0.046	0.046	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isobutanol	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butanol	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cresols (m,p,o)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclohexanone	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl acetate	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	0.073	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl ether	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methanol	mg/kg	37	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone (MEK)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitropropane	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyridine	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.52	0.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes Total	mg/kg	0.99	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alberta Landfill Solvent Scan - Soil	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Particle Size																	
>75 µm	%	NG	NG	43.7	32.8	39.4	38.4	36.1	31.5	45.3	39.5	70.7	57.3	39.8	38	40.2	26.8
Grain Size	N/A	NG	NG	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Coarse-Grained	Coarse-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained
Laboratory Identification Number				1378374-1	1378374-2	1378374-3	1378374-4	1378374-5	1378374-6	1378374-8	1378374-10	1381283-1	1381283-2	1381283-3	1381283-21	1381283-23	1381283-45
Laboratory Identification Number				1396314-1				1396314-2									

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 fine textured soils under Agricultural and Industrial land use.

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Table 5: 2019 Soil Analytical Results: Hydrocarbons, PAHs, VOCs, Grain Size

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-6				19-7	19-8				19-9	19-10		19-11	19-12	19-14	19-15	19-16
				0-15	15-30	30-60	60-100	0-15	0-15	15-30	30-60	60-100	0-15	0-15	15-30	0-15	0-15	0-15	0-15	0-15
				09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/19/19	09/25/19	09/25/19	09/24/19	09/24/19	09/24/19	09/25/19	09/25/19
Hydrocarbons																				
Benzene	mg/kg	0.046	0.046	0.016	-	-	-	<0.005	<0.005	-	-	-	<0.005	<0.005	-	<0.005	<0.005	<0.005	-	<0.005
Toluene	mg/kg	0.52	0.52	<0.02	-	-	-	<0.02	<0.02	-	-	-	<0.01	<0.02	-	<0.02	<0.02	<0.02	-	<0.02
Ethylbenzene	mg/kg	0.073	0.073	<0.005	-	-	-	<0.005	<0.005	-	-	-	<0.005	<0.005	-	<0.005	<0.005	<0.005	-	<0.005
Xylenes Total	mg/kg	0.99	0.99	<0.03	-	-	-	<0.03	<0.03	-	-	-	<0.01	<0.03	-	<0.03	<0.03	<0.03	-	<0.03
F1 (C_6-C_{10}) - BTEX	mg/kg	210	320	<10	-	-	-	<10	<10	-	-	-	<10	<10	-	<10	<10	<10	-	<10
F2 (C_{10}-C_{16})	mg/kg	150	260	<25	-	-	-	<25	<25	-	-	-	<25	<25	-	<25	<25	<25	-	<25
F3 (C_{16}-C_{34})	mg/kg	1300	2500	305	-	-	-	<50	83	-	-	-	<50	<50	-	<50	<50	<50	-	<50
F4 (C_{34}-C_{50})	mg/kg	5600	6600	221	-	-	-	<100	<100	-	-	-	<100	<100	-	<100	<100	<100	-	<100
F4G (C_{35}-C_{50+})	mg/kg	5600	6600	373	-	-	-	<100	<100	-	-	-	<100	<100	-	<100	<100	<100	-	<100
% C_{50+}	%	NG	NG	15.4	-	-	-	<5	<5	-	-	-	<5	<5	-	<5	<5	<5	-	14.9
Polycyclic Aromatic Hydrocarbons (PAHs)																				
Naphthalene	mg/kg	0.014	0.014	**0.032**	0.01	**0.016**	**0.015**	<0.01	**0.024**	**0.016**	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	mg/kg	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthene	mg/kg	0.33	0.33	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg	0.4	0.4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg	0.11	0.11	**0.19**	0.03	0.07	0.05	<0.01	**0.12**	0.06	0.04	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	mg/kg	1.3	1.3	0.068	0.005	0.016	0.009	<0.003	0.047	0.012	0.009	0.005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Fluoranthene	mg/kg	15.4	180	0.397	0.041	0.11	0.064	<0.01	0.244	0.095	0.049	0.033	<0.01	<0.01	<0.01	0.016	<0.01	<0.01	<0.01	<0.01
Pyrene	mg/kg	7.7	30000	0.379	0.046	0.117	0.072	<0.01	0.23	0.095	0.047	0.031	<0.01	<0.01	<0.01	0.018	<0.01	<0.01	<0.01	0.01
Benz(a)anthracene	mg/kg	6.2	NG	0.26	0.02	0.05	0.03	<0.01	0.15	0.06	0.03	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	mg/kg	6.2	NG	0.34	<0.05	0.08	<0.05	<0.05	0.2	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b+j)fluoranthene	mg/kg	6.2	NG	0.49	<0.05	0.11	<0.05	<0.05	0.28	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	6.2	NG	0.18	<0.05	0.06	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a) pyrene	mg/kg	0.6	72	0.35	<0.05	0.06	<0.05	<0.05	0.17	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	NG	NG	0.22	<0.05	<0.05	<0.05	<0.05	0.13	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	mg/kg	NG	NG	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	mg/kg	NG	NG	0.21	<0.05	0.05	<0.05	<0.05	0.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Index of Additive Cancer Risk-Coarse	N/A	1.0	1.0	0.294	0.003	0.078	0.013	<0.001	0.154	0.031	0.014	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Index of Additive Cancer Risk-Fine	N/A	1.0	1.0	0.56	0.007	0.148	0.026	<0.001	0.293	0.06	0.026	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carcinogenic PAHs (as B(a)P TPE)	mg/kg	5.3	8.0	0.523	0.022	0.088	0.039	<0.001	0.233	0.092	0.041	0.019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
Volatile Organic Compounds (VOCs)																				
Acetone	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<0.25	<10	-	<10	<10	-	-	<10
Benzene	mg/kg	0.046	0.046	-	-	-	-	-	-	-	-	-	<0.005	<0.005	-	<0.005	<0.005	-	-	<0.005
Isobutanol	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
n-Butanol	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Carbon disulfide	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Total Cresols (m,p,o)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Cyclohexanone	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Ethyl acetate	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Ethylbenzene	mg/kg	0.073	0.073	-	-	-	-	-	-	-	-	-	<0.005	<0.005	-	<0.005	<0.005	-	-	<0.005
Ethyl ether	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Methanol	mg/kg	37	37	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
2-Butanone (MEK)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<0.25	<10	-	<10	<10	-	-	<10
2-Nitropropane	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Pyridine	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<10	<10	-	<10	<10	-	-	<10
Toluene	mg/kg	0.52	0.52	-	-	-	-	-	-	-	-	-	<0.01	<0.02	-	<0.02	<0.02	-	-	<0.02
Xylenes Total	mg/kg	0.99	0.99	-	-	-	-	-	-	-	-	-	<0.01	<0.03	-	<0.03	<0.03	-	-	<0.03
Total Alberta Landfill Solvent Scan - Soil	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	<500	<500	-	<500	<500	-	-	<500
Particle Size																				
>75 µm	%	NG	NG	47.9	-	-	-	31.5	42.5	40.8	-	-	30.7	34.3	-	84	-	19.7	34.9	30.8
Grain Size	N/A	NG	NG	Fine-Grained	-	-	-	Fine-Grained	Fine-Grained	Fine-Grained	-	-	Fine-Grained	Fine-Grained	-	Coarse-Grained	-	Fine-Grained	Fine-Grained	Fine-Grained
Laboratory Identification Number				1379633-5	1379633-6	1379633-7	1379633-8	1379633-25	1379633-9	1379633-10	1379633-11	1379633-12	1378374-11	1379633-13	1379633-14	1379359-5	1379359-9	1379359-17	1379633-17	1379633-21
Laboratory Identification Number																				

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 fine textured soils under Agricultural and Industrial land use.

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Table 6: 2019 Soil Analytical Results: PCBs, Pesticides

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-3	19-4	19-5	19-6	19-7	19-8	19-9	19-10	19-11	19-12	19-16	
				0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15	60-100
				10/02/19	10/02/19	10/02/19	09/25/19	09/25/19	09/25/19	09/19/19	09/25/19	09/24/19	09/24/19	09/25/19	09/25/19
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1221	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1232	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1242	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1248	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1254	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1260	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1268	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Aroclor 1262	mg/kg	NG	NG	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
PCBs (Sum of total)	mg/kg	1.3	33	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Organochlorine Pesticides in Soil															
Aldrin	mg/kg	3.4	5.9	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
BHC (alpha)	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
BHC (beta)	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
BHC (delta)	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Captan	mg/kg	NG	NG	<3	-	<3	<3	<3	<3	-	-	-	-	-	<3
Chlorbenside	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Chlordane (cis)	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Chlordane (trans)	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Chlorfenson	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Chlorothalonil	mg/kg	0.0085	0.0085	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Chlorthal-dimethyl	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
DDD-o,p'	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
DDD-p,p'	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
DDE-o,p'	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
DDE-p,p'	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
DDT-o,p'	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
DDT-p,p'	mg/kg	0.7	12	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Dichlofluanid	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Dieldrin	mg/kg	0.59	0.59	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Endosulfan I	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Endosulfan II	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Endosulfan sulphate	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Endrin	mg/kg	2.4	2.4	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Folpet	mg/kg	NG	NG	<3	-	<3	<3	<3	<3	-	-	-	-	-	<3
Heptachlor	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Heptachlor epoxide	mg/kg	0.039	0.039	<0.2	-	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	<0.2
Hexachlorobenzene	mg/kg	0.8	3.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Lindane	mg/kg	0.11	0.31	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	<0.1
Methoxychlor	mg/kg	3500	50000	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	<0.1
Mirex	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Permethrin-cis	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Permethrin -trans	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Procymidone	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Propachlor	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Quintozene	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Tecnazene	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Tetradifon	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Tolyfluanid	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Triadimefon	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Vinclozolin	mg/kg	NG	NG	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	<0.5
Particle Size															
>75 µm	%	NG	NG	70.7	38	26.8	47.9	31.5	42.5	30.7	34.3	84	-	30.8	-
Grain Size	N/A	NG	NG	Coarse-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Coarse-Grained	-	Fine-Grained	-
Laboratory Identification Number				1381283-1	1381283-21	1381283-45	1379633-5	1379633-25	1379633-9	1378374-11	1379633-13	1379359-5	1379359-9	1379633-21	1379633-24

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 fine textured soils under Agricultural and Industrial land use.

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Table 7: 2019 Soil Analytical Results: Herbicides

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-3	19-5	19-6	19-7	19-8	19-16
				0-15	0-15	0-15	0-15	0-15	60-100
				10/02/19	10/02/19	09/25/19	09/25/19	09/25/19	09/25/19
Neutral Herbicides in Soil									
Alachlor	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benfluralin	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Butylate	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorpropham	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diallate	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichlobenil	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diclofop-methyl	mg/kg	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Diphenylamine	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Eptam	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethalfluralin	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fenoxaprop-ethyl	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluazifop-p-butyl	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexazinone	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Metalaxyl	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Metolachlor	mg/kg	0.048	0.048	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Metribuzin	mg/kg	0.012	0.024	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pirimicarb	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Profluralin	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Prometryn	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Propazine	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Propyzamide	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Quizalofop-ethyl	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Simetryn	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Terbuthylazine	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Terbutryn	mg/kg	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Triallate	mg/kg	0.0077	0.0077	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trifluralin	mg/kg	0.22	0.22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acid Herbicides in Soil									
2,4,5-T	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,5-TP	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-D	mg/kg	0.1	0.43	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-DB	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Bromoxynil	mg/kg	0.044	0.044	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Clopyralid	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dicamba	mg/kg	0.12	0.5	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dichlorprop	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dinoseb	mg/kg	1.1	2.8	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Imazamox	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Imazapyr	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Imazethapyr	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MCPA	mg/kg	0.026	0.42	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MCPB	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mecoprop	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Picloram	mg/kg	0.024	0.024	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Triclopyr	mg/kg	NG	NG	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Particle Size									
>75 µm	%	NG	NG	70.7	26.8	47.9	31.5	42.5	-
Grain Size	N/A	NG	NG	Coarse-Grained	Fine-Grained	Fine-Grained	Fine-Grained	Fine-Grained	-
Laboratory Identification Number				1381283-1	1381283-45	1379633-5	1379633-25	1379633-9	1379633-24

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 fine textured soils under Agricultural and Industrial land use.

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Table 8: 2019 Soil Analytical Results: Borehole 19-3 Metals Delineation

Parameter	Unit	2019 Tier 1 Agricultual	2019 Tier 1 Industrial	19-3			19-3A		19-3B				19-3C		19-3D	
				0-15	15-30	30-60	0-15	15-30	0-15	15-30	30-60	60-100	0-15	15-30	0-15	15-30
				10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19
Material Type				Replaced Topsoil	Fill	Till	Replaced Topsoil	Fill	Fill	Fill	Till	Till	Fill	Fill	Replaced Topsoil	Fill
Field Texture				Clay Loam	Clay	Clay	Clay Loam	Clay	Clay Loam	Clay	Sandy Clay	Sandy Clay	Clay	Clay	Clay Loam	Clay
Percent Saturation	%	NG	NG	63	64	64	86	58	109	49	54	46	60	55	107	50
Metals																
Antimony	mg/kg	20	40	0.8	0.5	0.3	3.2	0.5	5.6	1.3	0.5	0.4	0.4	0.3	4.1	0.4
Arsenic	mg/kg	17	26	5.9	5.6	6.2	9	6	13.7	7.3	7.7	6.4	8.7	5.7	9	5.9
Barium	mg/kg	750	2000	138	273	199	179	197	131	117	157	135	151	133	190	141
Beryllium	mg/kg	5	8	0.3	0.4	0.6	0.4	0.4	0.5	0.5	0.4	0.4	0.6	0.4	0.4	0.4
Boron (saturated paste)	mg/L	3.3	5	0.17	0.2	<0.5	0.37	<0.5	0.23	0.18	0.19	0.14	<0.5	<0.5	0.23	<0.5
Cadmium	mg/kg	1.4	22	0.38	0.21	0.19	**1.73**	0.18	**2.14**	0.31	0.15	0.2	0.15	0.15	**3.4**	0.19
Chromium	mg/kg	64	87	25.6	26.2	15.8	**75.4**	21	**79.9**	21.1	27.8	15.7	15.3	24.9	**94.2**	14.9
Chromium (hexavalent)	mg/kg	0.4	1.4	0.05	<0.05	0.07	0.07	<0.05	0.05	0.05	0.08	<0.05	<0.05	<0.05	0.08	<0.05
Cobalt	mg/kg	20	300	6.6	6.9	7.6	13.8	7.4	**25.9**	7.6	8.6	7.3	7.5	6.6	11.7	7.5
Copper	mg/kg	63	91	17	14.3	15	53	15.3	**77.2**	16	19.7	15.3	12.7	12.5	**101**	14.8
Lead	mg/kg	70	600	16.4	9.5	6.7	**108**	10.1	**176**	10.3	8.1	6.2	8.1	6	**237**	8
Mercury	mg/kg	6.6	50	0.09	0.1	<0.05	0.45	0.09	0.85	0.16	0.07	<0.05	0.06	0.06	0.63	0.06
Molybdenum	mg/kg	4	40	**6.9**	2.5	1.1	**25.4**	1.7	**22**	**13.9**	1.1	1.2	2.6	1.1	**17.1**	1.1
Nickel	mg/kg	45	89	32.9	33	22.6	**92.1**	28.9	**89.5**	31	29.6	23.1	22.9	27.3	**113**	23.7
Selenium	mg/kg	1	2.9	<0.3	<0.3	0.3	0.5	0.5	0.7	<0.3	0.4	<0.3	<0.3	<0.3	1	<0.3
Silver	mg/kg	20	40	0.2	<0.1	<0.1	1.1	0.1	2.9	0.2	<0.1	<0.1	<0.1	<0.1	2.9	<0.1
Thallium	mg/kg	1	1	0.13	0.13	0.14	0.14	0.14	0.19	0.13	0.15	0.14	0.09	0.12	0.15	0.13
Tin	mg/kg	5	300	<1	<1	<1	4.4	<1	**8.7**	<1	<1	<1	<1	<1	8.1	<1
Uranium	mg/kg	23	300	0.8	0.9	1	0.9	0.8	0.8	0.6	0.6	0.8	1.4	1.1	1	0.8
Vanadium	mg/kg	130	130	33.6	21.1	22.7	54.7	24.1	129	24.3	23.8	21.5	22.4	18.8	**259**	21.2
Zinc	mg/kg	250	410	116	61	48	**593**	61	**716**	66	55	47	59	44	**1530**	52
Laboratory Identification Number				1381283-1	1381283-2	1381283-3	1381283-5	1381283-6	1381283-9	1381283-10	1381283-11	1381283-12	1381283-13	1381283-14	1381283-17	1381283-18

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 fine textured soils under Agricultural and Industrial land use.

[2] AENV. 2001. Salt Contamination Assessment and Remediation Guidelines. Pub. No.: T/606. ISBN: 0-7785-1718-7 (On-Line Edition).

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Table 9: Borehole 19-4 Salinity Delineation

Parameter	Unit	2019 Tier 1 Agricultual [1]	2019 Tier 1 Industrial [1]	19-4				19-4A				19-4B		19-4C				19-4D				19-4E			
				0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-15	30-60	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100	0-15	15-30	30-60	60-100
				10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19	10/02/19
Material Type				Replaced Topsoil	Fill	Fill	Till	Replaced Topsoil	Fill	Fill	Till	Replaced Topsoil	Fill	Replaced Topsoil	Fill	Fill	Till	Replaced Topsoil	Fill	Fill	Till	Replaced Topsoil	Fill	Fill	Till
Field Texture				Loam	Clay	Clay	Clay	Loam	Clay	Clay	Clay	Loam	Clay	Loam	Clay	Clay	Clay	Loam	Clay	Clay	Clay	Loam	Clay	Clay	Clay
Salinity																									
pH	pH Units	6-8.5	6-8.5	6.9	6.5	7.4	7.8	7.4	7.6	7.3	7.7	6.7	7.4	7.3	7.4	7.6	7.9	7.4	7.5	7.2	7.4	7.5	7.4	7.8	7.7
Electrical Conductivity (EC)	dS/m	NG	NG	5.7	5.43	4.72	6.05	5.14	6.44	5.52	5.78	3.92	6.66	3.25	2.69	5.99	7.06	1.63	1.66	5.75	8.69	7.81	6.27	7.46	5.83
Sodium Absorption Ratio (SAR)	N/A	NG	NG	9	11.8	8.7	10.8	14.6	17.4	8.5	10.2	10.9	13.9	8.3	15	9.8	14	4.9	4.9	13.7	19.5	15.2	12.5	16.8	10.9
Percent Saturation	%	NG	NG	61	61	62	55	89	74	71	58	62	60	69	59	69	65	58	57	54	74	61	60	74	58
Calcium	mg/kg	NG	NG	338	214	273	277	215	234	387	309	147	273	169	48	368	316	66.4	62.3	199	345	307	299	277	274
Magnesium	mg/kg	NG	NG	118	90.2	86.8	114	79	92.1	117	112	63.5	111	48	18	125	142	20.2	20.3	66.3	163	128	104	144	105
Sodium	mg/kg	NG	NG	591	636	509	632	934	1070	627	625	495	841	394	364	710	961	135	131	643	1510	985	764	1190	640
Potassium	mg/kg	NG	NG	<6	<6	9	9	14	18	<7	10	8	11	9	<6	8	10	6	3	<5	9	7	8	11	9
Chloride	mg/kg	NG	NG	259	269	57	67	147	173	184	34	65	27	100	121	116	133	73	71	106	88	205	140	42	83
Sulphate	mg/kg	NG	NG	1810	1650	1900	2240	2450	2760	2280	2150	1410	2720	1140	671	2460	2950	354	286	1850	4310	2830	2380	3470	2180
Moisture	%	NG	NG	14.2	-	15.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laboratory Identification Number				1381283-21	1381283-22	1381283-23	1381283-24	1381283-25	1381283-26	1381283-27	1381283-28	1381283-29	1381283-31	1381283-33	1381283-34	1381283-35	1381283-36	1381283-37	1381283-38	1381283-39	1381283-40	1381283-41	1381283-42	1381283-43	1381283-44

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 fine textured soils under Agricultural and Industrial land use.

[2] AENV. 2001. Salt Contamination Assessment and Remediation Guidelines. Pub. No.: T/606. ISBN: 0-7785-1718-7 (On-Line Edition).

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

N/A - Not Applicable

Parameters [2]	Rating Categories				Maximum Background
	Good	Fair	Poor	Unsuitable	
Topsoil					
EC (dS/m)	<2	2 to 4	4 to 8	>8	7.38
SAR	<4	4 to 8	8 to 12	>12	14.7
Subsoil					
EC (dS/m)	<3	3 to 5	5 to 10	>10	12.5
SAR	<4	4 to 8	8 to 12	>12	37.2

Table 10: Historical Background Salinity and Metals Data - 1996 to 2014

Parameter	Unit	2019 Tier 1, Agricultural[1]	2019 Tier 1 Industrial [1]	96-S1				96-S2							96-S3			96-S4		
				1996			2002	1996			2001				1996			1996		
				0-11	11-35	35-65	30 - 65 cm	0-5	5-30	30-60	0 - 15 cm	15 - 30 cm	30 - 60 cm	60 - 100 cm	0-5	5-45	45-70	0-15	15-50	75-100
Salinity																				
pH	pH Units	6-8.5	6-8.5	7.4	5.2	7.6	-	**5.6**	**5.9**	7.9	**5.5**	6.6	7.9	8.4	6.3	7.7	8	**5.5**	6.8	7.9
Electrical Conductivity (EC)	dS/m	**	**	0.97	4.64	1.57	-	0.7	3.22	9.54	3.41	6.24	6.63	10.4	0.99	2.2	7.09	0.95	0.84	3.78
Sodium Absorption Ratio (SAR)	N/A	**	**	7.6	9.2	6.2	-	6.9	20.6	23.6	-	-	-	-	4.9	17.1	16.1	7.3	7.2	10.3
Percent Saturation	%	NG	NG	46	57	60	-	163	69	122	48	37	51	49	92	83	117	60	80	70
Calcium	mg/kg	NG	NG	14.7	180.5	42.1	-	26.1	30.4	462.1	-	-	-	-	36.9	29.9	408	13.2	24	134.7
Magnesium	mg/kg	NG	NG	4.5	72.1	15.3	-	13.9	16.8	215.1	-	-	-	-	16.8	18.2	207.7	5.1	7.8	68.9
Sodium	mg/kg	NG	NG	85.7	433.8	142.1	-	217.3	471.1	2695.4	-	-	-	-	135.4	438.9	1729.6	95.2	141.6	490.8
Potassium	mg/kg	NG	NG	<1.8	2.2	2.3	-	31.9	2.7	23.8	-	-	-	-	18	9.7	22.9	<2.3	<3.1	2.7
Chloride	mg/kg	NG	NG	6.5	4	36.2	-	28.9	7.3	17.3	-	-	-	-	45.7	26.5	12.4	21.3	22.7	5
Sulfate (as SO4)	mg/kg	NG	NG	24.3	525.4	94.3	-	73.2	338.5	2425	-	-	-	-	51.6	267.4	1706.7	51	57.7	500.5
Sulfate (as S)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moisture	%	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other																				
Cation Exchange Capacity (CEC)	meq/100g	NG	NG	21.8	22.8	22.2	-	19.4	18.1	21.6	-	-	-	-	27.6	25.8	18.6	20.5	26.8	18.1
Nitrate (as N)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur (Total)	%	NG	NG	-	-	-	-				0.08	0.08	-	-	-	-	-	-	-	-
Sulfur (Elemental)	mg/kg	500	NG	53	34	94	-	29	28	2	35	44	-	-	-	-	-	-	-	-
Total Organic Carbon (TOC)	%	NG	NG	1.9	2.5	0.64	-	5.5	2.2	0.52	-	-	-	-	5.4	1.3	0.42	5.6	1.2	0.31
Organic Matter	%	NG	NG	2.3	4.8	1.4	-	8.6	3.6	0.89	-	-	-	-	8.3	2.3	0.72	9.7	2.1	0.63
Metals																				
Antimony (Sb)	mg/kg	20	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (As)	mg/kg	17	26	-	-	-	-	-	-	-	4.6	5.8	-	-	-	-	-	-	-	-
Barium (Ba)	mg/kg	750	2000	213	188	282	-	120	184	297	138	241	-	-	-	-	-	-	-	-
Barium (Ba) - Extractable	mg/kg	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (Be)	mg/kg	5	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (B) - hot water soluble	mg/kg	2 [2]	-	<1	<1	<1	-	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-
Boron (B) - saturated paste [3]	mg/L	3.3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Cd)	mg/kg	1.4	22	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-
Hexavalent Chromium (Cr+6)	mg/kg	0.4	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Cr), total	mg/kg	64	1.4	9	7	10	-	6	8	9	8	8	-	-	-	-	-	-	-	-
Cobalt (Co)	mg/kg	20	300	38.9	17.3	27.1	-	26.2	30.9	35.9	16.3	25.3	-	-	-	-	-	-	-	-
Copper (Cu)	mg/kg	63	91	19	16	24	-	53	13	48	13	16	-	-	-	-	-	-	-	-
Lead (Pb)	mg/kg	70	600	-	-	-	-	-	-	-	0.01	0.04	-	-	-	-	-	-	-	-
Mercury (Hg)	mg/kg	6.6	50	-	-	-	-	-	-	-	552	367	-	-	-	-	-	-	-	-
Molybdenum (Mo)	mg/kg	4	40	30	17	33	-	16	20	33	13	20	-	-	-	-	-	-	-	-
Nickel (Ni)	mg/kg	45	89	9	9	**100**	11	15	8	10	7	12	-	-	-	-	-	-	-	-
Selenium (Se)	mg/kg	1	2.9	<5	<5	<5	-	<5	<5	<5	<0.1	0.8	-	-	-	-	-	-	-	-
Silver (Ag)	mg/kg	20	40	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-
Thallium (Tl)	mg/kg	1	1	-	-	-	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	-
Tin (Sn)	mg/kg	5	300	<1	<1	<1	-	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-
Uranium	mg/kg	23	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (V)	mg/kg	130	130	38	23	25	-	33	35	31	25	39	-	-	-	-	-	-	-	-
Zinc (Zn)	mg/kg	250	410	65.9	72.2	60.8	-	74.1	56.7	91.9	59.2	70.7	-	-	-	-	-	-	-	-
Grain Size																				
>75µm	%	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grain Size	N/A	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil Texture																				
Sand	%	NG	NG	40	42	33	-	53.3	52	46	-	-	-	-	27	26	40	37	22	40
Silt	%	NG	NG	25.3	27.3	20.3	-	32.1	33.3	13.3	-	-	-	-	38.3	29.3	23.3	36.3	36.3	27.3
Clay	%	NG	NG	34.7	30.7	46.7	-	14.5	14.7	40.7	-	-	-	-	34.7	44.7	36.7	26.7	41.7	32.7
Texture	N/A	NG	NG	Clay Loam	Clay Loam	Clay	-	Sandy Loam	Loam	Clay	-	-	-	-	Clay Loam	Clay	Clay Loam	Loam	Clay	Clay Loam

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 fine textured soils under agricultural land use.

[2] Hot water soluble boron guideline from the 2014 Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Method no longer in use.

[3] Saturated paste boron data shown for boreholes 14-1 and 14-2 was collected in 2019.

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NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

Parameters **	Rating Categories				Maximum Background
	Good	Fair	Poor	Unsuitable	
Topsoil					
EC (dS/m)	<2	2 to 4	4 to 8	>8	7.38
SAR	<4	4 to 8	8 to 12	>12	14.7
Subsoil					
EC (dS/m)	<3	3 to 5	5 to 10	>10	12.5
SAR	<4	4 to 8	8 to 12	>12	37.2

Table 10: Historical Background Salinity and Metals Data - 1996 to 2014

Parameter	Unit	2019 Tier 1, Agricultural[1]	2019 Tier 1 Industrial [1]	09-01				09-02				14-1				14-2			
				2009				2009				2014				2014			
				0-15	23-30	41-60	60-100	0-15	15-25	30-60	72-100	0-15	23-35	38-60	60-100	0-15	16-28	30-60	60-85
Salinity																			
pH	pH Units	6-8.5	6-8.5	**5.5**	**5.4**	7.3	7.5	**5.6**	6.6	7.8	8.1	**4.7**	7.4	8	8.2	**5.1**	**5.1**	6	7.6
Electrical Conductivity (EC)	dS/m	**	**	0.24	0.19	0.6	1.24	7.38	8.53	5.79	2.96	0.37	4.27	10.4	10.8	0.34	0.26	0.38	1.62
Sodium Absorption Ratio (SAR)	N/A	**	**	1.1	3.6	4.6	3.4	14.7	17.6	16.8	29.2	8	37.2	20.5	21.6	1.2	1.8	5.1	9.1
Percent Saturation	%	NG	NG	52	49	75	89	95	68	68	103	63	74	52	82	61	43	48	50
Calcium	mg/kg	NG	NG	10.9	2.7	15.6	81.4	414	308	171	26.3	3.7	17.6	232	392	21.8	9.2	6.1	28.3
Magnesium	mg/kg	NG	NG	3.6	1	6.2	26.9	171	131	54.7	11	1.3	15.4	148	234	4.9	2.1	1.6	8.8
Sodium	mg/kg	NG	NG	12	19	73	130	1380	1210	818	718	55	766	1170	1990	19	16	38	153
Potassium	mg/kg	NG	NG	4	<1	3	7	25	12	7	<10	<1	<7	9	20	<1	<1	<1	<1
Chloride	mg/kg	NG	NG	5	5	4	4	276	122	76	42	6	<1	<10	61	6	4	7	1
Sulfate (as SO4)	mg/kg	NG	NG	6.9	5.8	23	162	1330	1210	721	462	44.2	1510	3560	6040	53.7	27.9	13	286
Sulfate (as S)	mg/kg	NG	NG	-	-	-	-	-	-	-	-	14.7	502	1190	2010	17.9	9.3	4.4	95.2
Moisture	%	NG	NG	13.2	13.5	19.4	20.4	27	21.7	16	14.6	9.71	9.19	7.56	11	9.37	5.42	7.41	7.44
Other																			
Cation Exchange Capacity (CEC)	meq/100g	NG	NG	33	32	27	36	34	27	18	14	22	19	14	21	25	13	20	20
Nitrate (as N)	mg/kg	NG	NG	2	<2	2	<2	<2	<2	<2	<2	2	<2	<2	2	<2	<2	<2	<2
Sulfur (Total)	%	NG	NG	0.02	0.01	0.01	0.05	0.3	0.16	0.08	0.06	0.04	0.03	0.28	0.34	0.03	0.01	0.02	0.01
Sulfur (Elemental)	mg/kg	500	NG	<20	<20	<20	<20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Total Organic Carbon (TOC)	%	NG	NG	2.92	0.68	0.56	0.45	5.85	1.84	0.33	0.16	3.71	1.09	0.48	0.36	3.84	0.89	0.66	0.44
Organic Matter	%	NG	NG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																			
Antimony (Sb)	mg/kg	20	40	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	17	26	5.6	7.8	9.4	12.2	5.3	6.9	6.6	6.4	3.5	6	6.4	9.2	4.2	4.6	6.1	6.5
Barium (Ba)	mg/kg	750	2000	162	146	428	660	191	256	254	204	124	181	113	196	172	109	100	133
Barium (Ba) - Extractable	mg/kg	260	-	35.4	26.8	36.4	20.6	3.8	2.5	4.3	7.1	29	5.5	1.4	1.3	43.4	28.5	24.5	12.6
Beryllium (Be)	mg/kg	5	8	0.6	0.9	0.8	0.8	0.5	0.7	0.6	0.5	0.4	0.7	0.5	0.8	0.4	0.4	0.6	0.6
Boron (B) - hot water soluble	mg/kg	2 [2]	-	1.1	0.8	0.6	0.7	4.4	4.1	1.6	1	1.04	0.63	0.61	0.63	1.11	0.5	0.76	0.41
Boron (B) - saturated paste [3]	mg/L	3.3	5	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (Cd)	mg/kg	1.4	22	0.29	0.06	0.19	0.15	0.58	0.43	0.35	0.22	0.22	0.18	0.12	0.13	0.26	0.06	0.05	0.07
Hexavalent Chromium (Cr+6)	mg/kg	0.4	87	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium (Cr), total	mg/kg	64	1.4	19.7	31.7	28.7	27.7	18	24	26.9	24.7	10.3	20.7	13.8	16.2	12.9	14.1	19.5	17.9
Cobalt (Co)	mg/kg	20	300	10	18.5	11.4	11.3	9.6	13.2	8.9	8.8	5.8	11.6	7	8.4	8	8.1	9.6	8.2
Copper (Cu)	mg/kg	63	91	16	16	22	25	36	18	16	14	9.4	10.6	11.3	15.2	11.8	7.1	13.8	17.2
Lead (Pb)	mg/kg	70	600	11.7	11.5	12	14	12.1	10.4	8.7	8.2	7.9	9.3	7	9.4	10.4	7.4	8	8
Mercury (Hg)	mg/kg	6.6	50	0.03	0.05	0.06	0.07	0.06	0.04	0.04	0.04	0.02	0.03	0.04	0.03	0.03	<0.01	0.03	0.04
Molybdenum (Mo)	mg/kg	4	40	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	mg/kg	45	89	16.8	22.1	35.3	28.8	22.2	26.6	27.3	26.2	8.5	19.3	21.1	22.3	15.7	12.8	20.8	24.8
Selenium (Se)	mg/kg	1	2.9	0.4	0.8	0.3	<0.3	0.6	0.5	0.4	0.3	<0.3	0.7	0.6	0.7	0.6	0.4	0.6	0.8
Silver (Ag)	mg/kg	20	40	0.3	0.2	0.2	0.1	0.6	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Thallium (Tl)	mg/kg	1	1	0.19	0.27	0.26	0.25	0.18	0.23	0.24	0.23	0.1	0.21	0.17	0.16	0.14	0.15	0.18	0.18
Tin (Sn)	mg/kg	5	300	1	1	<1	<1	2	1	1	1	<1.0	<1.0	<1.0	<1.0	1.1	1.4	1.1	1.1
Uranium	mg/kg	23	300	1.2	2	1.2	1.4	3.3	2	1	1.4	0.8	1.1	0.6	1.2	0.7	0.5	1	1.1
Vanadium (V)	mg/kg	130	130	38	56.3	51.1	50.1	32.6	47.3	48.5	42.9	21.3	35.9	25.4	29.9	26.3	26.5	33.8	32
Zinc (Zn)	mg/kg	250	410	68	58	65	74	89	70	62	49	60	65	40	55	57	39	46	48
Grain Size																			
>75µm	%	NG	NG	32.8	34.1	15.5	14.6	29.9	32.1	25.2	34	32.7	22.8	49.3	38.8	33.7	35.9	41.2	40.3
Grain Size	N/A	NG	NG	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
Soil Texture																			
Sand	%	NG	NG	37.2	35.6	31.2	23.6	30.4	30	33.4	32.4	44.6	33	50	44.6	39.4	39	43	45
Silt	%	NG	NG	39.2	28.4	23.2	23.8	37.6	34.4	30.6	36.6	39.4	36.4	22.4	18.8	38.6	37.4	23.8	24.4
Clay	%	NG	NG	23.6	36	45.6	52.6	32	35.6	36	31	16	30.6	27.6	36.6	22	23.6	33.2	30.6
Texture	N/A	NG	NG	Loam	Clay Loam	Clay	Clay	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Loam	Clay Loam	Sandy Clay Loam	Clay Loam	Loam	Loam	Clay Loam	Sandy Clay Loam

Notes:

[1] Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelir
Referenced guidelines are for fine textured soils under agricultural land use.

[2] Hot water soluble boron guideline from the 2014 Alberta Tier 1 Soil and Groundwater Remediation Guic

[3] Saturated paste boron data shown for boreholes 14-1 and 14-2 was collected in 2019.

** AENV. 2001. Salt Contamination Assessment and Remediation Guidelines. Pub. No.: T/606. ISBN:

NG - No guideline

BOLD - Exceeds Tier 1 agricultural guideline

BOLD - Exceeds Tier 1 industrial guideline

"-" Not analyzed

Table 11: 2019 Soil Analytical Results: Quality Assurance / Quality Control

Parameter	Unit	Detection Limit	19-15		Relative Percent Difference		14-2		Relative Percent Difference		14-2		Relative Percent Difference		19-10		Relative Percent Difference		19-16		Relative Percent Difference		19-3		Relative Percent Difference		19-4A		Relative Percent Difference		19-4E		Relative Percent Difference	
			Duplicate 1	0-15	%RPD	P/F	Duplicate 2	0-15	%RPD	P/F	Duplicate 3	30-60	%RPD	P/F	Duplicate 4	0-15	%RPD	P/F	Duplicate 5	0-15	%RPD	P/F	Duplicate 6	0-15	%RPD	P/F	Duplicate 7	15-30	%RPD	P/F	Duplicate 8	60-100	%RPD	P/F
Laboratory Identification Number			1379633-29	1379633-17			1379633-30	1032350-52			1379633-31	1032350-78			1379633-32	1379633-13			1379633-33	1379633-21			1381283-49	1381283-1			1381283-50	1381283-26			1381283-51	1381283-44		
Salinity																																		
pH	pH Units	0.1	7.2	7.2	0.0	P	-	-	-	-	-	-	-	-	6.8	7	-2.9	P	7.7	7.6	1.3	P	7.9	7.2	9.3	P	7.6	7.6	0.0	P	7.7	7.7	0.0	P
Electrical Conductivity (EC)	dS/m	0.01	1.95	1.62	18.5	P	-	-	-	-	-	-	-	-	2.21	2.06	7.0	P	4.6	2.91	45.0	P	**1.21**	**0.64**	**61.6**	**F**	7.17	6.44	10.7	P	5.86	5.83	0.5	P
Sodium Absorption Ratio (SAR)	N/A	0.1	11.9	10.9	8.8	P	-	-	-	-	-	-	-	-	7.9	8.2	-3.7	P	11.1	12	-7.8	P	6.6	4.1	46.7	P	15.3	17.4	-12.8	P	10.9	10.9	0.0	P
Percent Saturation	%	0.1	69	63	9.1	P	63	69	-9.1	P	61	56	8.5	P	61	66	-7.9	P	97	96	1.0	P	54	61	-12.2	P	69	74	-7.0	P	62	58	6.7	P
Calcium	mg/kg	0.2	36.1	28.8	22.5	P	-	-	-	-	-	-	-	-	67.2	61	9.7	P	**312**	**117**	**90.9**	**F**	27.6	19.4	34.9	P	316	234	29.8	P	279	274	1.8	P
Magnesium	mg/kg	0.2	13	10.2	24.1	P	-	-	-	-	-	-	-	-	27	25	7.7	P	80	34	80.7	F	8.1	5.1	45.5	P	109	92.1	16.8	P	105	105	0.0	P
Potassium	mg/kg		3	4	-28.6	P	-	-	-	-	-	-	-	-	<6	<7	MDL!	P	16	11	37.0	P	5	4	22.2	P	19	18	5.4	P	7	9	-25.0	P
Sodium	mg/kg	1	273	211	25.6	P	-	-	-	-	-	-	-	-	238	246	-3.3	1770	839	554	40.9	P	**112**	**62**	**57.5**	**F**	1030	1070	-3.8	P	665	640	3.8	P
Chloride	mg/kg	2	15	9	50.0	P	-	-	-	-	-	-	-	-	4	5	-22.2	P	21	21	0.0	P	25	24	4.1	P	171	173	-1.2	P	82	83	-1.2	P
Sulfate (as SO4)	mg/kg	3	476	289	48.9	P	-	-	-	-	-	-	-	-	686	641	6.8	P	**2610**	**1370**	**62.3**	**F**	**219**	**52.3**	**122.9**	**F**	2960	2760	7.0	P	2180	2180	0.0	P
Moisture	%	0.1	-	-			-	-	-	-	-	-	-	-	-	-	-	-	20.2	21.6	-6.7	P	11.5	14.4	-22.4	P	-	-	-	-	-	-	-	-
Other																																		
Cation Exchange Capacity (CEC)	meq/100g	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/kg	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2	<2	MDL!	P	-	-	-	-	-	-	-	-
Nitrate and Nitrite (as N)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur (Total)	%	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.1	46.2	P	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur (Elemental)	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon (TOC)	%	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-
Metals																																		
Antimony	mg/kg	0.2	**0.3**	0.3	0.0	P	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.4	0.0	P	0.5	0.8	-46.2	P	-	-	-	-	-	-	-	-
Arsenic	mg/kg	0.2	6.4	6.2	3.2	P	-	-	-	-	-	-	-	-	-	-	-	-	10.5	8.6	19.9	P	7.2	5.9	19.8	P	-	-	-	-	-	-	-	-
Barium (total)	mg/kg	1	131	139	-5.9	P	-	-	-	-	-	-	-	-	-	-	-	-	171	153	11.1	P	165	138	17.8	P	-	-	-	-	-	-	-	-
Beryllium	mg/kg	0.1	0.4	0.5	-22.2	P	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	0.0	P	**0.6**	**0.3**	**66.7**	**F**	-	-	-	-	-	-	-	-
Boron (Saturated Paste)	mg/kg	0.05	0.14	0.15	-6.9	P	<0.5	<0.5	MDL!	P	<0.5	<0.5	MDL!	P	-	-	-	-	<0.5	<0.5	MDL!	P	0.2	0.17	16.2	P	-	-	-	-	-	-	-	-
Cadmium	mg/kg	0.01	0.25	0.26	-3.9	P	-	-	-	-	-	-	-	-	-	-	-	-	0.23	0.25	-8.3	P	**0.18**	**0.38**	**-71.4**	**F**	-	-	-	-	-	-	-	-
Chromium	mg/kg	0.5	13.7	13.3	3.0	P	-	-	-	-	-	-	-	-	-	-	-	-	15.3	13.2	14.7	P	19.3	25.6	-28.1	P	-	-	-	-	-	-	-	-
Chromium (hexavalent)	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.06	0.07	-15.4	P	<0.05	0.05	MDL!	P	-	-	-	-	-	-	-	-
Cobalt	mg/kg	0.1	6.5	7.1	-8.8	P	-	-	-	-	-	-	-	-	-	-	-	-	9.4	7.7	19.9	P	8.3	6.6	22.8	P	-	-	-	-	-	-	-	-
Copper	mg/kg	1	13.9	14.4	-3.5	P	-	-	-	-	-	-	-	-	-	-	-	-	18.1	16.4	9.9	P	14.7	17	-14.5	P	-	-	-	-	-	-	-	-
Lead	mg/kg	0.1	10	10.4	-3.9	P	-	-	-	-	-	-	-	-	-	-	-	-	12.4	12.4	0.0	P	**8.3**	**16.4**	**-65.6**	**F**	-	-	-	-	-	-	-	-
Mercury	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	0.1	0.09	10.5	P	-	-	-	-	-	-	-	-
Molybdenum	mg/kg	1	1.6	2	-22.2	P	-	-	-	-	-	-	-	-	-	-	-	-	2.3	2.6	-12.2	P	**3.6**	**6.9**	**-62.9**	**F**	-	-	-	-	-	-	-	-
Nickel	mg/kg	0.5	15.9	17.2	-7.9	P	-	-	-	-	-	-	-	-	-	-	-	-	25.2	20.6	20.1	P	36.2	32.9	9.6	P	-	-	-	-	-	-	-	-
Selenium	mg/kg	0.3	0.5	0.6	-18.2	P	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.6	0.0	P	<0.3	<0.3	MDL!	P	-	-	-	-	-	-	-	-
Silver	mg/kg	0.1	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.1	<0.1	MDL!	P	<0.1	0.2	MDL!	P	-	-	-	-	-	-	-	-
Thallium	mg/kg	0.05	0.12	0.11	8.7	P	-	-	-	-	-	-	-	-	-	-	-	-	0.17	0.16	6.1	P	0.12	0.13	-8.0	P	-	-	-	-	-	-	-	-
Tin	mg/kg	1	<1	<1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	MDL!	P	<1	<1	MDL!	P	-	-	-	-	-	-	-	-
Uranium	mg/kg	0.5	0.9	1	-10.5	P	-	-	-	-	-	-	-	-	-	-	-	-	1.3	1.1	16.7	P	0.9	0.8	11.8	P	-	-	-	-	-	-	-	-
Vanadium	mg/kg	0.1	26.9	30.5	-12.5	P	-	-	-	-	-	-	-	-	-	-	-	-	25.4	24.1	5.3	P	21	33.6	-46.2	P	-	-	-	-	-	-	-	-
Zinc	mg/kg	1	70	74	-5.6	P	-	-	-	-	-	-	-	-	-	-	-	-	86	92	-6.7	P	**60**	**116**	**-63.6**	**F**	-	-	-	-	-	-	-	-
Soil Texture																																		
Sand	%	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41	40	2.5	P	-	-	-	-	-	-	-	-	-	-	-	-
Silt	%	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	30	-3.4	P	-	-	-	-	-	-	-	-	-	-	-	-
Clay	%	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	30	0.0	P	-	-	-	-	-	-	-	-	-	-	-	-
Texture	N/A	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Clay Loam	Clay Loam	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grain Size																																		
>75µm	%	0.1	46.1	34.9	27.7	P	-	-	-	-	-	-	-	-	-	-	-	-	29.5	30.8	-4.3	P	-	-	-	-	-	-	-	-	-	-	-	-
Grain Size	N/A	N/A	Fine-Grained	Fine-Grained	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Fine-Grained	Fine-Grained	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocarbons																					-													
Benzene	mg/kg	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	MDL!	P	<0.005	<0.005	MDL!	P	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	MDL!	P	<0.005	<0.005	MDL!	P	-	-	-	-	-	-	-	-
Xylenes Total	mg/kg	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03	<0.03	MDL!	P	<0.03	<0.03	MDL!	P	-	-	-	-	-	-	-	-
F1 (C6-C10) - BTEX	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	<10	<10	MDL!	P	-	-	-	-	-	-	-	-
F2 (C10-C16)	mg/kg	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	<25	MDL!	P	<25	<25	MDL!	P	-	-	-	-	-	-	-	-
F3 (C16 - C34)	mg/kg	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	MDL!	P	<50	<50	MDL!	P	-	-	-	-	-	-	-	-
F4 (C34 - C50)	mg/kg	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	<100	MDL!	P	<100	<100	MDL!	P	-	-	-	-	-	-	-	-
F4G (C35-C50+)	mg/kg	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	<100	MDL!	P	<100	<100	MDL!	P	-	-	-	-	-	-	-	-
% C50+	%	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	14.9	MDL!	P	<5	<5	MDL!	P	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)																																		
Naphthalene	mg/kg	0.01	<0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	0.01	<0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	0.003	<0.003	<0.003	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.003	<0.003	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	0.01	<0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.018	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	0.01	<0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	**0.018**	**0.01**	**57.1**	**F**	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.01	<0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.01	<0.01	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b+j)fluoranthene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a) pyrene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	mg/kg	0.05	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Index of Additive Cancer Risk-Coarse	n/a	0.001	<0.001	<0.001	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.003	<0.001	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Index of Additive Cancer Risk-Fine	n/a	0.001	<0.001	<0.001	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	0.005	<0.001	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Carcinogenic PAHs (as B(a)P TPE)	mg/kg	0.001	<0.001	<0.001	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-	**0.022**	**0.005**	**125.9**	**F**	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)																																		
Acetone	mg/kg	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	mg/kg	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	MDL!	P	<0.005	<0.005	MDL!	P	-	-	-	-	-	-	-	-
iso-Butanol	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
n-Butanol	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Carbon Disulfide	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Total Cresols (m,p,o)	mg/kg		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Cyclohexanone	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Ethyl Acetate	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	MDL!	P	<0.005	<0.005	MDL!	P	-	-	-	-	-	-	-	-
Ethyl Ether	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Methanol	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
2-Butanone (MEK)	mg/kg	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
2-Nitropropane	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Pyridine	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<10	MDL!	P	-	-			-	-	-	-	-	-	-	-
Toluene	mg/kg	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Total Xylenes (m,p,o)	mg/kg	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03	<0.03	MDL!	P	<0.03	<0.03	MDL!	P	-	-	-	-	-	-	-	-
Total Alberta Landfill Solvent Scan - Soil	mg/kg	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<500	<500	MDL!	P	-	-			-	-	-	-	-	-	-	-

Notes:
MDL! signifies one or both of the duplicate pair were less than the MDL value and RPD was not calculated
Bold signifies greater than 50% RPD or duplicate pair did not meet other criteria set out in Section 4.17 of the report.
Data is presented only where a duplicate sample was analysed.

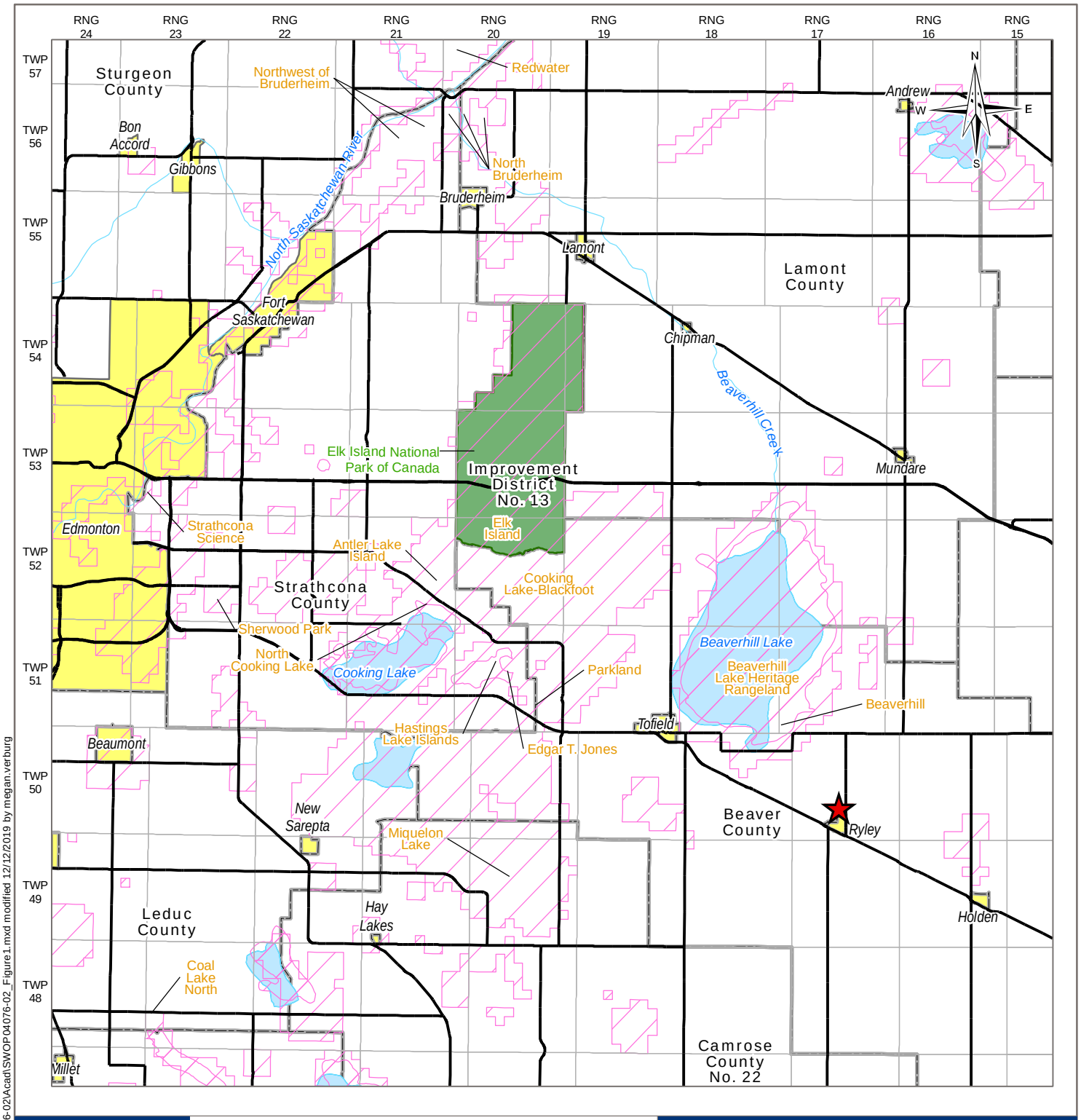
TETRA TECH

Table 11: 2019 Soil Analytical Results: Quality Assurance / Quality Control

Parameter	Unit	Detection Limit	19-15		Relative Percent Difference		14-2		Relative Percent Difference		14-2		Relative Percent Difference		19-10		Relative Percent Difference		19-16		Relative Percent Difference		19-3		Relative Percent Difference		19-4A		Relative Percent Difference		19-4E		Relative Percent Difference	
			Duplicate 1	0-15	%RPD	P/F	Duplicate 2	0-15	%RPD	P/F	Duplicate 3	30-60	%RPD	P/F	Duplicate 4	0-15	%RPD	P/F	Duplicate 5	0-15	%RPD	P/F	Duplicate 6	0-15	%RPD	P/F	Duplicate 7	15-30	%RPD	P/F	Duplicate 8	60-100	%RPD	P/F
Laboratory Identification Number			1379633-29	1379633-17			1379633-30	1032350-52			1379633-31	1032350-78			1379633-32	1379633-13			1379633-33	1379633-21			1381283-49	1381283-1			1381283-50	1381283-26			1381283-51	1381283-44		
Polychlorinated Biphenyls (PCBs)																																		
Aroclor 1016	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1221	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1232	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1242	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1248	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1254	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1260	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1262	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1268	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-	-	-	-	-
Organochlorine Pesticides in Soil																																		
Aldrin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
BHC (alpha isomer)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
BHC (beta isomer)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
BHC (delta isomer)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Captan	mg/kg	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<3	<3	MDL!	P	-	-	-	-	-	-	-	-
Chlorbenside	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Chlordane-cis	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Chlordane-trans	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Chlorfenson	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Chlorothalonil	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Chlorthal-dimethyl	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
DDD-o,p'	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
DDD-p,p'	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
DDE-o,p'	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
DDE-p,p'	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
DDT-o,p'	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
DDT-p,p'	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Dichlofluanid	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Dieldrin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Endosulfan I	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Endosulfan II	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Endosulfan sulfate	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Endrin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Folpet	mg/kg	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<3	<3	MDL!	P	-	-	-	-	-	-	-	-
Heptachlor	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Heptachlor epoxide	mg/kg	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	MDL!	P	-	-	-	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Lindane	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-
Methoxychlor	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-
Mirex	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Permethrin-cis	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Permethrin-trans	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Procymidone	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Propachlor	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Quintozene	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Tecnazene	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Tetradifon	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Tolyfluanid	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Triadimefon	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Vinclozolin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Neutral Herbicides in Soil																																		
Alachlor	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Benfluralin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Butylate	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Chlorpropham	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Diallate	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Dichlobenil	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Diclofop-methyl	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-
Diphenylamine	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Eptam (EPTC)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Ethalfluralin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Fenoxaprop-ethyl	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Fluazifop-p-butyl	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Hexazinone	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Metalaxyl	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Metolachlor	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-
Metribuzin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Pirimicarb	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Profluralin	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Prometryn	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Propazine	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Propyzamide	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Quizalofop-ethyl	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Simetryn	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Terbuthylazine	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Terbutryn	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	MDL!	P	-	-	-	-	-	-	-	-
Triallate	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-
Trifluralin	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	MDL!	P	-	-	-	-	-	-	-	-
Acid Herbicides in Soil																																		
2,4,5-T	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
2,4,5-TP	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
2,4-D	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Bromoxynil	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Clopyralid	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Dicamba	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Dichlorprop	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Dinoseb	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Imazamox	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Imazapyr	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Imazethapyr	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
2-Methyl-4-Chlorophenoxy Butanoic Acid (MCPB)	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Mecoprop	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Picloram	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-
Triclopyr	mg/kg	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	MDL!	P	-	-	-	-	-	-	-	-

Notes:
MDL! signifies one or both of the duplicate pair were less than the MDL value and RPD was not calculated
Bold signifies greater than 50% RPD or duplicate pair did not meet other criteria set out in Section 4.17 of the report.
Data is presented only where a duplicate sample was analysed.

FIGURES



LEGEND

- Site Location
- Primary/Secondary Highway
- Environmentally Significant Area
- National Parks
- Urban Area
- Municipal Area
- Watercourse
- Waterbody

NOTES

Base data source: ESRI, CanVec (50,000), AltaLIS, ESRD & Government of Alberta (Tourism, Parks and Recreation)

2019 SOIL MONITORING PROGRAM RYLEY, ALBERTA

Site Location and Regional Environmental Setting

PROJECTION	DATUM
UTM Zone 12	NAD83

Scale: 1:500,000

10 5 0 10

Kilometres

FILE NO. SWOP04076-02_Figure1.mxd

PROJECT NO.	DWN	CKD	APVD	REV
SWOP04076-02	RG/CF	BS	AS	0

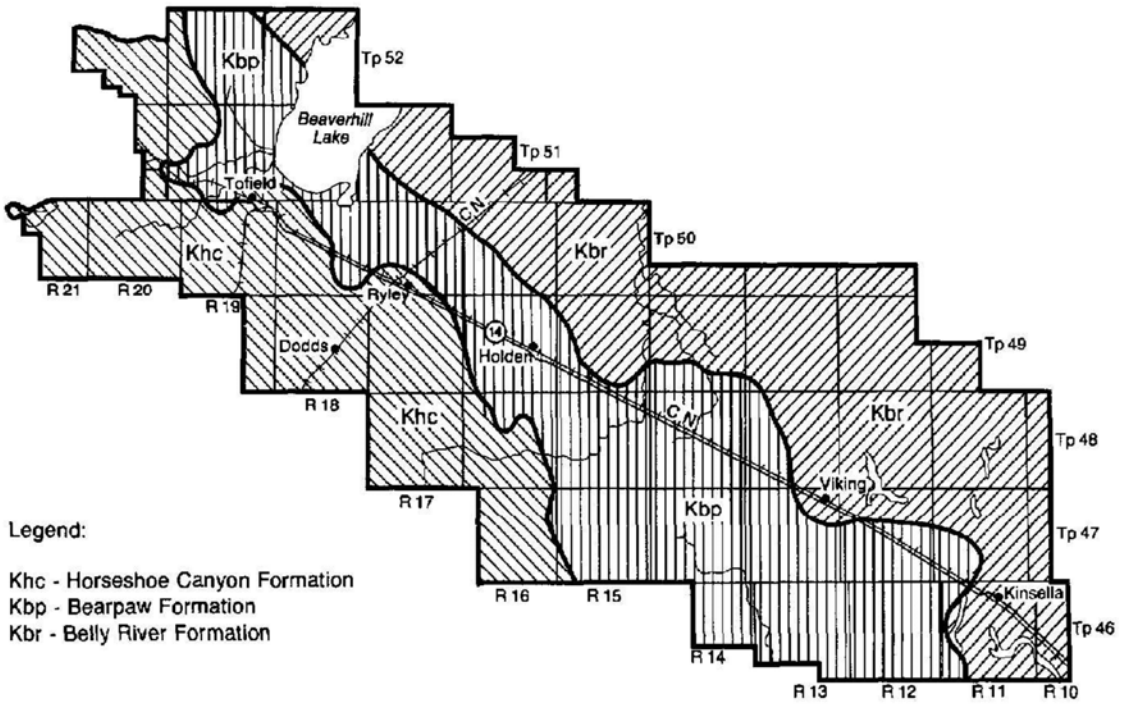
OFFICE	DATE
EDM	January 2020

CleanHarbors

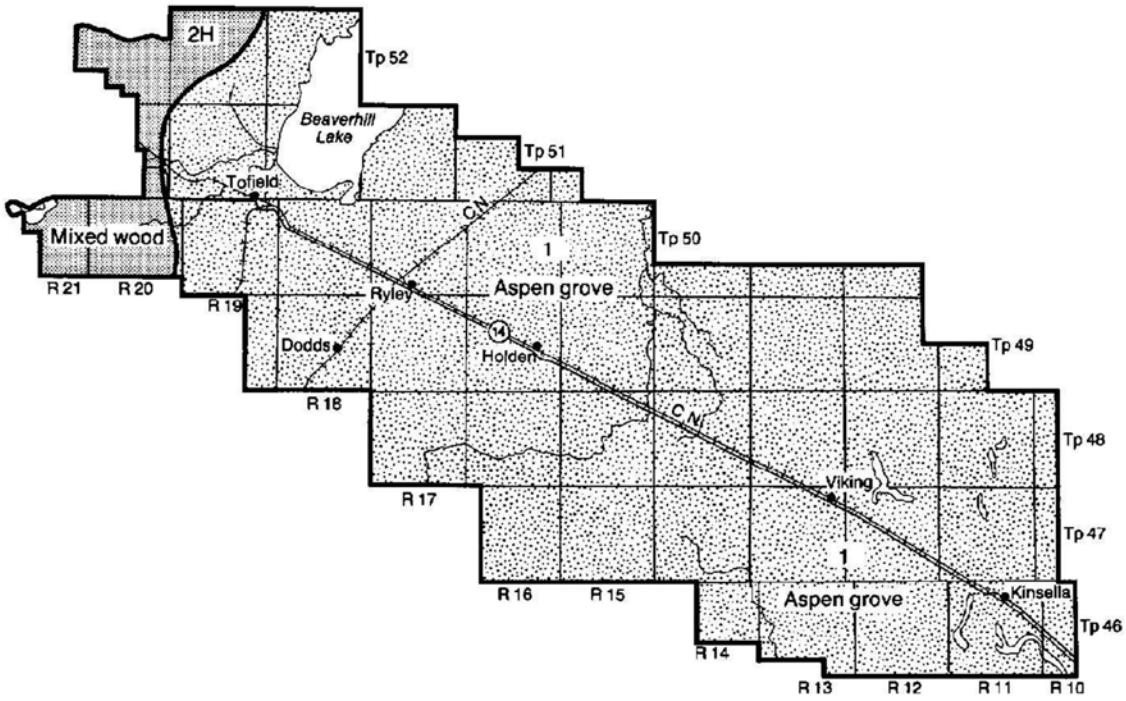
PREPARED BY: TETRA TECH

Figure 1

Q:\Edmonton\Drafting\PROJECTS\704-SWM.SWOP\SWM.SWOP04076-02\Acad\SWOP04076-02_Figure1.mxd modified 12/12/2019 by megan.verburg



Location and extent of bedrock formations in the County of Beaver.



Climatic and vegetation zonation in the County of Beaver.

Note: Figure contents obtain from:
Alberta Soil Survey Report No. 47 1988.
Soil Survey of the County of Beaver, Alberta

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2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

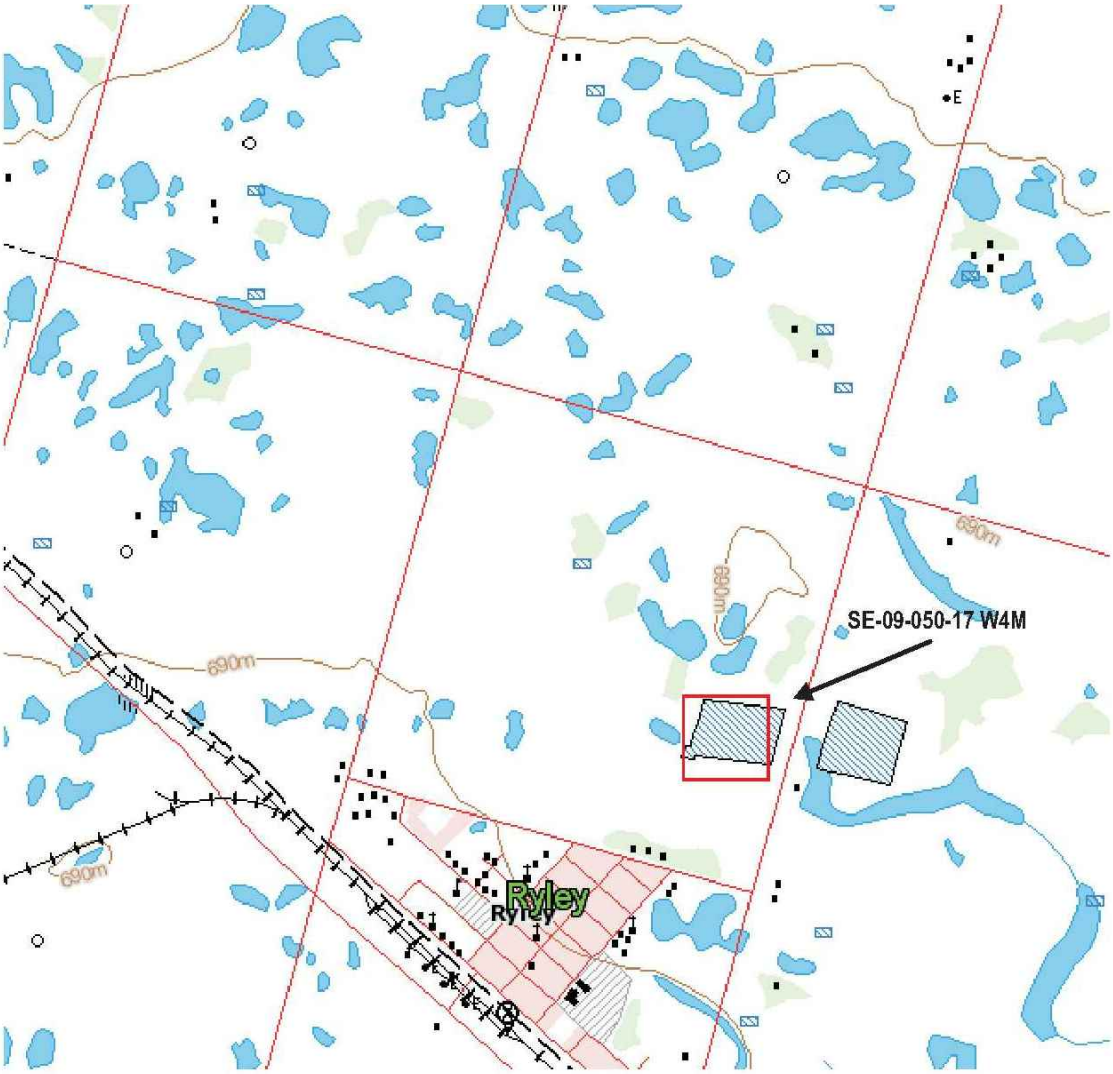
Background Bedrock and Vegetation Information

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	TB/DBD	GC	0

OFFICE	DATE
EDM	January 2020

Figure 2

Q:\Edmonton\Drafting\PROJECTS\704-SWM.SWOP\SWM.SWOP04076-02\Acad\SWOP04076-02_Figures 2-4_7.dwg [FIGURE 2] December 12, 2019 - 6:05:37 pm (BY: VERBURG, MEGAN)



Legend

- Lakes and ponds
- Rivers and streams
- Intermediate contours
- Township lines
- Roads
- Lagoon/Disposal area

Note: Figure contents obtain from:
Toporama - Topographic Maps. Atlas of Canada.
http://atlas.nrcan.gc.ca

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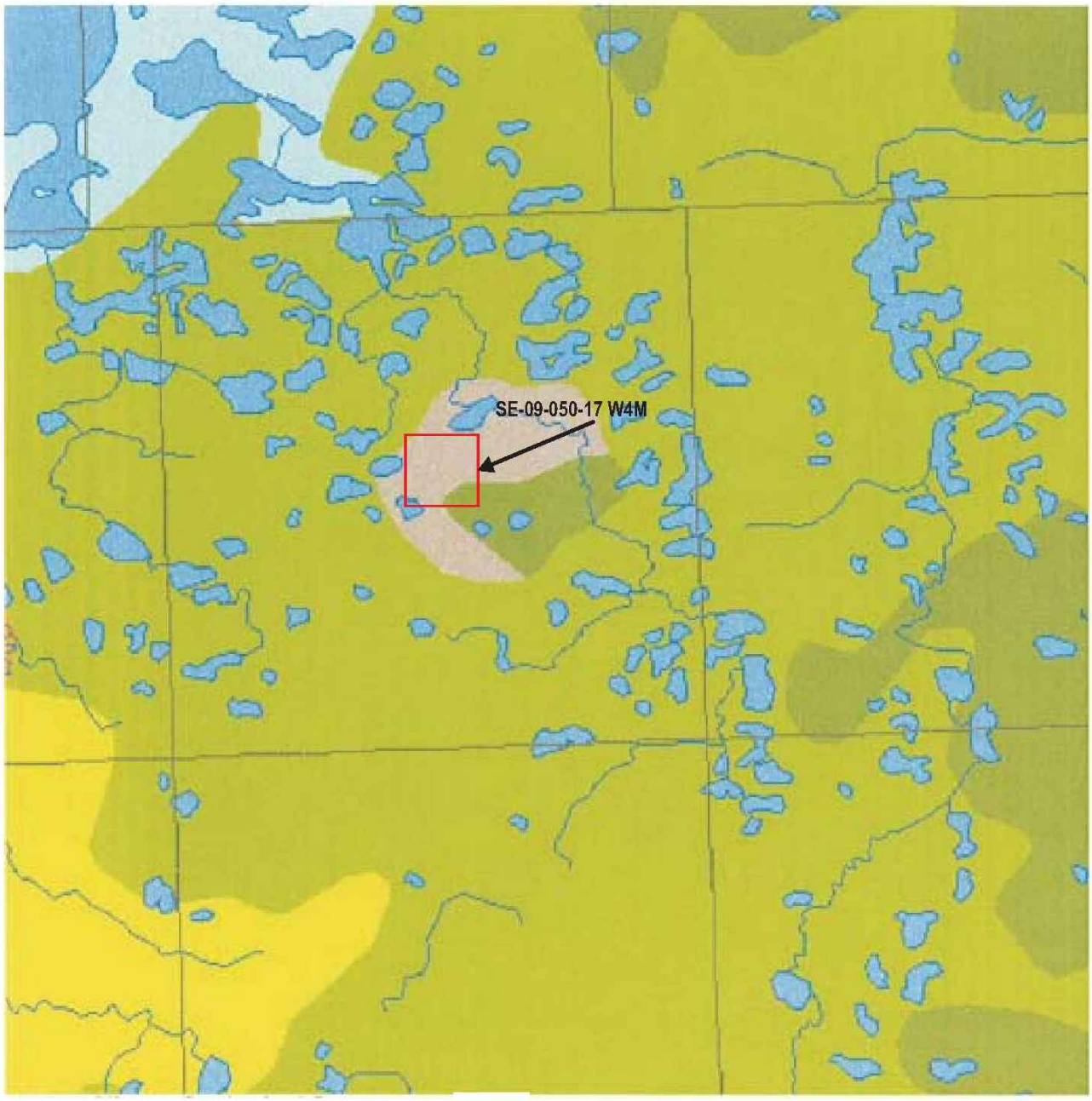
2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Surface Waterbodies and
Regional Topography

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	TB/DBD	GC	0

OFFICE	DATE
EDM	January 2020

Figure 3



Note: Figure contents obtained from:
2008 Alberta Geological Survey - Surface Geology
www.ags.gov.ab.ca

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2019 SOIL MONITORING PROGRAM
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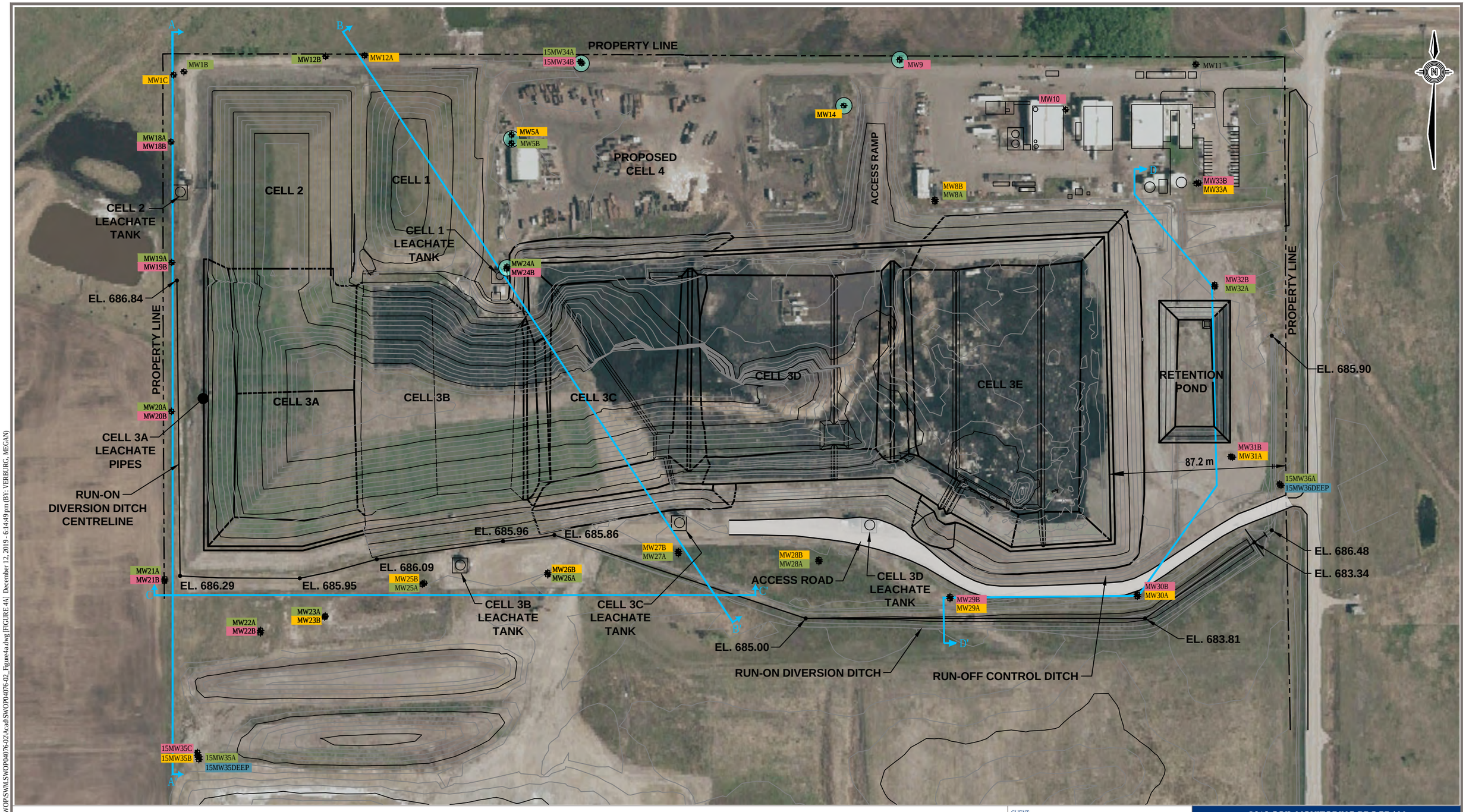
Surficial Geology

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	TB/DBD	GC	0

OFFICE	DATE
EDM	January 2020

Figure 4



LEGEND:

- MONITORING WELL LOCATION
- DECOMMISIONED MONITORING WELLS
- SURFICIAL MATERIALS
- UPPER SANDSTONE
- CLAY SHALE
- LOWER BEDROCK
- CROSS-SECTION LOCATION

0 100 m

Scale: 1: 2 500

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2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

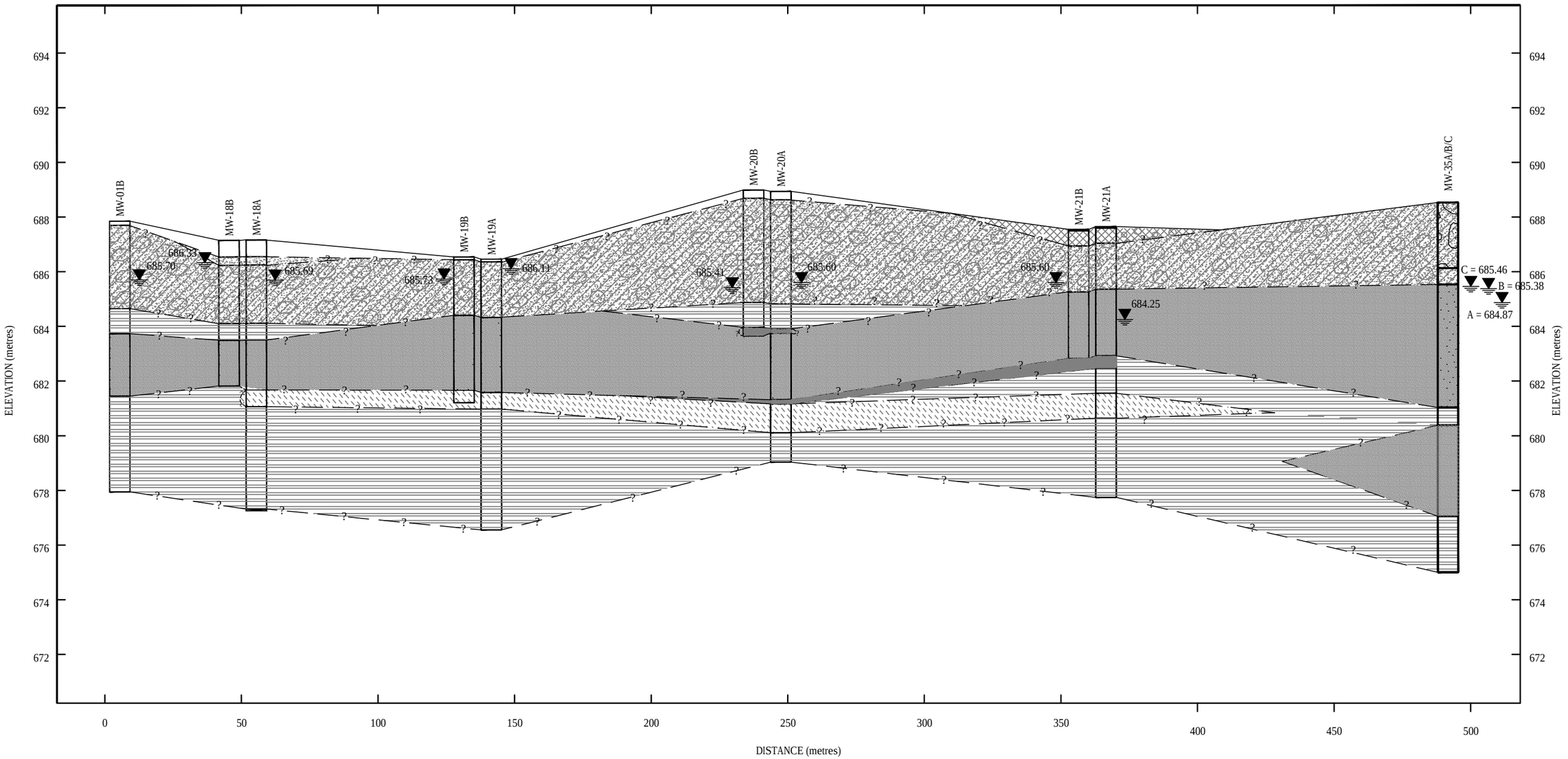
Cross-Section Locations

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	MM/DBD	MF	0
OFFICE: EDM	DATE: January 2020		

Figure 4a

A (NORTH)

A' (SOUTH)



SCALE AS SHOWN

10 X VERTICAL EXAGGERATION

LEGEND:

- TOPSOIL
- SAND
- SHALE
- SAND AND SHALE STONE
- CLAY
- GRAVEL
- SANDSTONE
- FILL
- SILT
- TILL
- SILTSTONE
- xxx.xx - GROUNDWATER ELEVATIONS IN METRES ABOVE SEA LEVEL (MASL)
- ? —— ? —— ? — - INFERRED

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2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Cross-Section A-A'

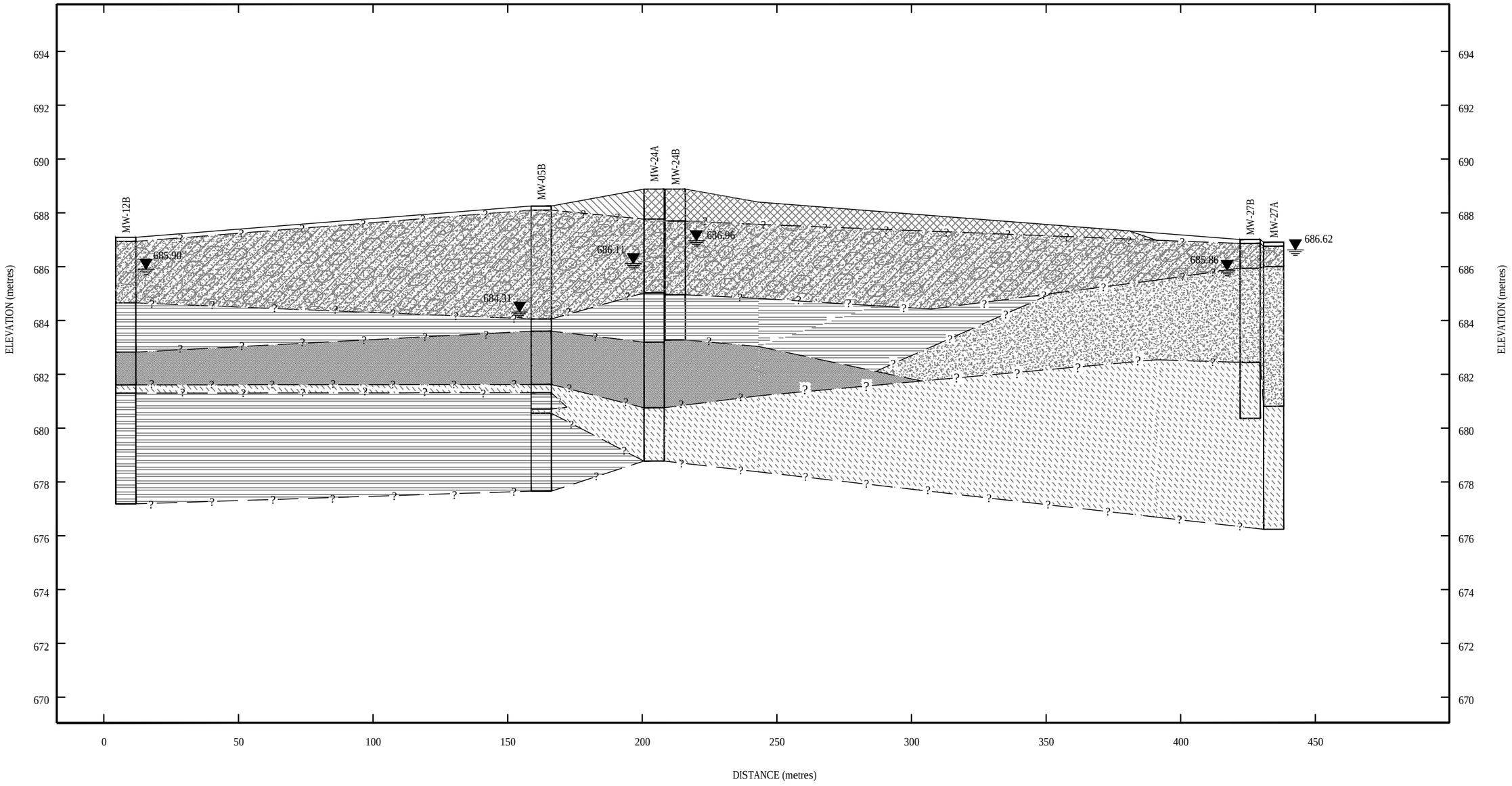
PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	MM/DBD	MF	0

OFFICE	DATE
EDM	January 2020

Figure 4b

B (NORTH-WEST)

B' (SOUTH-EAST)



SCALE AS SHOWN
10 X VERTICAL EXAGGERATION

LEGEND:

- TOPSOIL
- SAND
- SHALE
- SAND AND SHALE STONE
- CLAY
- GRAVEL
- SANDSTONE
- FILL
- SILT
- TILL
- SILTSTONE
- XXX.XX - GROUNDWATER ELEVATIONS IN METRES ABOVE SEA LEVEL (MASL)
- ? —— ? ——? — - INFERRED

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2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Cross-Section B-B'

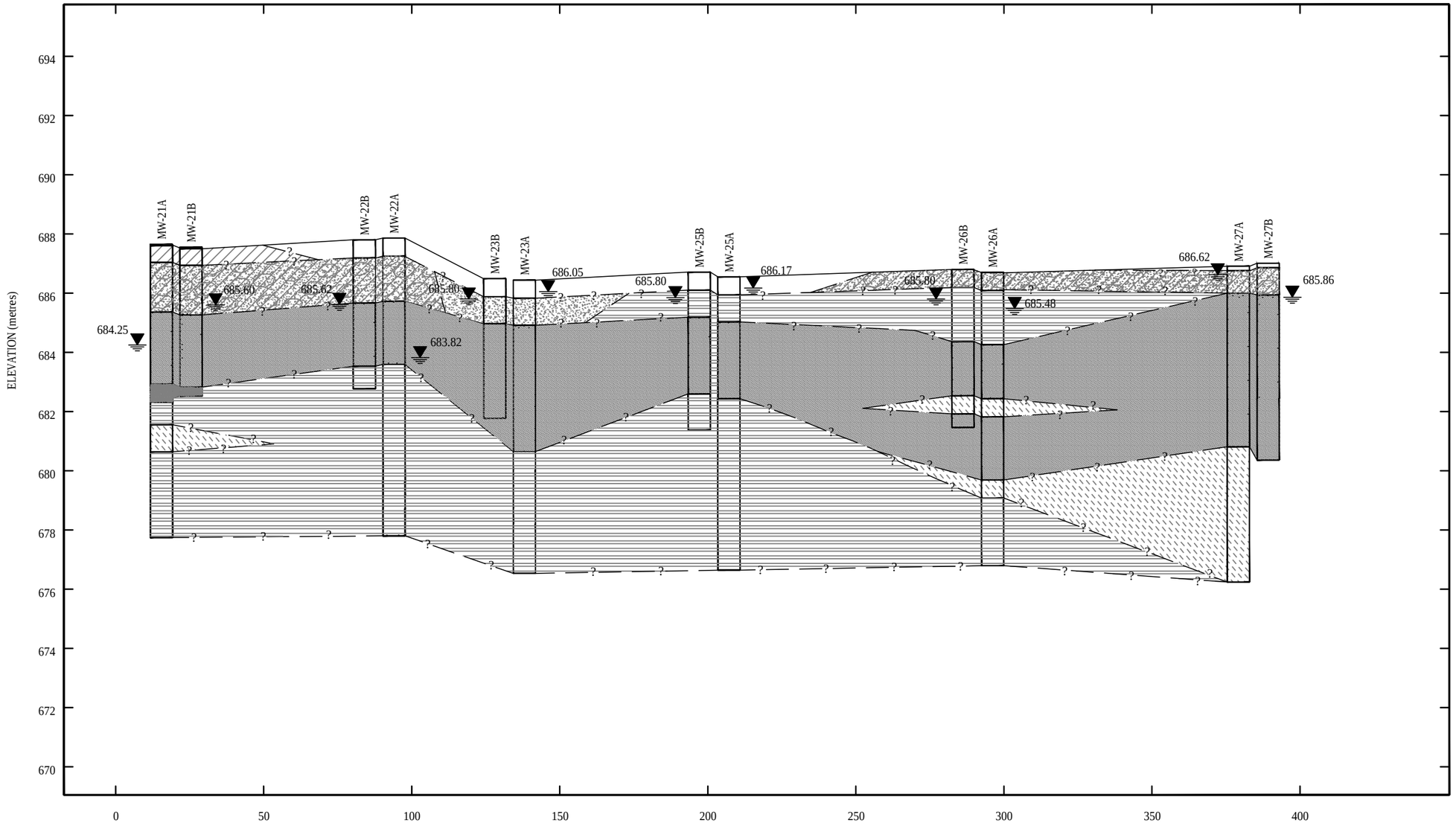
PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	MM/DBD	MF	0
OFFICE: EDM	DATE: January 2020		

Figure 4c

Q:\Edmonton\Drafting\PROJECTS\704-SWM.SWOP\SWM.SWOP04076-02\Acad\SWOP04076-02_Figures 4b-4e.dwg [FIGURE 4C] December 12, 2019 - 6:18:47 pm (BY: VERBURG, MEGAN)

C (WEST)

C' (EAST)



SCALE AS SHOWN
10 X VERTICAL EXAGGERATION

LEGEND:

- TOPSOIL
- SAND
- SHALE
- SAND AND SHALE STONE
- CLAY
- GRAVEL
- SANDSTONE
- FILL
- SILT
- TILL
- SILTSTONE
- xxx.xx - GROUNDWATER ELEVATIONS IN METRES ABOVE SEA LEVEL (MASL)
- ? —— ? ——? — - INFERRED

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2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Cross-Section C-C'

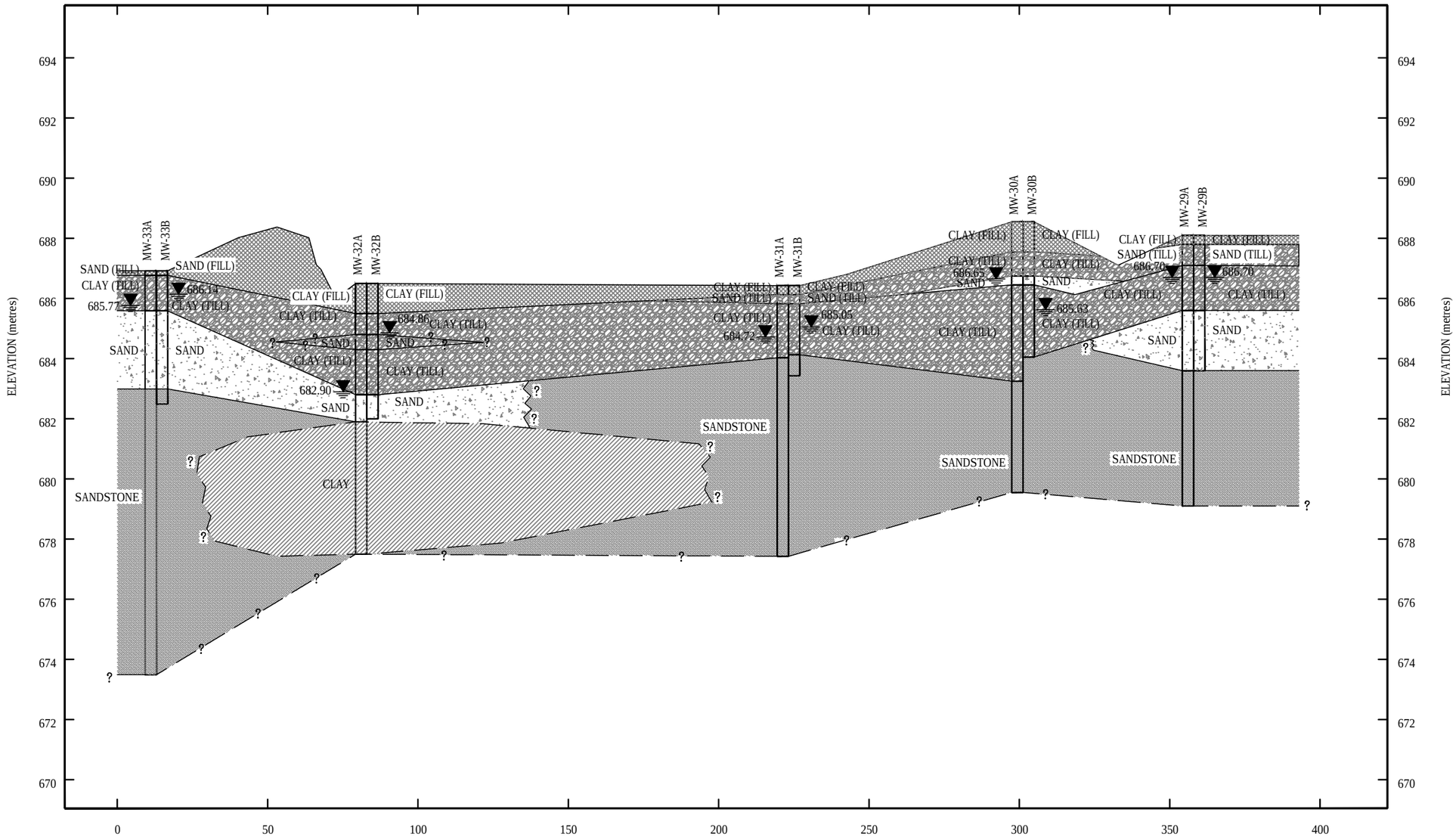
PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	MM/DBD	MF	0

OFFICE	DATE
EDM	January 2020

Figure 4d

D (NORTH)

D' (SOUTH)



SCALE AS SHOWN
10 X VERTICAL EXAGGERATION

LEGEND:

- FILL
- SAND
- CLAY
- SANDSTONE
- TILL
- xxx.xx - GROUNDWATER ELEVATIONS IN METRES ABOVE SEA LEVEL (MASL)
- — ? — ? — ? — - INFERRED

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Clean Harbors

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2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Cross-Section D-D'

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	MM/DBD	MF	0

OFFICE	DATE
EDM	January 2020

Figure 4e

PROPERTY LINE

CELL 2

CELL 1

CELL 4

ACCESS RAMP

CELL 2 LEACHATE TANK

CELL 1 LEACHATE TANK

EL. 686.84

PROPERTY LINE

CELL 3A

CELL 3B

CELL 3C

CELL 3D

CELL 3E

RETENTION POND

PROPERTY LINE

EL. 685.90

87.2 m

CELL 3A LEACHATE PIPES

RUN-ON DIVERSION DITCH CENTRELINE

EL. 686.29

EL. 685.95

EL. 686.09

EL. 685.96

EL. 685.86

CELL 3B LEACHATE TANK

CELL 3C LEACHATE TANK

ACCESS ROAD

CELL 3D LEACHATE TANK

EL. 685.00

RUN-ON DIVERSION DITCH

RUN-OFF CONTROL DITCH

EL. 686.48

EL. 683.34

EL. 683.81

LEGEND:

- ● - 2019 SAMPLE LOCATION
- ● - 2019 SAMPLE LOCATION WITH HISTORICAL GUIDELINE EXCEEDANCES
- → - DRAINAGE DIRECTION

0 100 m

Scale: 1: 2 500

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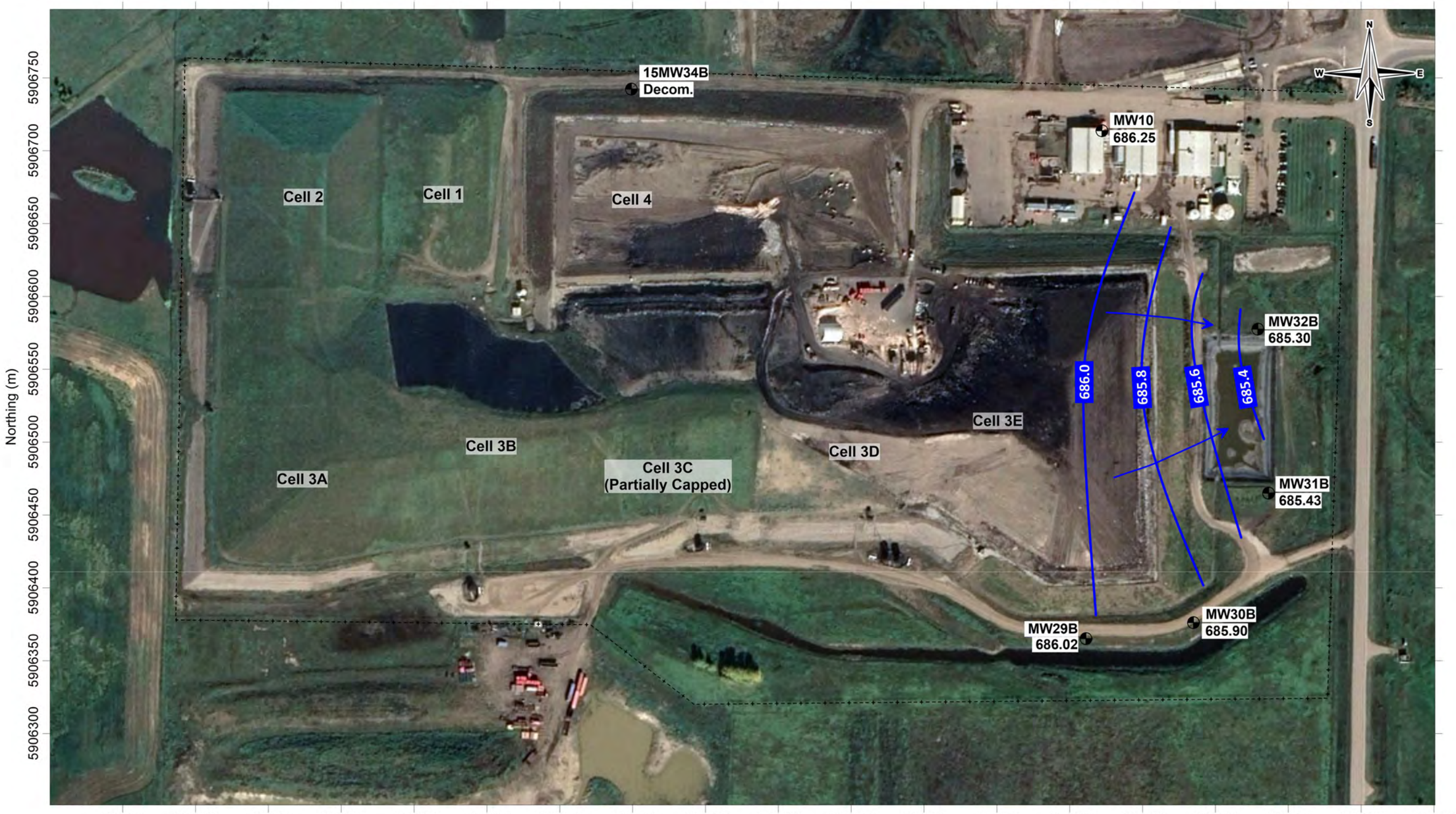
2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Surface Drainage

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	MRV	MF	0
OFFICE: EDM	DATE: January 2020		

Figure 5

Q:\Edmonton\Drafting\PROJECTS\704-SWM.SWOP\SWM.SWOP\04076-02\Acad\SWOP04076-02_Figure5.dwg [FIGURE 5] December 12, 2019 - 6:09:42 pm (BY: VERBURG, MEGAN)



LEGEND

- MONITORING WELL LOCATION
- 686.55 m - GROUNDWATER ELEVATION (MASL = Metres above sea level)
- GROUNDWATER ELEVATION CONTOUR
- INTERPOLATED GROUNDWATER FLOW DIRECTION
- SITE BOUNDARY

Note: Imagery obtained from AbaData, January 2019

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2019 GROUNDWATER MONITORING PROGRAM
RYLEY, AB

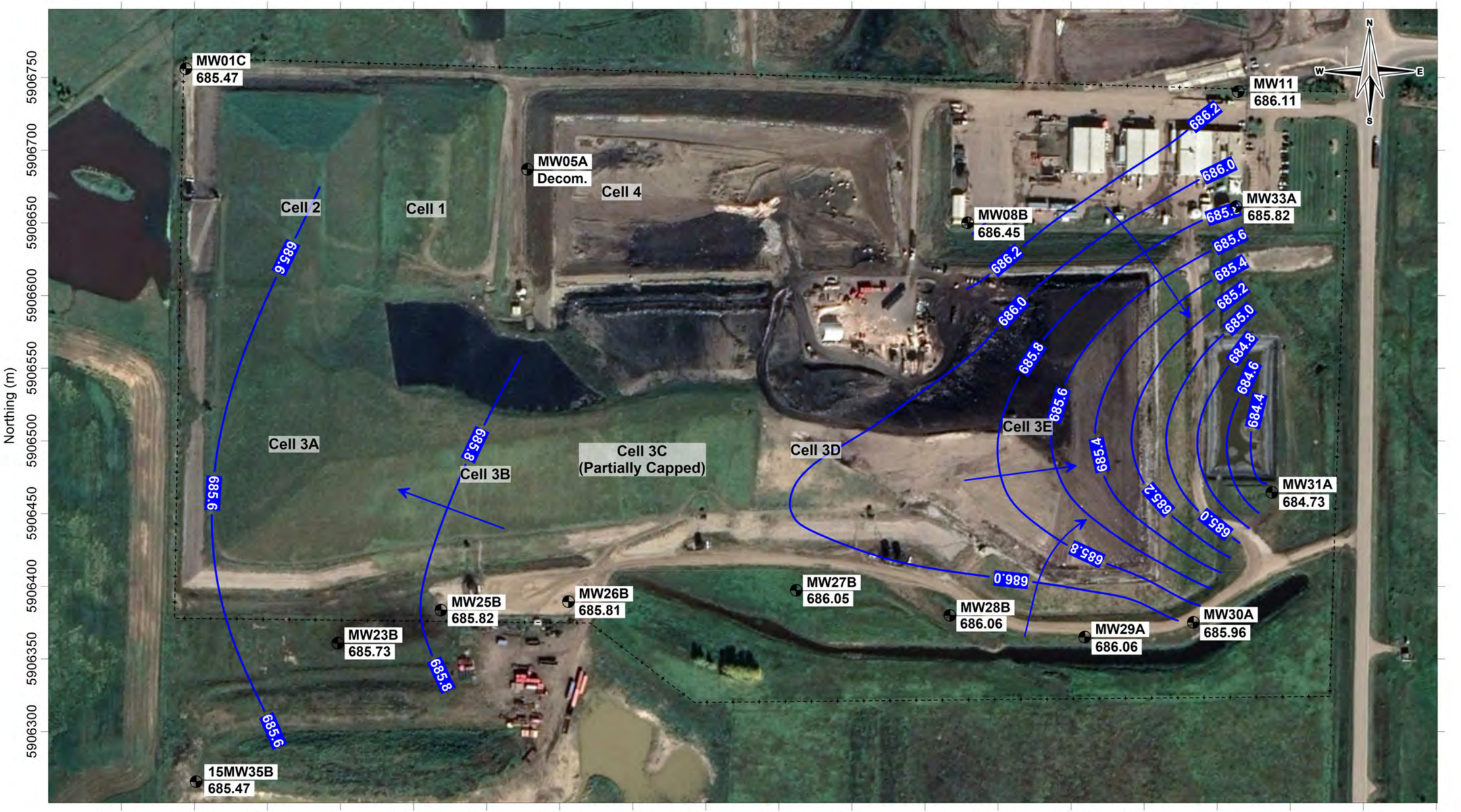
Groundwater Elevation Contours
Surficial Materials - June 12, 2019

PROJECT NO.	DWN	CKD	APVD	REV
SWM.SWOP04117-01	CF	BG	AS	000

OFFICE	DATE	STATUS
TT- EBA - Cal	January 2020	Issued for Review

Figure 6a

filepath:W:\eba\Projects\CGY\78070\SWOP04117-01\Data\Figre 6A - Surficial Materials.srf



LEGEND

- MONITORING WELL LOCATION
- 686.55 m - GROUNDWATER ELEVATION (MASL = Metres above sea level)
- GROUNDWATER ELEVATION CONTOUR
- INTERPOLATED GROUNDWATER FLOW DIRECTION
- SITE BOUNDARY

* Well not included in groundwater elevation contours

Note: Imagery obtained from AbaData, January 2019

CLIENT

CleanHarbors

TETRA TECH

2019 GROUNDWATER MONITORING PROGRAM
RYLEY, AB

Groundwater Elevation Contours
Upper Sandstone - June 12, 2019

PROJECT NO.	DWN	CKD	APVD	REV
SWM.SWOP04117-01	CF	BG	AS	000

OFFICE	DATE	STATUS
TT- EBA - Cal	January 2020	Issued for Review

Figure 6b

filepath:W:\eba\Projects\CGY\78070\SWOP04117-01\Data\Figre 6b - Upper Bedrock.srf

LEGEND

- MONITORING WELL LOCATION
- 2018 INTERPOLATED GROUNDWATER FLOW DIRECTION
- SITE BOUNDARY
- APPROXIMATE EXPANSION AREA

Note: Data from wells 16MW11A and 16MW09A from expansion area was not available in 2019.
Imagery obtained from AbaData, January 2019

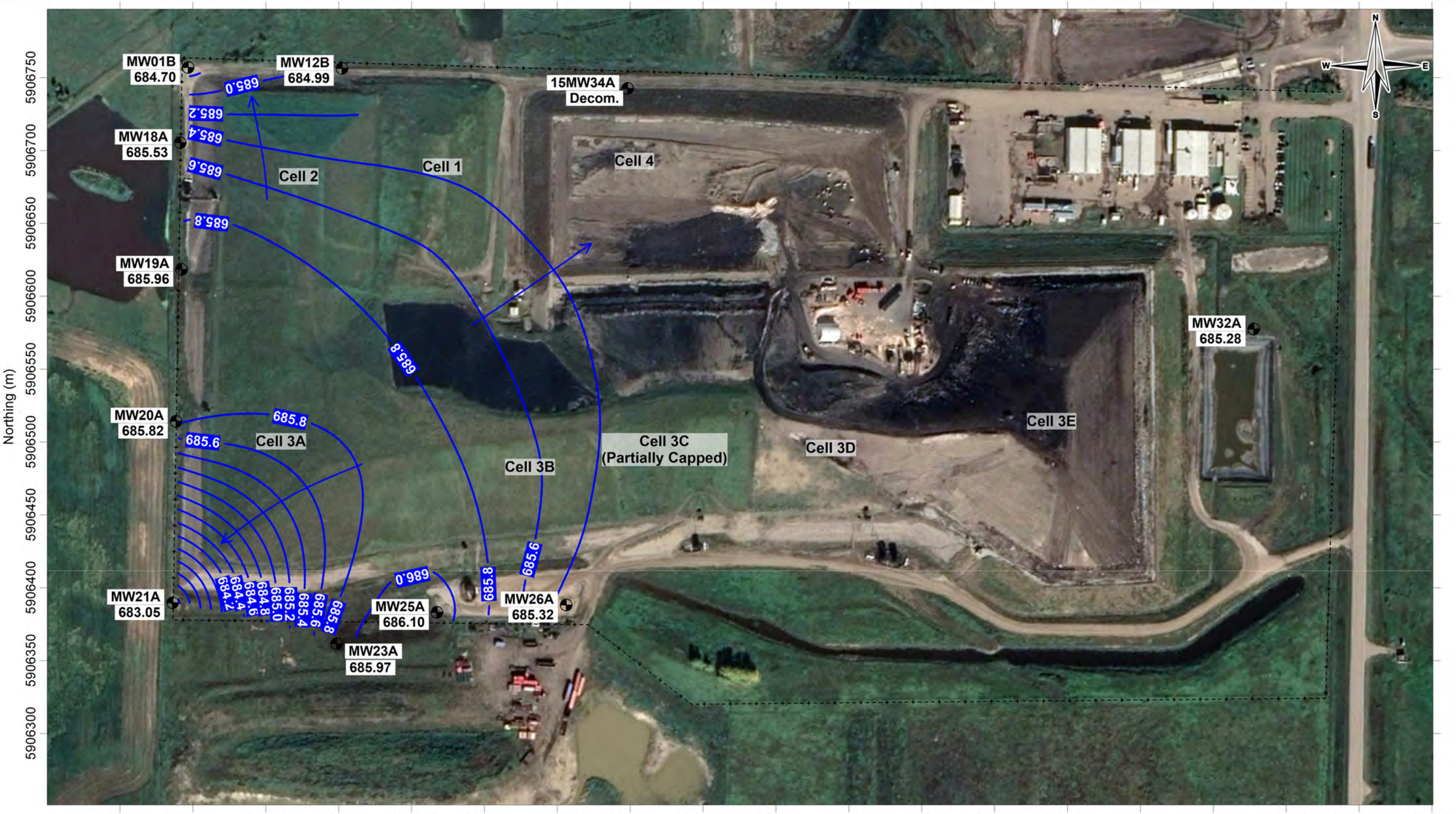
STATUS
Issued for Use

2019 GROUNDWATER MONITORING PROGRAM, RYLEY, ALBERTA

Groundwater Elevation Contours Lower Bedrock - June 12 and 17, 2019

PROJECTION: UTM Zone 12	DATUM: NAD83			CLIENT: CleanHarbors
0 40 80 120 160 Metres				TETRA TECH
FILE NO.: Figure6D - LowerBedrock.srf				
PROJECT NO.: SWM.SWOP04117-01	DWN: CF	CKD: BG	APVD: BG	REV: 0
OFFICE: Tt-CAL	DATE: January 2020			Figure 6d

filepath:W:\eba\Projects\CGY\78070\SWOP04117-01\Data\Figre 6D - LowerBedrock_Portrait.srf



LEGEND

- MONITORING WELL LOCATION
- 686.55 m - GROUNDWATER ELEVATION (MASL = Metres above sea level)
- GROUNDWATER ELEVATION CONTOUR
- INTERPOLATED GROUNDWATER FLOW DIRECTION
- SITE BOUNDARY

Note: Imagery obtained from AbaData, January 2019

CLIENT

CleanHarbors

TETRA TECH

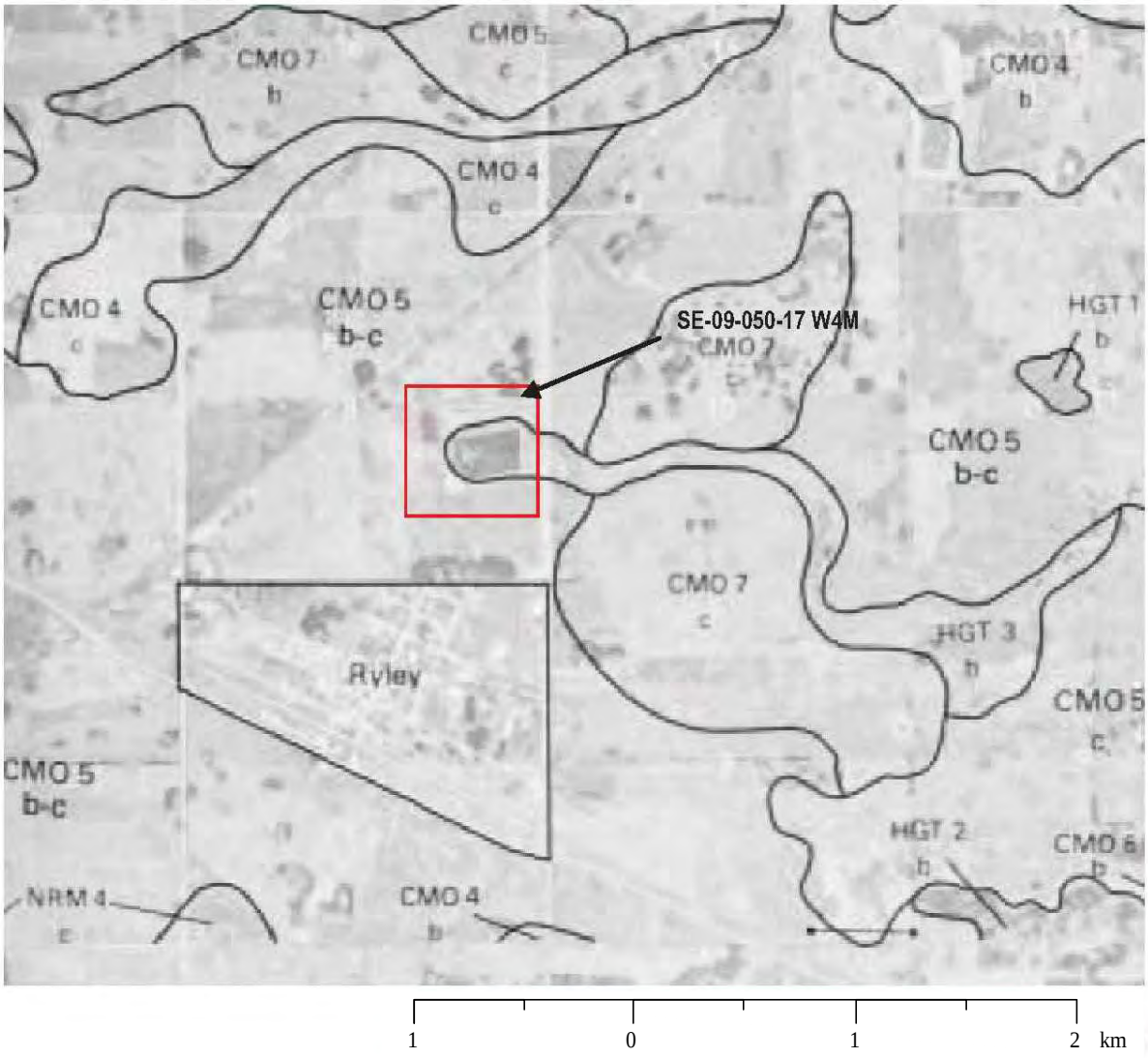
2019 GROUNDWATER MONITORING PROGRAM
RYLEY, AB

Groundwater Elevation Contours
Clay Shale - June 12, 2019

PROJECT NO.	DWN	CKD	APVD	REV
SWM.SWOP04117-01	CF	BG	AS	000
OFFICE: TT - EBA - Cal	DATE: January 2020		STATUS: Issued for Review	

Figure 6c

filepath:W:\eba\Projects\CGY\78070\SWOP04117-01\Data\Figre 6C - MiddleBedrock.srf



CMO 4	Camrose	Fine loamy brown till; undulating to slightly hummocky.	Mostly well-drained, Black Solonetic (Solodized Solonetz and Solod) soils but including some Chernozemic soils and some Gleyed subgroups.
CMO 5	Camrose	Fine loamy brown till; undulating to slightly hummocky with numerous scattered depressions.	Mostly well-drained, Black Solonetzic (Solodized Solonetz and Solod) soils with poorly-drained Humic Gleysols in scattered depressions; also includes some Chernozemic soils and Gleyed subgroups.
CMO 7	Camrose	Mostly fine loamy brown till of variable thickness with some gray till at the surface; undulating to slightly hummocky with numerous scattered depressions.	Mostly well-drained, Black Solonetzic (Solodized Solonetz and Solod) soils with poorly-drained Humic Gleysols in scattered depressions; also includes some Chernozemic soils and Gleyed subgroups.
HGT 3	Haight	Fine clayey glaciolacustrine veneer; mapped in sinuous meltwater channels.	Poorly drained Humic Gleysols with some well and imperfectly drained Black Solonetzic and Chernozemic soils and some saline soils.

Note: Figure contents obtain from:
Alberta Soil Survey Report No. 47 1988.
Soil Survey of the County of Beaver, Alberta
Mosaic 9

CLIENT

Clean Harbors

TETRA TECH

2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Background Soil

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04076-02	TB/DBD	GC	0

OFFICE	DATE
EDM	January 2020

Figure 7

LEGEND

- Historical Background Sample

NOTES
Base data source: Imagery provided by Google Earth; DigitalGlobe (2010)

2019 SOIL MONITORING PROGRAM
RYLEY, ALBERTA

Historical Background Sample Locations

PROJECTION UTM Zone 12			**DATUM** NAD83		**CLIENT** CleanHarbors
Scale: 1:5,000 100 50 0 100 Metres					
FILE NO. SWOP04076-02_Figure8.mxd					TETRA TECH
OFFICE Tt-EDM	**DWN** MRV	**CKD** SL	**APVD** MF	**REV** 0	**Figure 8**
DATE January 2020	**PROJECT NO.** SWM.SWOP04076-02				

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04076-02\Maps\SWOP04076-02_Figure8.mxd modified 1/24/2020 by megan.verburg

404800 404900 405000 405100 405200 405300 405400 405500 405600 405700

5906700 5906600 5906500 5906400 5906300

19-10 19-8 19-6 19-16 19-4A 19-4B 19-4C 19-4 19-4D 19-4E 19-3A 19-3D 19-3B 19-3C 19-3 19-7 19-9 19-14 19-11 Hwy 854 19-15 19-5 19-12 19-13 14-2

N W E S

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04076-02\Maps\SWOP04076-02_001_Figure9.mxd modified 1/24/2020 by megan.verburg

LEGEND

- 2019 Sampling Location
- 2019 Sampling Location with Guideline Exceedence

NOTES
Base data source: Imagery provided by Google Earth; DigitalGlobe (2019)

STATUS
ISSUED FOR USE

2019 SOIL MONITORING PROGRAM RYLEY, ALBERTA

2019 Sampling Locations

PROJECTION UTM Zone 12		**DATUM** NAD83		**CLIENT** CleanHarbors
Scale: 1:2,500 — 50 25 0 50 — Metres				TETRA TECH
FILE NO. SWOP04076-02_001_Figure9.mxd				
OFFICE Tt-EDM	**DWN** MRV	**CKD** SL	**APVD** MF	**REV** 0
DATE January 2020	**PROJECT NO.** SWM.SWOP04076-02			**Figure 9a**

404800 404900 405000 405100 405200 405300 405400 405500 405600 405700

5907100 5907000 5906900 5906800

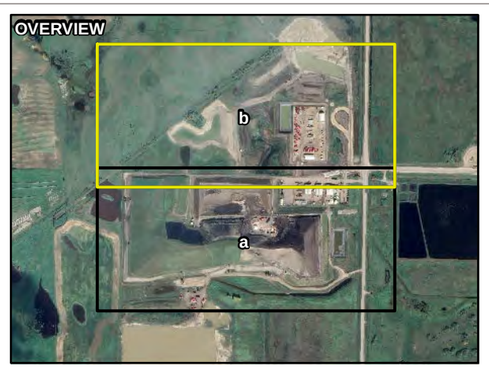
N W E S

Hwy 854

19-2 19-1 19-10 19-8 19-6 19-16 19-4A 19-4B 19-3A 14-1

LEGEND

- 2019 Sampling Location
- 2019 Sampling Location with Guideline Exceedence



NOTES
Base data source: Imagery provided by Google Earth; DigitalGlobe (2019)

STATUS
ISSUED FOR USE

2019 SOIL MONITORING PROGRAM RYLEY, ALBERTA

2019 Sampling Locations

PROJECTION UTM Zone 12		**DATUM** NAD83			**CLIENT** CleanHarbors
Scale: 1:2,500 — 50 25 0 50 Metres					TETRA TECH
FILE NO. SWOP04076-02_001_Figure9.mxd					
OFFICE Tt-EDM	**DWN** MRV	**CKD** SL	**APVD** MF	**REV** 0	**Figure 9b**
DATE January 2020	**PROJECT NO.** SWM.SWOP04076-02				

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04076-02\Maps\SWOP04076-02_001_Figure9.mxd modified 1/24/2020 by megan.verburg

404800 404900 405000 405100 405200 405300 405400 405500 405600 405700

5906700 5906600 5906500 5906400 5906300

19-16
19-10
19-8
19-6
19-9
19-11
19-5
19-12
19-13
19-4A
19-4B
19-4C
19-4
19-4D
19-4E
19-7
19-3A
19-3D
19-3B
19-3C
19-3
19-14
19-15
14-2
Hwy 854

19-8 0-15 cm
Molybdenum
Zinc
Naphthalene
Phenanthrene
19-8 15-30 cm
Molybdenum
Zinc
Naphthalene
19-8 30-60 cm
Molybdenum
Zinc
Chloride

19-6 0-15 cm
Cadmium
Lead
Molybdenum
Nickel
Zinc
Naphthalene
Phenanthrene
19-6 15-30 cm
Molybdenum
Zinc
19-6 30-60 cm
Cadmium
Lead
Molybdenum
Nickel
Zinc
Naphthalene
Chloride
19-6 60-100 cm
Naphthalene

19-3 0-15 cm
Molybdenum

19-3A 0-15 cm
Cadmium
Chromium
Lead
Molybdenum
Nickel
Zinc

19-3B 0-15 cm
Cadmium
Chromium
Cobalt
Copper
Lead
Molybdenum
Nickel
Tin
Zinc
19-3B 15-30 cm
Molybdenum

19-3D 0-15 cm
Cadmium
Chromium
Copper
Lead
Molybdenum
Nickel
Vanadium
Zinc

19-4 0-15 cm
Chloride
19-4 15-30 cm
Chloride

19-4A 0-15 cm
Chloride
19-4A 15-30 cm
Chloride
19-4A 30-60 cm
Chloride

19-4C 15-30 cm
Chloride
19-4C 30-60 cm
Chloride
19-4C 60-100 cm
Chloride

19-4D 30-60 cm
Chloride

19-4E 0-15 cm
Chloride
19-4E 15-30 cm
Chloride

19-7 0-15 cm
Chloride
19-7 15-30 cm
Chloride
19-7 30-60 cm
Chloride
19-7 60-100 cm
Chloride

LEGEND

- 2019 Sampling Location
- 2019 Sampling Location with Guideline Exceedence

NOTES
Base data source: Imagery provided by Google Earth; DigitalGlobe (2019)

2019 SOIL MONITORING PROGRAM RYLEY, ALBERTA

2019 Sampling Locations With Parameters Exceeding Guidelines

PROJECTION: UTM Zone 12	DATUM: NAD83			CLIENT: CleanHarbors
Scale: 1:2,500 (50 25 0 50 Metres)				TETRA TECH
FILE NO.: SWOP04076-02_Figure9.mxd				
OFFICE: Tt-EDM	DWN: MRV	CKD:	APVD: MF	REV: 0
DATE: January 2020	PROJECT NO.: SWM.SWOP04076-02			Figure 10

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APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

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

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

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 persons 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 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

EPEA APPROVAL NO. 10348-03-00

Alberta Environment and Parks

Operations
Regulatory Approvals Centre
5 Floor, South Petroleum Plaza
9915 – 108 Street
Edmonton, Alberta T5K 2G8
Telephone: (780) 427-6311
Fax: (780) 422-0154
www.aep.alberta.ca

April 19, 2017

Michael Parker
Vice President, Canadian Environmental Compliance
Clean Harbors Canada, Inc.
4090 Telfer Road RR#1
Corunna ON NON 1G0

Dear Mr. Parker:

Re: Ryley Hazardous Waste Storage Facility and Landfill
Application No. 014-10348

Your application for a renewal of an existing approval under the *Environmental Protection and Enhancement Act* (EPEA) has been reviewed and enclosed is Approval No. 10348-03-00.

It is your responsibility to obtain any approvals, permits or licences that are required from other agencies.

The Act may provide the approval holder a right of appeal against any term or condition contained in the approval to the Alberta Environmental Appeals Board. You should note that there are strict time lines for filing an appeal dependent on the type of appeal. If you choose to appeal, please contact the office of the Registrar of Appeals, Environmental Appeals Board of Alberta, 3rd Floor, 10011 - 109 Street, Edmonton, Alberta, T5J 3S8, telephone (780) 427-6207.

If you have any questions, please contact me at (780) 415-2201 in Edmonton.

Yours truly,

A Vawter

Annette Vawter
Application Coordinator

Enclosure

cc: Weiguo Wu, Red Deer/North Saskatchewan Region - Edmonton
cc: Tetra Tech EBA Inc.
Attention: J. Paul Ruffell

Alberta Environment and Parks

APPROVAL

PROVINCE OF ALBERTA

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
R.S.A. 2000, c.E-12, as amended.

APPROVAL NO. 10348-03-00

APPLICATION NO. 014-10348

EFFECTIVE DATE: March 31, 2017

EXPIRY DATE: March 31, 2027

APPROVAL HOLDER: Clean Harbors Canada, Inc.

ACTIVITY: **CONSTRUCTION, OPERATION AND RECLAMATION OF THE**

Ryley Industrial Waste Management Facility, consisting of a Class I and Class II Industrial Landfill and a Hazardous Waste/Recyclable Storage and Processing Facility,

IS SUBJECT TO THE ATTACHED TERMS AND CONDITIONS.

Designated Director under the Act .....
Mohammad Habib, P. Eng.

Date Signed March 31, 2017

TERMS AND CONDITIONS ATTACHED TO APPROVAL

PART 1: DEFINITIONS

SECTION 1.1: DEFINITIONS

1.1.1 All definitions from the Act and the regulations apply except where expressly defined in this approval.

1.1.2 In all PARTS of this approval:

(a) "Act" means the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c.E-12, as amended;

(b) "action leakage rate" means the leakage rate that would occur through the primary liner, based on two holes per hectare, each with a diameter of 2 mm and that is calculated to be 790L/ha/day;

(c) "active landfill area" means the portion of the landfill that has received or is receiving waste for disposal, where final cover has not been placed, and includes areas that are being used for interim management of waste prior to disposition;

(d) "active landfill life" means the period of landfill life during which waste is received for disposal at the landfill, beginning with the initial receipt of waste and ending with the start of final landfill closure activities;

(e) "AER" means Alberta Energy Regulator;

(f) "affected lands" means lands which have received substances released from the facility;

(g) "air effluent stream" means any substance in a gaseous medium released by or from a facility;

(h) "APEGA" means the Association of Professional Engineers and Geoscientists of Alberta;

(i) "application" means the written submissions from the approval holder to the Director in respect of application No. 014-10348 and any subsequent applications where amendments are issued for this approval;

(j) "application No. 005-10348" means the written submissions from the approval holder to the Director in respect of renewal application No. 005-10348;

(k) "application No. 008-10348" means the written submissions from the approval holder to the Director in respect of amendment application No. 008-10348;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(l) "application No. 012-10348" means the written submissions from the approval holder to the Director in respect of amendment application No. 012-10348;

(m) "as-built plans" means survey plans, signed and stamped by a professional registered with APEGA, that document variances from design or construction plans that were either approved or authorized according to the terms and conditions of this approval;

(n) "BTEX" means benzene, toluene, ethylbenzene and xylene;

(o) "COD" means Chemical Oxygen Demand;

(p) "composite liner" means a liner that meets the specifications in 3.1.2(b) of this approval;

(q) "container" means any portable device in which a substance is kept, including but not limited to the following:

(i) drums, barrels and pails which have a capacity greater than 18 litres but less than 210 litres,

(ii) 320 litre overpack drums, and

(iii) 1000 litre tote tanks or sacks;

(r) "cover" means soil or other approved material that is used to cover compacted wastes in a landfill cell;

(s) "day", when referring to sampling, means any sampling period of 24 consecutive hours;

(t) "decommissioning" means the dismantling and decontamination of the facility undertaken subsequent to the termination or abandonment of any activity or any part of any activity regulated under the Act, excluding the landfill cells and those infrastructure components and facilities that are required for the landfill post-closure;

(u) "decontamination" means the treatment or removal of substances from the facility and affected lands;

(v) "Director" means an employee of the Government of Alberta designated as a Director under the Act;

(w) "dismantling" means the removal of buildings, structures, process and pollution abatement equipment, vessels, storage facilities, material handling

TERMS AND CONDITIONS ATTACHED TO APPROVAL

facilities, railways, roadways, pipelines and any other installations that are being or have been used or held for or in connection with the facility;

(x) "DOC" means Dissolved Organic Carbon;

(y) "domestic wastewater" means wastewater that is the composite of liquid and water-carried wastes associated with the use of water for drinking, cooking, cleaning, washing, hygiene, sanitation or other domestic purposes, together with any infiltration and inflow wastewater, that is released into a wastewater collection system;

(z) "domestic wastewater system" means the parts of the facility that collect, store, or treat domestic wastewater from the facility;

(aa) "existing landfill cells" means Cell 1, Cell 2, Cell 3A, Cell 3B, and Cell 3C as described in application No. 005-10348;

(bb) "facility" means all buildings, structures, process and pollution abatement equipment, vessels, storage facilities, material handling facilities, roadways, railways, pipelines and other installations, the Class I and Class II industrial landfill and the HWRSP Facility, and includes the land, located on the SE 1/4 of Section 9, Township 50, Range 17, West of the 4th Meridian, that is being or has been used or held for or in connection with the Ryley Industrial Waste Management Facility;

(cc) "facility developed area" means the areas of the facility used for the storage, treatment, processing, transport, or handling of raw material, intermediate product, by-product, finished product, process chemicals, or waste material, and includes the active landfill area;

(dd) "final cover" means a designed system, natural or man-made, that is placed on the surface of a landfill or landfill cell that has reached its maximum designated waste elevation to control transmission of moisture and landfill gas, and conforms to the end use plan;

(ee) "final landfill closure" means the period of time when waste is no longer placed in the defined portion of a landfill and activities are undertaken to complete the final cover system and decommission components and facilities that are no longer required, and includes the construction of any additional components or monitoring systems that are necessary for post-closure;

(ff) "free liquids" means the liquids as determined by the US EPA SW-846 Test Method 9095B: Paint Filter Liquids Test, as specified in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, US EPA Publication No. SW-846, as amended;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(gg) "fugitive emissions" means emissions of substances to the atmosphere other than ozone depleting substances, originating from a facility source other than a flue, vent, or stack but does not include sources which may occur due to breaks or ruptures in process equipment;

(hh) "GCL" means geosynthetic clay liner that is made of a thin layer of bentonite either bonded to a geomembrane or fixed between two sheets of geotextile;

(ii) "geomembrane" means a sheet of manufactured synthetic material designed to control migration of liquid and gas;

(jj) "grab sample" means an individual sample collected in less than 30 minutes and which is representative of the substance sampled;

(kk) "groundwater" means groundwater as defined in the *Water Act,* R.S.A. 2000, c.W-3, as amended;

(ll) "groundwater monitoring well" means a well drilled at a site to measure groundwater levels and collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the concentration of groundwater constituents;

(mm) "HDPE" means High Density Polyethylene;

(nn) "HWRSP Facility" means the Hazardous Waste/Recyclable Storage and Processing Facility as described in the application for storage, processing and transfer of hazardous wastes and hazardous recyclables and which includes the Maintenance Shop, and is an integral part of the facility;

(oo) "hydraulic conductivity" means the ease with which water can be transported through a material

(pp) "hydrocarbon" means a chemical compound that consists entirely of hydrogen and carbon;

(qq) "ISO/IEC 17025" means the international standard, developed and published by International Organization for Standardization (ISO), specifying management and technical requirements for laboratories;

(rr) "incompatible waste" means waste materials which could cause dangerous reactions from direct contact with one another;

(ss) "industrial wastewater" means the composite of liquid wastes and water-carried wastes, any portion of which results from any industrial process carried on at the HWRSP Facility;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(tt) "landfill" means the Class I and Class II industrial landfill as described in the application and which includes the waste stabilization area, and is an integral part of the facility;

(uu) "landfill cell" means a designed area of a landfill comprised of an excavation or earthen structure in which waste is enclosed;

(vv) "landfill cell closure" means the construction of a final cover for landfill cell including placement of previously conserved top soil and upper subsoil and re-vegetation as required for the intended future use of the landfill;

(ww) "landfill gas" means a mixture of gases generated by the microbial decomposition of and chemical reactions between wastes in a landfill;

(xx) "lateral expansion" means an expansion of landfill cell boundaries beyond the approved area;

(yy) "leachate" means a liquid that has been in contact with waste in the landfill cell and has undergone chemical or physical changes;

(zz) "leachate collection system" means a system that gathers leachate so that it may be removed from a landfill, and includes a permeable drainage material, a network of perforated pipes and sumps or manholes from where leachate can be removed;

(aaa) "leak detection liquid" means any liquid collected within the leak detection system;

(bbb) "leak detection system" means a system that gathers liquid between a primary liner and a secondary liner system, and consists of a permeable drainage material, a network of perforated pipes and sumps or manholes from where the liquid can be removed;

(ccc) "liner" means a continuous layer of synthetic material or compacted natural clay placed beneath and at the sides of a landfill cell that is compatible with the waste and restricts the migration of leachate, or landfill gas, or both;

(ddd) "local environmental authority" means the Department of Environment and Parks, in the Province of Alberta, or the agency that has the equivalent responsibilities for any jurisdiction outside the Province;

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(eee) "major ions" means the following:

Calcium	Carbonate
Magnesium	Bicarbonate
Sodium	Chloride
Potassium	Sulfate

(fff) "maximum acceptable leachate head" means the maximum depth of leachate above the lowest part of the primary liner, not including the sumps or leachate collection pipe trenches, and is:

(i) 1.0 m in each of the existing landfill cells, and

(ii) 0.3 m in each of the new landfill cells

during active landfill life, landfill cell closure, final landfill closure, and post-closure;

(ggg) "maximum designated waste elevation" means the maximum elevation of waste in metres above sea level that can be disposed of at the landfill prior to construction of final cover, and is 714 metres;

(hhh) "metals" means the following:

Aluminum, dissolved	Chromium, dissolved (hexavalent)	Nickel, dissolved
Antimony, dissolved	Cobalt, dissolved	Selenium, dissolved
Arsenic, dissolved	Copper, dissolved	Silver, dissolved
Barium, dissolved	Lead, dissolved	Thallium, dissolved
Boron, dissolved	Manganese, dissolved	Tin, dissolved
Cadmium, dissolved	Mercury, total	Uranium, dissolved
Chromium, total	Molybdenum, dissolved	Zinc, dissolved

(iii) "monitoring system" means all equipment used for sampling, conditioning, analyzing or recording data in respect of any parameter listed or referred to in this approval, including equipment used for continuous monitoring;

(jjj) "month" means calendar month;

(kkk) "municipal solid waste" means solid waste resulting from or incidental to municipal, community, commercial, institutional and recreation activities, and includes garbage, rubbish, ashes, street cleanings, abandoned automobiles and all other solid wastes except hazardous waste, industrial solid waste, oilfield waste and biomedical wastes;

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(lll) "new landfill cells" means Cell 3D as described in application No. 005-10348, Cell 3E as described in application No. 012-10348, and Cell 4 as described in the application;

(mmm) "new surface water detention pond" means the surface water detention pond as described in application No. 012-10348;

(nnn) "NORM" means Naturally Occurring Radioactive Materials;

(ooo) "NORM waste" means any waste material with concentrations of NORM above the limits specified in Tables 5.1, 5.2, or 5.3 of the *Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, Health Canada, 2011, as amended;

(ppp) "nutrients" means the following:

Ammonia nitrogen	Nitrite nitrogen
Total Kjeldahl nitrogen	Total phosphorus
Nitrate nitrogen	Dissolved phosphorus

(qqq) "old surface water detention pond" means the surface water detention pond as described in application No. 005-10348;

(rrr) "Petroleum Hydrocarbons Fractions F1 and F2" means the specific hydrocarbon fraction measured by the analytical methods described in the *Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method,* published by the Canadian Council of Ministers of the Environment, 2001, as amended;

(sss) "points of compliance" means the location or locations of the groundwater monitoring wells where measurements of groundwater quality are taken to assess landfill and waste treatment performance;

(ttt) "post-closure" means the period of time after completion of the final landfill closure;

(uuu) "ppm" means concentration in parts per million;

(vvv) "primary liner" means the uppermost geomembrane liner;

(www) "QA/QC" means quality assurance and quality control;

(xxx) "quarter year" means a time period of three consecutive months designated as January, February and March; or April, May and June; or July, August and September; or October, November and December;

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(yyy) "regulations" means the regulations enacted pursuant to the Act, as amended;

(zzz) "representative grab" means a sample consisting of equal volume portions of water collected from at least four sites between 0.20 to 0.30 metres below the water surface within a pond;

(aaaa) "runoff" means any rainwater or melt water that drains as surface flow from the facility developed areas, excluding leachate;

(bbbb) "runoff control system" means the parts of the facility that collect, store or treat runoff from the facility, and includes but is not limited to runoff collection ditches, surface water detention pond(s) and tank farm bermed area;

(cccc) "run-on" means any rainwater or melt water that drains as surface flow toward the active landfill area;

(dddd) "run-on control system" means the parts of the facility that divert run-on away from the active landfill area;

(eeee) "scrubber exhaust stack" means the exhaust stack through which the air effluent streams that are:

(i) collected from the exhaust vents of the Drum Processing Building or Staging Building or both, and

(ii) treated with the caustic scrubber and activated carbon filter

are released to the atmosphere as described in the application;

(ffff) "secondary liner" means the lowermost geomembrane liner;

(gggg) "soil" means mineral or organic earthen materials that can, have, or are being altered by weathering, biological processes, or human activity;

(hhhh) "SOP" means Standard Operating Procedures;

(iiii) "storm event" means a 1 in 25 year, 24 hour duration rainfall event at Ryley, Alberta;

(jjjj) "tank" means a stationary device, designed to contain an accumulation of a substance, which is constructed primarily of non-earthen materials that provide structural support including wood, concrete, steel, and plastic;

(kkkk) "TDGR" means the *Transportation of Dangerous Goods Regulations* (SOR/2001-286) made under the *Transportation of Dangerous Goods Act*, 1992 (Canada), as amended;

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(llll) "TDS" means Total Dissolved Solids;

(mmmm) "topsoil" means the uppermost layer of soil and consists of:

(i) the A-horizons and all organic horizons as defined in *The Canadian System of Soil Classification* (Third Edition), Agriculture and Agri-Food Canada, Publication 1646, 1998, as amended, and

(ii) the soil ordinarily moved during tillage;

(nnnn) "TSS" means Total Suspended Solids;

(oooo) "upper subsoil" means the layer of soil directly below the topsoil layer that consists of the B-horizons as defined in *The Canadian System of Soil Classification,* (Third Edition), Agriculture and Agri-Food Canada, Publication 1646, 1998, as amended;

(pppp) "volume estimate" means a technical evaluation based on the sources contributing to the release including but not limited to pump capabilities, water meters, and batch release volumes;

(qqqq) "waste stabilization area" means the portion of the landfill that is used for waste stabilization or solidification or both, as described in application no. 008-10348;

(rrrr) "waste storage area" means the areas designated for storage of containers for waste or hazardous recyclable or both, or for storage of tanks for waste or hazardous recyclable or both, or for storage of both, as described in application No. 005-10348;

(ssss) "week" means any consecutive 7-day period;

(tttt) "working face" means that portion of the active landfill area where waste is currently being deposited, spread and compacted; and

(uuuu) "year" means calendar year.

PART 2: GENERAL

SECTION 2.1: REPORTING

2.1.1 The approval holder shall immediately report to the Director by telephone any contravention of the terms and conditions of this approval at 1-780-422-4505.

2.1.2 The approval holder shall submit a written report to the Director within 7 days of the reporting pursuant to 2.1.1.

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2.1.3 The approval holder shall immediately notify the Director in writing if any of the following events occurs:

(a) the approval holder is served with a petition into bankruptcy;

(b) the approval holder files an assignment in bankruptcy or Notice of Intent to make a proposal;

(c) a receiver or receiver-manager is appointed;

(d) an application for protection from creditors is filed for the benefit of the approval holder under any creditor protection legislation; or

(e) any of the assets which are the subject matter of this approval are seized for any reason.

2.1.4 If the approval holder monitors for any substances or parameters which are the subject of operational limits as set out in this approval more frequently than is required and uses procedures authorized in this approval, then the approval holder shall provide the results of such monitoring as an addendum to the reports required by this approval.

2.1.5 The approval holder shall submit all monthly reports required by this approval to be compiled or submitted to the Director on or before the end of the month following the month in which the information was collected, unless otherwise specified in this approval.

2.1.6 The approval holder shall submit all annual reports required by this approval to be compiled or submitted to the Director on or before March 31 of the year following the year in which the information was collected, unless otherwise specified in this approval.

SECTION 2.2: RECORD KEEPING

2.2.1 The approval holder shall:

(a) record; and

(b) retain

all the following information in respect of any sampling conducted or analyses performed in accordance with this approval for a minimum of ten years, unless otherwise authorized in writing by the Director:

(i) the place, date and time of sampling,

(ii) sample type,

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(iii) the dates the analyses were performed,

(iv) the analytical techniques, methods or procedures used in the analyses,

(v) the names of the persons who collected and analysed each sample, and

(vi) the results of the analyses.

2.2.2 The approval holder shall keep and maintain an Operating Record of the landfill as per 4.6.34(a) until the end of the landfill post-closure.

2.2.3 The Operating Record referred to in 2.2.2 shall include, at a minimum, all of the following information:

(a) the information required in section 7.3(c) of the *Standards for Landfills in Alberta*, as amended;

(b) the name and contact information of all persons who discover any contravention;

(c) the names and contact information of all persons who take any remedial actions arising from the contravention of the Act, the regulations, or this approval; and

(d) a description of the remedial measures taken in respect of a contravention of the Act, the regulations, or this approval.

2.2.4 The approval holder shall submit a copy of the most recent Operating Record to the Director upon written request from the Director within the timeline specified in writing by the Director.

SECTION 2.3: ANALYTICAL REQUIREMENTS

2.3.1 With respect to any sample required to be taken pursuant to this approval, the approval holder shall ensure that:

(a) collection;

(b) preservation;

(c) storage;

(d) handling; and

(e) analysis

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shall be conducted in accordance with the following unless otherwise authorized in writing by the Director:

(i) for air:

(A) the *Alberta Stack Sampling Code*, Alberta Environment, 1995, as amended,

(B) the *Methods Manual for Chemical Analysis of Atmospheric Pollutants*, Alberta Environment, 1993, as amended, and

(C) the *Air Monitoring Directive*, Alberta Environment, 1989, as amended;

(ii) for industrial wastewater, industrial runoff, groundwater and domestic wastewater:

(A) the *Standard Methods for the Examination of Water and Wastewater*, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation, 1998, as amended;

(iii) for whole effluent toxicity tests:

(A) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout*, Environment Canada, Environmental Protection Series 1/RM/13, December 2000, as amended,

(B) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia Magna*, Environment Canada, Environmental Protection Series 1/RM/14, December 2000, as amended,

(C) the *Biological Test Method: Growth Inhibition Test Using the Freshwater Alga Selenastrum capricornutum*, Environment Canada, Environmental Protection Series, November 1992, as amended,

(D) the *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia*, Environment Canada, Environmental Protection Series 1/RM/21, February 1992, as amended,

(E) the *Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows*, Environment Canada,

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Environmental Protection Series 1/RM/22, February 1992, as amended, and

(F) the *Biological Test Method: Toxicity Test Using Luminescent Bacteria (Photobacterium phosphoreum)*, Environment Canada, Environmental Protection Series, 1/RM/24, November 1992, as amended;

(iv) for soil:

(A) the *Soil Monitoring Directive,* Alberta Environment, May 2009, as amended, and

(B) the *Soil Quality Criteria Relative to Disturbance and Reclamation*, Alberta Agriculture, March 1987, as amended; and

(v) for waste:

(A) the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, USEPA, SW-846, September 1986, as amended,

(B) the *Methods Manual for Chemical Analysis of Water and Wastes*, Alberta Environmental Centre, Vegreville, Alberta, 1996, AECV96-M1, as amended,

(C) the *Toxicity Characteristic Leaching Procedure (TCLP)* USEPA Regulation 40 CFR261, Appendix II, Method No. 1311, as amended, or

(D) the *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, and the Water Environment Federation, 2010, as amended.

2.3.2 The approval holder shall analyse all samples that are required to be obtained by this approval in a laboratory accredited pursuant to ISO/IEC 17025, as amended, for the specific parameter(s) to be analysed, unless otherwise authorized in writing by the Director.

2.3.3 The term sample used in 2.3.2 does not include samples directed to continuous monitoring equipment, unless specifically required in writing by the Director.

2.3.4 The approval holder shall comply with the terms and conditions of any written authorization issued by the Director under 2.3.2.

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SECTION 2.4: OTHER

2.4.1 The terms and conditions of this approval are severable. If any term or condition of this approval or the application of any term or condition is held invalid, the application of such term or condition to other circumstances and the remainder of this approval shall not be affected thereby.

2.4.2 Any conflict between the *Standards for Landfills in Alberta*, as amended, and the terms and conditions of this approval shall be resolved in favour of this approval.

2.4.3 *Environmental Protection and Enhancement Act* Approval No. 10348-02-00, as amended, is cancelled.

2.4.4 All tanks shall conform to the *Guidelines for Secondary Containment for Above Ground Storage Tanks,* Alberta Environmental Protection, 1997, as amended, unless otherwise authorized in writing by the Director.

2.4.5 All above ground storage tanks containing liquid hydrocarbons or organic compounds shall conform to the *Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks*, Canadian Council of Ministers of the Environment, PN 1180, 1995, as amended.

PART 3: CONSTRUCTION

SECTION 3.1: LANDFILL

3.1.1 The approval holder shall not commence construction of Cell 4 unless and until updated financial security of the facility has been provided to include Cell 4 lateral expansion.

3.1.2 The approval holder shall construct each new Class I industrial landfill cell in such a way that each new Class I landfill cell shall consist of the following components, at a minimum, unless otherwise authorized in writing by the Director:

(a) a minimum of 0.45 metre thick cover of clean sand or soil placed over top of the uppermost drainage layer;

(b) a composite liner that consists of, at a minimum:

(i) a GCL liner placed in direct contact with an underlying 80 mil HDPE geomembrane liner as a primary liner;

(ii) a GCL liner placed in direct contact with an underlying 80 mil HDPE geomembrane liner as a secondary liner; and

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(iii) a GCL liner placed in direct contact with an underlying clay liner that has:

(A) a minimum thickness of 1.0 metre at all points, measured perpendicular to the slope, and

(B) been compacted to achieve an in-place hydraulic conductivity of 1×10^{-9} m/s or less;

(c) a leachate collection system that:

(i) is placed over the primary liner;

(ii) is capable of maintaining the maximum acceptable leachate head; and

(iii) consists of:

(A) a geo-composite drainage layer with a transmissivity of at least 1×10^{-4} m^2/s placed over top of the primary liner,

(B) a network of perforated leachate collection pipes, and

(C) a leachate collection sump placed over the primary liner;

(d) a leak detection system that:

(i) is installed over the secondary liner;

(ii) is capable of detecting the leakage through the primary liner; and

(iii) consists of:

(A) a geo-composite drainage layer with a transmissivity of at least 1×10^{-4} m^2/s placed over top of the secondary liner,

(B) a network of perforated leak detection liquid collection pipes, and

(C) a leak detection liquid collection sump placed over the secondary liner;

(e) a final cover:

(i) that meets the requirements in section 6.1(c) of the *Standards for Landfills in Alberta*, as amended; or

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(ii) as specified in the Landfill Cell Closure Plan submitted by the approval holder and authorized in writing by the Director pursuant to 7.1.1 and 7.1.4;

(f) a run-on control system capable of preventing flow onto the active landfill area from at least the peak discharge from a 1 in 25 year, 24 hour duration storm event at the facility; and

(g) a runoff control system capable of collecting and controlling at least the runoff volume resulting from a 1 in 25 year, 24 hour duration storm event at the facility.

3.1.3 The composite liner for the landfill shall be constructed on a foundation or base such that there shall be no failure of the liners due to settlement, compression, or uplift.

3.1.4 The approval holder shall submit to the Director the following plans and specifications for the proposed construction of each of the items listed in 3.1.2, signed and stamped by a professional registered with APEGA at least three (3) months prior to construction:

(a) a Detailed Construction Plan and Specifications prepared as per 3.1.2;

(b) a Construction Quality Assurance Plan; and

(c) a Construction Quality Control Plan.

3.1.5 If the Detailed Construction Plan and Specifications in 3.1.4 is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within the timeline specified in writing by the Director.

3.1.6 The approval holder shall implement the Detailed Construction Plan and Specifications in 3.1.4 as authorized in writing by the Director.

3.1.7 During construction of any of the items listed in 3.1.2, the approval holder shall not deviate from the Detailed Construction Plan and Specifications as authorized in writing by the Director in 3.1.6, unless the following conditions are met:

(a) the deviation results in a minor adjustment to the Detailed Construction Plan and Specifications in order to suit field conditions encountered; and

(b) the deviation will result in an equivalent or better design performance of the landfill.

3.1.8 The approval holder shall submit to the Director a summary report of the Construction Quality Assurance and Construction Quality Control results signed and stamped by a professional registered with APEGA.

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3.1.9 The summary report in 3.1.8 shall contain the following information, at a minimum:

(a) confirmation that the landfill has been constructed according to:

(i) the Construction Quality Assurance Plan,

(ii) the Construction Quality Control Plan, and

(iii) the Detailed Construction Plan and Specifications as authorized in writing by the Director in 3.1.6, subject to the deviations as per 3.1.7;

(b) description of any minor deviations as per 3.1.7;

(c) confirmation by the professional registered with APEGA, that deviations as per 3.1.7 will result in an equivalent or better design performance of the landfill;

(d) "as-built" plans;

(e) photo-documentation of important stages of construction including any repair work or remediation activities to establish or maintain liner integrity; and

(f) any other information as required in writing by the Director.

3.1.10 The approval holder shall notify the Director in writing at least fourteen (14) days prior to commencing operations of any new landfill cell.

3.1.11 The approval holder shall construct the off-loading area (tipping area) as described in the application, unless otherwise authorized in writing by the Director.

3.1.12 The approval holder shall manage landfill progression in such a manner as to minimize off-site visual impacts of the landfill, as described in the Landfill Cell Closure Plan submitted by the approval holder and authorized in writing by the Director pursuant to 7.1.1 and 7.1.4.

SECTION 3.2: WASTE STABILIZATION AREA

3.2.1 The approval holder shall construct the waste stabilization area in accordance with the following:

(a) application No. 008-10348; and

(b) within a Class I landfill cell;

unless otherwise authorized in writing by the Director.

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SECTION 3.3: SOIL CONSERVATION

3.3.1 The approval holder shall:

(a) salvage; and

(b) conserve

all topsoil for land reclamation of the landfill.

3.3.2 The approval holder shall:

(a) salvage; and

(b) conserve

all upper subsoil for land reclamation of the landfill.

3.3.3 The approval holder shall:

(a) conserve; and

(b) stockpile

all topsoil separately from the upper subsoil.

3.3.4 The approval holder shall place all:

(a) topsoil stockpiles; and

(b) upper subsoil stockpiles

at the landfill.

3.3.5 The approval holder shall stockpile all topsoil as follows:

(a) on stable foundations; and

(b) on undisturbed topsoil.

3.3.6 The approval holder shall stockpile all upper subsoil as follows:

(a) on stable foundations; and

(b) on areas where the topsoil has been removed.

3.3.7 The approval holder shall take all steps necessary to prevent any erosion (e.g., wind or water), including but not limited to, all of the following:

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(a) revegetating the stockpiles; and

(b) any other steps authorized in writing by the Director.

3.3.8 The approval holder shall immediately suspend conservation of:

(a) topsoil; and

(b) upper subsoil

when:

(i) wet or frozen conditions will result in mixing, loss, degradation or compaction of topsoil or upper subsoil, or

(ii) high wind velocities, any other field conditions or facility operations will result in mixing, loss, or degradation of topsoil or upper subsoil.

3.3.9 The approval holder shall recommence conservation of:

(a) topsoil; and

(b) upper subsoil

only when conditions in 3.3.8 no longer exist.

PART 4: OPERATIONS, LIMITS, MONITORING AND REPORTING

SECTION 4.1: GENERAL

4.1.1 The approval holder shall maintain the geographical boundaries of the landfill to that located within SE 1/4 of Section 9, Township 50, Range 17, West of the 4th Meridian, as described in the application.

4.1.2 The approval holder shall limit the waste elevation of the landfill to no more than the maximum designated waste elevation.

4.1.3 The approval holder shall restrict access to the facility to only personnel authorized by the approval holder.

4.1.4 The approval holder shall maintain a publicly available 24 hour "HOTLINE" number for a prompt response during an emergency.

4.1.5 The approval holder shall:

(a) operate; and

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(b) maintain the integrity of

the following waste management facilities at the facility:

(i) the HWRSP Facility;

(ii) the Class I and Class II industrial landfill, including:

(A) Class I landfill cells,

(B) Class II landfill cell(s), and

(C) waste stabilization area within a Class I landfill cell; and

(iii) waste storage area(s);

as described in the application.

4.1.6 In addition to 4.1.5, the approval holder shall:

(a) operate; and

(b) maintain the integrity of

the following infrastructure components at the facility:

(i) the composite liner;

(ii) the leachate collection system,

(iii) the leak detection system,

(iv) the run-on control system,

(v) the runoff control system,

(vi) the groundwater monitoring wells,

(vii) the weigh scale, and

(viii) the site access control;

as described in the application.

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FACILITY AUDIT

4.1.7 The approval holder shall cause the facility to be audited by an independent third-party environmental consultant or organization to assess compliance with the terms and conditions of this approval:

(a) at least once every three years; and

(b) commencing on or before October 1, 2018 for the first audit.

4.1.8 The approval holder shall submit the audit report required in 4.1.7 in the Annual Landfill Operations Report as required in 4.6.58(c).

4.1.9 The requirements in 4.1.7 and 4.1.8 shall not relieve the approval holder of any duty under the Act, or its associated regulations, or this approval.

SECTION 4.2: AIR

OPERATIONS

4.2.1 The approval holder shall not release any air effluent streams to the atmosphere except as authorized by this approval.

4.2.2 The approval holder shall only release air effluent streams to the atmosphere from the following sources:

(a) the scrubber exhaust stack;

(b) the Drum Processing Building natural gas fired air make up unit exhaust vent;

(c) the Staging Building natural gas fired air make up unit exhaust vent;

(d) the Administration Building natural gas fired furnaces exhaust vents;

(e) the Laboratory fume hood and natural gas fired air make up unit exhaust vents;

(f) the Maintenance Shop equipment and natural gas fired Radiant Heater exhaust vents;

(g) the Leachate Collection Tanks natural gas fired heaters exhaust vents;

(h) the leachate transfer lines passive gas vents; and

(i) any other source authorized in writing by the Director.

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4.2.3 The approval holder shall not operate any process equipment unless and until the pollution abatement equipment associated with the corresponding process equipment is:

(a) operational; and

(b) operating.

4.2.4 The approval holder shall treat all air effluent streams from the exhaust vents of the Drum Processing or Staging or both Buildings with a caustic scrubber and an activated carbon filter before directing the air effluent streams to the scrubber exhaust stack for release to the atmosphere while:

(a) hazardous waste or hazardous recyclables or both are being processed;

(b) hazardous waste or hazardous recyclables or both are being transferred; or

(c) containers of hazardous waste or hazardous recyclables or both are open

in the Drum Processing or Staging or both Buildings.

4.2.5 The approval holder shall control fugitive emissions and any source not specified in 4.2.2 in accordance with 4.2.6 of this approval unless otherwise authorized in writing by the Director.

4.2.6 With respect to fugitive emissions and any source not specified in 4.2.2, the approval holder shall not release a substance or cause to be released a substance that causes or may cause any of the following:

(a) impairment, degradation or alteration of the quality of natural resources;

(b) material discomfort, harm or adverse effect to the well being or health of a person; or

(c) harm to property or to vegetative or animal life.

4.2.7 The approval holder shall not burn any debris by means of an open fire unless authorized in writing by the Director.

4.2.8 If the approval holder receives complaints of offensive odours, or fugitive dust, or both, beyond the facility boundaries, the approval holder shall:

(a) conduct the following to reduce the release of those odours, or fugitive dust, or both by:

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(i) placing restrictions on types, or volumes, or both, of the wastes being handled or processed or deposited that are causing those odours, or fugitive dust, or both,

(ii) increasing the frequency of cover placement, or modifying waste handling activities, or performing both, at the landfill,

(iii) modifying waste handling activities at the HWRSP Facility, or

(iv) performing any combination of the above; and

(b) activate the Odour and Fugitive Dust Response Program as specified in the Landfill Operations Plan 4.6.34(j).

LIMITS

4.2.9 The approval holder shall maintain the pH of the scrubbing liquid of the caustic scrubber referred to in 4.2.4 at 8.0 or higher.

4.2.10 The approval holder shall replace activated carbon in the activated carbon filter referred to in 4.2.4 immediately when the concentration of total petroleum hydrocarbons in the air effluent streams released from the scrubber exhaust stack to the atmosphere exceeds 25 ppm.

MONITORING AND REPORTING

4.2.11 The approval holder shall monitor, daily at a minimum, the pH of the scrubbing liquid of the caustic scrubber referred to in 4.2.4.

4.2.12 The approval holder shall monitor, weekly at a minimum, the air effluent streams released from the scrubber exhaust stack, using a portable total petroleum hydrocarbon analyzer while:

(a) hazardous waste or hazardous recyclables or both are being processed;

(b) hazardous waste or hazardous recyclables or both are being transferred; or

(c) containers of hazardous waste or hazardous recyclables or both are open

in the Drum Processing or Staging or both Buildings.

4.2.13 The portable total petroleum hydrocarbon analyzer referred to in 4.2.12 shall:

(a) have a detection limit of 1 ppm or lower for total petroleum hydrocarbons;

(b) be located in a straight section of the scrubber exhaust stack, a minimum of one (1) metre downstream from the last flow disturbance; and

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(c) be calibrated regularly in accordance with the analyzer manufacturer's specifications.

4.2.14 The approval holder shall continue to implement the Ambient Air Monitoring Program as authorized in writing by the Director on June 24, 2009, unless and until otherwise authorized in writing by the Director pursuant to 4.2.18.

4.2.15 The approval holder shall submit to the Director the results of the Ambient Air Monitoring Program in 4.2.14 with the following reports:

(a) a Monthly Ambient Air Monitoring Report; and

(b) an Annual Ambient Air Monitoring Report

in accordance with the written authorization by the Director on June 24, 2009, unless and until otherwise authorized in writing by the Director pursuant to 4.2.18.

4.2.16 The approval holder shall submit:

(a) a revised Ambient Air Monitoring Program;

(b) revised reporting requirements, or

(c) both of the above

to the Director upon written request from the Director within the timeline specified in writing by the Director.

4.2.17 If the revised:

(a) Ambient Air Monitoring Program;

(b) reporting requirements; or

(c) both of the above

submitted pursuant to 4.2.16 is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within the timeline specified in writing by the Director.

4.2.18 The approval holder shall implement the revised:

(a) Ambient Air Monitoring Program;

(b) reporting requirements; or

(c) both of the above

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submitted pursuant to 4.2.16 as authorized in writing by the Director within the timeline specified in writing by the Director.

SECTION 4.3: RUNOFF AND INDUSTRIAL WASTEWATER

OPERATIONS

4.3.1 The approval holder shall not release any substances from the facility to the surrounding watershed except as authorized by this approval.

4.3.2 The approval holder shall operate and maintain the integrity of:

(a) the run-on control system to prevent flow onto the active landfill area from at least the peak discharge from a 1 in 25 year, 24 hour duration storm event at the facility; and

(b) the runoff control system for the facility to collect and control at least the runoff volume resulting from a 1 in 25 year, 24 hour duration storm event at the facility.

4.3.3 All runoff from the facility developed area shall be directed to the runoff control system as described in:

(a) application No. 012-10348, prior to decommissioning and reclamation of the old surface water detention pond; and

(b) the application, after decommissioning and reclamation of the old surface water detention pond;

unless otherwise authorized in writing by the Director.

4.3.4 Prior to decommissioning and reclamation of the old surface water detention pond and subject to 4.3.7, the approval holder shall only make or permit a release from the old surface water detention pond:

(a) at the release point as designated in application No. 012-10348, which is:

(i) located in the south east corner of the old surface water detention pond, and

(ii) referred to as sampling location A1 in 4.3.11;

(b) through a pump and a release hose over the south berm into the drainage control ditch, east of the landfill access road, to the new surface water detention pond, under normal operating conditions; and

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(c) through a pump and a release hose over the south berm directly to the culvert under Highway 854, during periods of high runoff exceeding the holding capacity of the old surface water detention pond;

unless otherwise authorized in writing by the Director.

4.3.5 Subject to 4.3.7, the approval holder shall only make or permit a release from the new surface water detention pond:

(a) at the release point as designated in application No. 012-10348, which is:

(i) located in the north east corner of the new surface water detention pond, and

(ii) referred to as sampling location B1 in 4.3.11; and

(b) through a pump and a release hose over the east berm into the culvert under Highway 854;

unless otherwise authorized in writing by the Director.

4.3.6 The approval holder shall only dispose of industrial wastewaters, or specified runoff in TABLE 4.3-A, or both, by one or more of the following methods:

(a) to facilities holding a current Act authorization to accept such waste;

(b) to facilities approved by a local environmental authority outside of Alberta to accept such waste;

(c) to a disposal well approved by AER;

(d) as per 4.6.51; or

(e) as otherwise authorized in writing by the Director.

TABLE 4.3-A: SPECIFIED RUNOFF

SOURCES
Runoff that exceeds any of the limits for the parameters listed in TABLE 4.3-B.
Runoff for which the results of the parameters listed in TABLE 4.3-B are unavailable at the time that the runoff must be disposed of.
Runoff from within the tank farm bermed area.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

LIMITS

4.3.7 Releases of runoff from:

(a) the old surface water detention pond;

(b) the new surface water detention pond; or

(c) both ponds

to the surrounding watershed shall comply with the limits specified in TABLE 4.3-B.

4.3.8 Releases of runoff from within the tank farm bermed area to the old or new or both surface water detention ponds shall comply with the limits specified in TABLE 4.3-C.

TABLE 4.3-B: RUNOFF LIMITS FOR SURFACE WATER DETENTION POND

PARAMETER	LIMITS Maximum unless otherwise indicated
pH	6.0 – 9.5 pH units
COD	50 mg/L
TDS	2500 mg/L
TSS	25 mg/L
Ammonia (expressed as Nitrogen)	5 mg/L
Chloride	250 mg/L
Sodium	200 mg/L
Sulphate	500 mg/L
Oil or other substances	Not present in amounts sufficient to create a visible film or sheen
96-Hour Multiple Concentration Acute Lethality Test Using Rainbow Trout (*Oncorhynchus mykiss*)	50% or greater survival

TABLE 4.3-C: RUNOFF LIMITS FOR TANK FARM BERMED AREA

PARAMETER	LIMITS Maximum unless otherwise indicated
pH	6.0 – 9.5 pH units
COD	50 mg/L
TSS	25 mg/L
Ammonia (expressed as Nitrogen)	5 mg/L
Oil or other substances	Not present in amounts sufficient to create a visible film or sheen

TERMS AND CONDITIONS ATTACHED TO APPROVAL

MONITORING AND REPORTING

4.3.9 The approval holder shall monitor the runoff control system as required in TABLE 4.3-D, subject to 4.3.12.

4.3.10 The approval holder shall report to the Director the results of the runoff control system monitoring as required in TABLE 4.3-D, subject to 4.3.12.

4.3.11 For the purpose of TABLE 4.3-D:

(a) sampling location A1 is defined as the old surface water detention pond release point;

(b) sampling location A2 is defined as the old surface water detention pond;

(c) sampling location B1 is defined as the new surface water detention pond release point;

(d) sampling location B2 is defined as the new surface water detention pond; and

(e) sampling location C is defined as the tank farm bermed area.

4.3.12 The monitoring and reporting requirements in 4.3.9 and 4.3.10 for the old surface water detention pond (sampling locations A1 and A2) shall not apply after decommissioning and reclamation of the old surface water detention pond.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

TABLE 4.3-D: RUNOFF CONTROL SYSTEM MONITORING AND REPORTING

MONITORING				REPORTING	
Parameter	**Frequency**	**Sample Type**	**Sampling Location**	**Monthly**	**Annually**
Surface Water Detention Pond(s)				Monthly Runoff and Industrial Wastewater Report, for each month when release occurs	Annual Runoff and Industrial Wastewater Report
Flow (m^3/day)	Daily during release	Estimate	A1, B1		
pH	Once per batch release, prior to release	Representative Grab	A2, B2		
COD					
TDS					
TSS					
Ammonia (expressed as nitrogen)					
Chloride					
Sodium					
Sulphate					
Oil or other substances	Daily during release	Visual			
96-hour multiple concentration acute lethality test using rainbow trout (*oncorhynchus mykiss*)	Each month when release occurs, prior to release, for the first batch release of the month	Representative Grab			
48-hour static acute lethality test using *daphnia magna*					
Tank Farm Bermed Area					
Volume (m^3)	Total batch volume released	Estimate	C		
pH	Once per batch release, prior to release to the surface water detention pond(s)	Representative Grab			
COD					
TSS					
Ammonia (expressed as nitrogen)					
Oil or other substances		Visual			

4.3.13 The monitoring and reporting required in TABLE 4.3-D for the acute lethality tests shall comply with:

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(a) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout*, Environment Canada, Environmental Protection Series 1/RM/13, December2000, as amended; and

(b) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia Magna*, Environment Canada, Environmental Protection Series 1/RM/14, December 2000, as amended.

4.3.14 The approval holder shall:

(a) treat any acute lethality test that deviates from the corresponding test method referred to in 4.3.13 as invalid; and

(b) repeat the test as soon as logistically possible.

4.3.15 In the event that less than 50% of the rainbow trout survived in the 100% concentration sample, the approval holder shall:

(a) implement a program immediately to identify the source of the toxicity; and

(b) submit to the Director within 90 days after the test result is available, a proposed program to reduce the toxicity of the runoff.

4.3.16 The approval holder shall submit the Monthly Runoff and Industrial Wastewater Report in TABLE 4.3-D to the Director.

4.3.17 The Monthly Runoff and Industrial Wastewater Report shall include, at a minimum, all of the following information:

(a) a monthly assessment of the monitoring results relative to the limits in TABLE 4.3-B;

(b) a monthly assessment of the monitoring results relative to the limits in TABLE 4.3-C;

(c) a monthly assessment of the performance of the:

(i) runoff control system,

(ii) pollution abatement equipment, and

(iii) monitoring equipment;

(d) a monthly summary of management and disposal of the:

(i) industrial wastewaters, and

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(ii) specified runoff

as per 4.3.6;

(e) a monthly summary of management and disposal of runoff in general;

(f) a monthly summary of runoff contraventions reported pursuant to 2.1.1; and

(g) any other information as required in writing by the Director.

4.3.18 The approval holder shall submit the Annual Runoff and Industrial Wastewater Report in TABLE 4.3-D to the Director.

4.3.19 The Annual Runoff and Industrial Wastewater Report shall include, at a minimum, all of the following information:

(a) an annual summary assessment of the monitoring results relative to the limits in TABLE 4.3-B;

(b) an annual summary assessment of the monitoring results relative to the limits in TABLE 4.3-C;

(c) an annual summary assessment of the performance of the:

(i) runoff control system,

(ii) pollution abatement equipment, and

(iii) monitoring equipment;

(d) an annual summary of management and disposal of the:

(i) industrial wastewaters, and

(ii) specified runoff

as per 4.3.6;

(e) an annual summary and evaluation of management and disposal of runoff in general;

(f) an annual summary of the results pursuant to 4.3.21;

(g) an annual summary of runoff contraventions reported pursuant to 2.1.1; and

(h) any other information as required in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.3.20 The approval holder shall:

(a) collect a representative grab sample from the old surface water detention pond at least once per year, prior to decommissioning and reclamation of the pond;

(b) collect a representative grab sample from the new surface water detention pond at least once per year; and

(c) analyze the sample(s) for all of the parameters specified in TABLE 4.3-E.

4.3.21 The approval holder shall submit the results of the analyses in 4.3.20 to the Director in the Annual Runoff and Industrial Wastewater Report.

TABLE 4.3-E: ANNUAL MONITORING OF SURFACE WATER DETENTION POND

PARAMETERS			
pH	TDS; TSS	Fluoride, dissolved	Phenols
Electrical conductivity	Metals	Cyanide (weak acid dissociable)	Total chlorinated phenols
COD	Major ions	BTEX	Polychlorinated biphenyls, total
DOC	Nutrients	Petroleum Hydrocarbons Fractions F1 and F2	Total organic halogens

SECTION 4.4: LEACHATE COLLECTION AND LEAK DETECTION

OPERATIONS

4.4.1 The approval holder shall only dispose of leachate removed from the leachate collection system by one or more of the following methods:

(a) to facilities holding a current Act authorization to accept such waste;

(b) to facilities approved by a local environmental authority outside of Alberta to accept such waste;

(c) to a disposal well approved by AER; or

(d) as per 4.6.51.

4.4.2 The approval holder shall only dispose of liquid removed from the leak detection system by one or more of the following methods:

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(a) to facilities holding a current Act authorization to accept such waste;

(b) to facilities approved by a local environmental authority outside of Alberta to accept such waste;

(c) to a disposal well approved by AER; or

(d) as per 4.6.51.

LIMITS

4.4.3 Subject to 4.4.4, the approval holder shall not exceed the maximum acceptable leachate head in any landfill cell.

4.4.4 Subsequent to a storm event, the leachate head in any landfill cell shall not exceed the maximum acceptable leachate head for more than fourteen (14) days, unless otherwise authorized in writing by the Director.

4.4.5 The volume of liquid in the leak detection system, as monitored in TABLE 4.6-D, shall not exceed the action leakage rate in any landfill cell.

MONITORING AND REPORTING

4.4.6 The approval holder shall monitor the leachate collection and leak detection systems as required in TABLE 4.6-D and for all parameters specified in TABLE 4.4-A, subject to 4.4.8 and 4.4.9.

4.4.7 The approval holder shall report to the Director the results of the leachate collection and leak detection systems monitoring as required in TABLE 4.6-D, including the results of the analyses for all parameters specified in TABLE 4.4-A, subject to 4.4.8 and 4.4.9.

TABLE 4.4-A: LEACHATE AND LEAK DETECTION LIQUID MONITORING

PARAMETERS		
pH (field and laboratory)	TDS	Nutrients
Electrical conductivity (field and laboratory)	TSS	BTEX
COD	Metals	Phenols
DOC	Major Ions	Petroleum Hydrocarbons Fractions F1 and F2

4.4.8 The requirements in 4.4.6 and 4.4.7 for monitoring and reporting the parameters in TABLE 4.4-A for leachate shall not apply if insufficient leachate is available for conducting the analyses.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.4.9 The requirements in 4.4.6 and 4.4.7 for monitoring and reporting the parameters in TABLE 4.4-A for leak detection liquid shall not apply if insufficient leak detection liquid is available for conducting the analyses.

4.4.10 If the volume of liquid removed from the leak detection system exceeds the action leakage rate, in addition to reporting pursuant to 2.1.1, the approval holder shall submit a Response Action Plan to the Director within 30 days of the exceedance.

SECTION 4.5: DUGOUTS AND WATER WELLS IN SURROUNDING AREA

MONITORING AND REPORTING

4.5.1 The approval holder shall:

(a) collect a representative sample from:

(i) each of the dugouts, and

(ii) each of the water wells

within an approximate 1.6 kilometre radius around the facility; and

(b) analyze the sample for the parameters listed in TABLE 4.5-A;

unless the approval holder is not granted access by the landowner.

4.5.2 The monitoring required in 4.5.1 shall be conducted once each year in October unless otherwise authorized in writing by the Director.

4.5.3 The approval holder shall record the analytical results of the sampling information required in 4.5.1 in an Annual Dugout and Water Well Sampling Program Report.

4.5.4 The approval holder shall submit the Annual Dugout and Water Well Sampling Program Report to the Director pursuant to 4.6.58(i).

TABLE 4.5-A: DUGOUT AND WATER WELL MONITORING

PARAMETERS		
pH (field and laboratory)	TDS	Nutrients
Electrical conductivity (field and laboratory)	TSS	BTEX
COD	Metals	Phenols
DOC	Major Ions	Petroleum Hydrocarbons Fractions F1 and F2

TERMS AND CONDITIONS ATTACHED TO APPROVAL

SECTION 4.6: HWRSP FACILITY AND LANDFILL

GENERAL

4.6.1 The approval holder shall not:

(a) receive;

(b) process;

(c) dispose of; or

(d) perform any combination of the above for

any of the following wastes, individually or in any combination, at the places specified below respectively:

(i) explosives (Class 1 TDGR wastes), at the facility;

(ii) radioactive wastes (Class 7 TDGR wastes), at the facility;

(iii) radioactive wastes regulated under the *Nuclear Safety and Control Act* (Canada), at the facility;

(iv) biomedical waste, at the facility;

(v) waste containing free liquids, at the landfill, excluding the waste stabilization area;

(vi) material containing ozone depleting substances, at the landfill;

(vii) municipal solid waste, at the facility; and

(viii) NORM waste, at the facility.

4.6.2 Incompatible wastes and incompatible hazardous recyclables shall be prevented from mixing.

4.6.3 The approval holder shall dispose of wastes generated at the facility only:

(a) to facilities holding a current Act authorization;

(b) to facilities approved by a local environmental authority outside of Alberta; or

(c) as otherwise authorized in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

HWRSP FACILITY

OPERATIONS PLAN

4.6.4 The approval holder shall:

(a) develop;

(b) keep up-to-date; and

(c) implement

an HWRSP Facility Operations Plan.

4.6.5 The approval holder shall:

(a) review the HWRSP Facility Operations Plan annually, at a minimum; and

(b) update the HWRSP Facility Operations Plan if any of the following circumstances apply:

(i) there are facility expansions or changes in site operations or equipment,

(ii) there is an applicable change to an applicable regulation, or

(iii) an update is required in writing by the Director.

4.6.6 The approval holder shall retain a copy of the most recent HWRSP Facility Operations Plan at the facility.

4.6.7 The approval holder shall submit a copy of the most recent HWRSP Facility Operations Plan to the Director upon written request from the Director within the timeline specified in writing by the Director.

4.6.8 If the HWRSP Facility Operations Plan submitted pursuant to 4.6.7 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

4.6.9 The approval hold shall implement the latest HWRSP Facility Operations Plan, unless otherwise authorized in writing by the Director.

OPERATIONS

4.6.10 The approval holder shall only transfer wastes and hazardous recyclables at designated transfer areas designed to contain spills and leaks.

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4.6.11 The approval holder shall use the following when transferring substances to, from, and between containers, tanks, and trucks:

(a) couplings equipped with seals that are compatible with the substance transferred;

(b) the necessary precautions to prevent spills when the couplings are disconnected;

(c) emergency shut-off valves;

(d) established transfer areas and associated curbing, paving and catchment areas;

(e) drip trays to capture potential losses under coupling devices and other connections; and

(f) manual inspections of the transfer area for leaks and spills during and after waste transfer.

4.6.12 All wastes and all hazardous recyclables that are unloaded shall be immediately transferred to the waste storage area.

4.6.13 All containers and unrinsed empty containers shall be stored in the waste storage area.

4.6.14 The approval holder shall:

(a) provide and maintain an adequate aisle space between containers in the waste storage area to allow:

(i) inspection, and

(ii) unobstructed movement of personnel, fire protection equipment, spill control equipment and decontamination equipment to any area of the waste storage area; and

(b) arrange inspection aisles in the waste storage area such that the identification label on each container is readable.

4.6.15 All tanks within the tank farm area shall be equipped, at a minimum, with all of the following:

(a) sensors for detecting the level in each tank;

(b) high level alarms that activate when a tank overfill is imminent;

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(c) automatic shut-off devices or sufficient free board space above the high level sensor to allow operators time to prevent overfill from occurring; and

(d) earthen dikes or equivalent secondary containment structures capable of containing 110% of the volume of the largest tank within the bermed area plus 10% of the aggregate capacity of all other tanks in the bermed area.

4.6.16 All tanks containing hazardous waste and all tanks containing hazardous recyclables in each building shall be equipped, at a minimum, with all of the following:

(a) sensors or gauges for detecting the level in each tank;

(b) a written operating procedure to prevent tank overfill; and

(c) secondary containment structures capable of containing 110% of the volume of the largest tank within the building plus 10% of the aggregate capacity of all other tanks containing hazardous waste and hazardous recyclables in the same building.

4.6.17 Hazardous waste and hazardous recyclables stored in containers and tanks shall be stored in accordance with the *Hazardous Waste Storage Guidelines*, June 1988, Alberta Environment, as amended.

4.6.18 The approval holder shall only carry out the following activities, individually or in any combination, at the HWRSP Facility in relation to hazardous waste or hazardous recyclables or both:

(a) commingling of hazardous waste or hazardous recyclables to make maximum use of available container or tank capacity, only if the resultant mixture has the same TDGR hazard classification as any one of the individual components;

(b) phase separation by gravity settling, only without the addition of any chemicals designed to accelerate settling;

(c) dispersion of solids into liquids by natural or mechanical means, only if the resultant mixture has the same TDGR hazard classification as the original waste;

(d) physical segregation of hazardous from non-hazardous articles or components from the same container, only if no process equipment is used;

(e) washing of drums or other objects, only for the purpose of removing hazardous residue;

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(f) crushing or shredding of used filters, rags, absorbent materials, or empty containers, only for the purpose of volume reduction or liquid recovery, unless otherwise authorized in writing by the Director; or

(g) treatment of hazardous waste, only as authorized in writing by the Director.

4.6.19 Notwithstanding 4.6.18(g), the approval holder shall not incinerate waste at the facility.

LIMITS

4.6.20 The approval holder shall not store a total of more than 752,500 litres of hazardous waste or hazardous recyclables or both at the HWRSP Facility at any time.

4.6.21 In addition to the storage limits in 4.6.20, the approval holder shall not exceed the waste storage limits as specified in TABLE 4.6-A.

TABLE 4.6-A: STORAGE LIMITS FOR HAZARDOUS WASTE OR HAZARDOUS RECYCLABLES OR BOTH AT HWRSP FACILITY

Waste/Recyclable Type	Material	Maximum Quantity
Containers: Hazardous waste or hazardous recyclables or both	TDGR Classification 2, 3, 4, 5, 6, 8 or 9 waste type only	512,500 litres (consisting of 2,500 drum equivalents, each 205 litre capacity)
Bulk Tanks: Hazardous waste or hazardous recyclables or both	Waste flammable liquids, used oil, or wastewaters; or TDGR Classification 3, 5, 6, 8 or 9 waste type only	240,000 litres (consisting of a total of 135 m^3 in the tank farm area, and a total of 105 m^3 inside the buildings)

4.6.22 Containers other than 205 litre drums shall be prorated to 205 litre drum equivalents based on their nominal volumes, e.g., 10 X 20 litre pails = 1 X 205 litre drum.

4.6.23 The limits referred to in 4.6.20 and 4.6.21 shall be calculated based on the:

(a) total nominal volumes of all containers, treating all partially filled containers as if they were full; and

(b) total filled capacities of all tanks.

MONITORING AND REPORTING

4.6.24 The approval holder shall:

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(a) identify;

(b) characterize; and

(c) classify

all waste streams and all hazardous recyclables, generated or received at the HWRSP Facility, not including runoff, industrial wastewater streams and air effluent streams in accordance with the:

(i) *Industrial Waste Identification and Management Options*, Alberta Environment, May 1996, as amended, and

(ii) *Alberta User Guide for Waste Managers*, Alberta Environment, August 1996, as amended.

4.6.25 The approval holder shall measure or, when not feasible to measure, estimate, the quantity of each waste and hazardous recyclable identified in 4.6.24 each year.

4.6.26 The approval holder shall keep a daily:

(a) total; and

(b) inventory

of all materials being stored at the HWRSP Facility.

4.6.27 The daily total and inventory records in 4.6.26 shall be available at the facility at all times for inspection by the Director or an inspector.

4.6.28 The approval holder shall submit a Monthly Waste Management Report to the Director.

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TABLE 4.6-B: MONTHLY WASTE INVENTORY REPORT (BY WASTE CLASS)

COMPANY NAME: _____ APPROVAL NO.: _____

REPORT PERIOD: MONTH _____ YEAR _____

CLASS	UNIT (Kg or L)	OPENING BALANCE	+ RECEIVED IN PROVINCE	+ RECEIVED OUT OF PROVINCE	- SHIPPED *		- ON-SITE DISPOSAL	+ or - ADJUSTMENT **	CLOSING BALANCE	APPROVAL LIMIT
					RECYCLING / PRODUCT	OFF-SITE DISPOSAL				
2										
3										
4										
5										
6.1										
8										
9.1										
9.2										
9.3										
PCB										
NR										
TOTAL										XXXXX
							No. of Containers On site			XXXXX
							Total Litres in Bulk Tanks			XXXXX

Name of Company Official: _____ Title: _____ Signature: _____

Report Date: _____

* Provide a list of the recycling and disposal locations.

** Identity the amount and reason for each adjustment.
Adjustments include consolidation/reclassification, losses to processing, spills, volume miscalculations, or any other circumstances, which would affect the mass balance of the monthly inventory report.

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4.6.29 The approval holder shall compile all of the information indicated in TABLE 4.6-B in the Monthly Waste Management Report which shall contain, at minimum, all of the following information:

(a) an opening waste and hazardous recyclables inventory balance in kilograms or litres by waste class or material type;

(b) the amount and type of waste and hazardous recyclables received:

(i) within the province, and

(ii) from outside the province;

(c) the amount and type of waste and hazardous recyclables:

(i) shipped for recycling or product,

(ii) shipped off-site for disposal, and

(iii) disposed on-site;

(d) any adjustments, including but not limited to, consolidation, reclassification, losses to processing, spills, volume miscalculations, or any other circumstances, which would affect the mass balance of the monthly inventory report;

(e) closing balance in kilograms or litres;

(f) a summary of contraventions reported pursuant to 2.1.1 related to waste and hazardous recyclables; and

(g) any other information as required in writing by the Director.

4.6.30 The approval holder shall compile all the information required by 4.6.24 and 4.6.25 in an Annual Waste Management Summary Report:

(a) as specified in TABLE 4.6-C; and

(b) in accordance with the:

(i) *Industrial Waste Identification and Management Options*, Alberta Environment, May 1996, as amended, and

(ii) *Alberta User Guide for Waste Managers*, Alberta Environment, August 1996, as amended.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

TABLE 4.6-C: ANNUAL WASTE MANAGEMENT SUMMARY

Waste or Hazardous Recyclable Name	Uniform Waste Code				Quantity (kg or L)		Stored	Recycled		Disposed	
	WC	PIN	Class	Mgmt	Hazardous	Non-hazardous	On-site	On-site	Off-site	On-site	Off-site
TOTAL											

4.6.31 The approval holder shall submit the Annual Waste Management Summary Report to the Director.

LANDFILL

OPERATIONS PLAN

4.6.32 The approval holder shall:

(a) develop;

(b) keep up-to-date; and

(c) implement

a Landfill Operations Plan that does not contravene with the requirements of this approval.

4.6.33 The approval holder shall:

(a) review the Landfill Operations Plan annually, at a minimum; and

(b) update the Landfill Operations Plan if any of the following circumstances apply:

(i) there are facility expansions or changes in site operations or equipment,

(ii) there is an applicable change to the *Standards for Landfills in Alberta,* as amended,

(iii) an update is required in writing by the Director, or

(iv) there is an update to an applicable regulation.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.6.34 The Landfill Operations Plan shall include, at a minimum, all of the following:

(a) SOP for keeping and maintaining an Operating Record;

(b) SOP for waste control, run-on and runoff controls, and nuisance controls;

(c) SOP for the waste stabilization area operations;

(d) SOP for the acceptance, handling and disposal of wastes, including;

(i) waste characterization and classification at source,

(ii) waste manifesting and tracking,

(iii) QA/QC waste acceptance procedures, and

(iv) waste sampling;

(e) SOP for detecting, preventing and disposal of unauthorized wastes;

(f) SOP for placing waste in a landfill cell including;

(i) working face width,

(ii) lift depth,

(iii) compaction, and

(iv) waste placement location using a grid system;

(g) SOP for managing contaminated sulphur and sulphur containing wastes;

(h) SOP for managing asbestos wastes;

(i) SOP for placing leachate, leak detection liquid, or other authorized wastes and liquids over the surface of the active landfill area for the purpose of evaporation or dust suppression;

(j) an Odour and Fugitive Dust Response Program;

(k) a Fugitive Dust and Odour Best Management Plan;

(l) a runoff and industrial wastewater monitoring and management program;

(m) a leachate monitoring and management program;

(n) a leak detection liquid monitoring and management program;

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(o) a groundwater monitoring program;

(p) a Remediation Plan to deal with groundwater quality deterioration;

(q) a soil monitoring program;

(r) a soil management program;

(s) a landfill cell cover system;

(t) a monitoring and maintenance program for the scale house and heavy operational equipment;

(u) a health and safety program;

(v) an emergency response program, including SOP for handling fires, substance releases to the environment, and health concerns; and

(w) an up-to-date plan of the landfill layout with survey records showing the location of all infrastructure components of the landfill including final cover elevations and contours.

4.6.35 The approval holder shall retain a copy of the most recent Landfill Operations Plan at the facility.

4.6.36 The approval holder shall submit to the Director the most recent Landfill Operations Plan when requested in writing by the Director within the timeline specified in writing by the Director.

4.6.37 The approval holder shall correct all deficiencies in the Landfill Operations Plan submitted pursuant to 4.6.36, as outlined in writing by the Director, within the timeline specified in writing by the Director.

4.6.38 The approval holder shall implement the latest Landfill Operations Plan, unless otherwise authorized in writing by the Director.

OPERATIONS

4.6.39 The approval holder shall classify all materials entering the landfill in accordance with the:

(a) *Waste Control Regulation (AR 192/96)*;

(b) *Industrial Waste Identification and Management Options*, Alberta Environment, May 1996, as amended; and

(c) *Alberta User Guide for Waste Managers*, May 1995, as amended.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.6.40 The approval holder shall obtain a detailed representative physical and chemical analysis of a waste prior to disposal of the waste into the landfill at the following times, at a minimum:

(a) the first time a waste is received from a new generator;

(b) the first time a delivery is received from a different process associated with a known waste generator;

(c) the first time a waste is received from a different location associated with a known waste generator; and

(d) when the nature or composition of the waste that was previously characterized by the generator changes.

4.6.41 The approval holder shall not dispose of hazardous waste in any Class II landfill cell.

4.6.42 The approval holder shall:

(a) only carry out waste stabilization or solidification or both within the waste stabilization area; and

(b) not transfer waste from the waste stabilization area to the Class I landfill cell before the waste stabilization or solidification or both have completed.

4.6.43 The approval holder shall only dispose of any liquid collected within the waste stabilization area by one or more of the following methods:

(a) to facilities holding a current Act authorization to accept such waste;

(b) to facilities approved by a local environmental authority outside of Alberta to accept such waste;

(c) to a disposal well approved by AER; or

(d) as otherwise authorized in writing by the Director.

4.6.44 The approval holder shall conduct:

(a) annually, in-house visual inspections for corrosion; and

(b) biennially, ultrasonic testing to monitor thickness

of the steel plate liner of the stabilization pits in the waste stabilization area, unless otherwise authorized in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.6.45 The approval holder shall dispose of asbestos wastes in accordance with *"Guidelines for the Disposal of Asbestos Waste"*, Environmental Protection Services, Alberta Environment, 1989, as amended.

4.6.46 The approval holder shall dispose of sulphur waste in accordance with *"Guidelines for Landfill Disposal of Sulphur Wastes and Remediation of Sulphur Containing Soils"*, Alberta Environment, 2011, as amended.

4.6.47 The approval holder shall only dispose of wastes that the landfill is not authorized to dispose of:

(a) to facilities holding a current Act authorization;

(b) to facilities approved by a local environmental authority outside of Alberta; or

(c) as otherwise authorized in writing by the Director.

4.6.48 If an unauthorized waste is received at the landfill, the approval holder shall remove the waste from the landfill within seven (7) days of the receipt, unless otherwise authorized in writing by the Director.

4.6.49 The approval holder shall restrict the working face of each landfill cell to the smallest practical area.

4.6.50 For any waste disposed of at the landfill that is subject to wind dispersal, the approval holder shall:

(a) wet the waste to prevent dispersal of particulate matter; or

(b) immediately apply cover on top of the waste to minimize entrainment of particulate matter.

4.6.51 Notwithstanding 4.6.1(v), the approval holder may place any of the following wastes over the surface of the active landfill area for the purpose of dust suppression:

(a) specified runoff;

(b) leachate;

(c) leak detection liquid;

(d) sump waste of car wash bays or similar operations;

(e) waste from hydrovac excavation operations; or

(f) any other waste authorized by t*he Alberta User Guide for Waste Managers*, May 1995, as amended;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

provided that placement of such wastes will not cause offensive odours.

4.6.52 The approval holder shall inspect the landfill, at a minimum:

(a) weekly; and

(b) immediately after each storm event to:

(i) detect evidence of deterioration of any infrastructure components, including the composite liner,

(ii) detect any malfunction or improper operation of the run-on and runoff control systems, leachate collection system, or leak detection system, and

(iii) take corrective measures to repair any damage to infrastructure components, including the composite liner.

4.6.53 The approval holder shall:

(a) keep a record of inspections conducted pursuant to 4.6.52;

(b) have the record of inspections available for review upon written request from the Director; and

(c) immediately report any deficiencies detected by the inspection in 4.6.52 to the Director in writing along with any corrective measures taken or proposed.

4.6.54 The approval holder shall not stockpile waste exceeding the maximum designated waste elevation of the landfill for a period of more than two (2) weeks, unless otherwise authorized in writing by the Director.

4.6.55 The approval holder shall take all practical measures to prevent off-site tracking of waste from vehicles and equipment leaving the facility.

MONITORING AND REPORTING

4.6.56 The approval holder shall monitor the landfill operations as required in TABLE 4.6-D.

4.6.57 The approval holder shall report to the Director the results of the landfill operations monitoring as required in TABLE 4.6-D.

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TABLE 4.6-D: LANDFILL OPERATIONS MONITORING AND REPORTING REQUIREMENTS

MONITORING AND REPORTING				
Parameter	**Frequency**	**Sample Type**	**Sampling Location**	**Reporting**
Quantity and type of waste received	Continuously, When operating	Measured or estimated	At entrance to landfill	Annual Landfill Operations Report
Quantity and type of material removed	Continuously, when operating	Measured or estimated	At entrance to landfill	
General location of waste deposited	Continuously, when operating	As per survey, or using grid system	At active landfill area, or survey coordinates	
Leachate head	at least: - once every three working days; - after storm event; and - immediately prior to leachate removal	Calculated	At primary leachate collection system sumps for existing landfill Cell 1	
		Measured	At primary leachate collection system sumps for all other landfill cells	
Leachate analysis, as per TABLE 4.4-A	At least once every quarter year, unless insufficient sample volume is available	Grab sample	At each primary leachate collection system sump	
Volume of leachate removed from the leachate collection system	As removed	Measured or calculated	At leachate collection system sumps	
Leak detection liquid analysis, as per TABLE 4.4-A	At least once every quarter year, unless insufficient sample volume is available	Grab sample	At each leak detection system sump	
Volume of leak detection liquid removed from the leak detection system	At least once every working day, as removed	Measured or calculated	At leak detection system sumps	
Final cover	When final cover is applied	Final cover by survey cores or test pits or both	On each completed landfill cell	

4.6.58 The Annual Landfill Operations Report required in TABLE 4.6-D shall include, at a minimum, all of the following:

(a) the name and contact information of the person responsible for the facility;

(b) a summary of all information collected as required in TABLE 4.6-D;

(c) a summary of the results of any audit conducted in accordance with 4.1.7;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(d) a summary of the operations of the waste stabilization area;

(e) a summary of the performance of the run-on and runoff control systems, including a comparison to the limits in TABLES 4.3-B and 4.3-C;

(f) a summary of the performance of the leachate collection system, including a comparison to the maximum acceptable leachate head;

(g) a summary of the performance of the leak detection system, including a comparison to the action leakage rate limit;

(h) the Response Action Plan for the leak detection system pursuant to 4.4.10;

(i) the Annual Dugout and Water Well Sampling Program Report pursuant to 4.5.4;

(j) a summary of all revisions to the Landfill Operations Plan pursuant to 4.6.33(b);

(k) any groundwater remedial action taken pursuant to 4.6.34(p);

(l) a summary of records of landfill inspections pursuant to 4.6.53;

(m) a summary of:

  (i) operational issues encountered,

  (ii) emergencies occurred, and

  (iii) measures or actions taken;

(n) a summary of records of:

  (i) public complaints, and

  (ii) the approval holder's responses;

(o) an up-to-date financial security estimate pursuant to 5.1.2;

(p) an updated site development plan showing the status of the landfill progression at the end of the operating year, including but not limited to:

  (i) contour mapping,

  (ii) the location of active and inactive disposal areas,

  (iii) areas where a final cover has been placed, and

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(iv) the location of new landfill cell(s) constructed;

(q) the Annual Landfill Cell Closure Report pursuant to 7.1.7;

(r) a summary of contraventions reported pursuant to 2.1.1 related to landfill operations; and

(s) any other information as required in writing by the Director.

4.6.59 The approval holder shall submit the Annual Landfill Operations Report to the Director.

SECTION 4.7: DOMESTIC WASTEWATER

OPERATIONS

4.7.1 The approval holder shall not release any substances from the domestic wastewater system to the surrounding watershed except as authorized by this approval.

4.7.2 The approval holder shall direct all domestic wastewater to the domestic wastewater system.

4.7.3 The approval holder shall only dispose of substances from the domestic wastewater system:

(a) to facilities holding a current Act authorization;

(b) to facilities approved by a local environmental authority outside of Alberta; or

(c) as otherwise authorized in writing by the Director.

SECTION 4.8: WATERWORKS

Not used at this time.

SECTION 4.9: GROUNDWATER

MONITORING

4.9.1 The approval holder shall continue to implement the existing Groundwater Monitoring Program as authorized in writing by the Director, unless and until otherwise authorized in writing by the Director pursuant to 4.9.4.

4.9.2 The approval holder shall submit a revised Groundwater Monitoring Program to the Director on or before September 30, 2017, unless otherwise authorized in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.9.3 If the revised Groundwater Monitoring Program submitted pursuant to 4.9.2 is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within the timeline specified in writing by the Director.

4.9.4 The approval holder shall implement the revised Groundwater Monitoring Program submitted pursuant to 4.9.2 as authorized in writing by the Director within the timeline specified in writing by the Director.

4.9.5 The approval holder shall:

(a) collect a representative groundwater sample from each of the groundwater monitor wells specified in the Groundwater Monitoring Program, including the groundwater monitoring wells designated as points of compliance; and

(b) analyze each sample for the parameters listed in TABLE 4.9-A.

TABLE 4.9-A: GROUNDWATER MONITORING PROGRAM

PARAMETERS	
pH	Metals
Electrical conductivity	Major ions
COD	Nutrients
DOC	BTEX
TDS	Petroleum Hydrocarbons Fractions F1 and F2

4.9.6 The monitoring required in 4.9.5 shall be conducted at the following frequencies, unless otherwise authorized in writing by the Director:

(a) a minimum of once per year during each of the active landfill life, landfill cell closure, final landfill closure, and post-closure periods; and

(b) a minimum of four times per year following detection of leachate constituents in groundwater at levels above those specified in 4.9.7, and until the levels specified in 4.9.7 have been met.

4.9.7 The groundwater quality in the monitoring wells, designated as points of compliance in the Groundwater Monitoring Program, shall not exceed the higher of:

(a) the objectives established in the water quality objectives in the *Canadian Environmental Quality Guidelines (CEQG)* for drinking water published by the Canadian Council of Ministers of the Environment (CCME), as amended; or

(b) background groundwater chemistry as determined through a statistical analysis, as a derived alternate groundwater performance standard.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.9.8 The approval holder shall implement the Remediation Plan as specified in the Landfill Operations Plan, when groundwater quality exceeds the groundwater performance criteria in 4.9.7.

4.9.9 The samples extracted from the groundwater monitor wells shall be collected using scientifically acceptable purging, sampling and preservation procedures so that a representative groundwater sample is obtained.

4.9.10 The approval holder shall:

(a) protect from damage; and

(b) keep locked except when being sampled

all groundwater monitoring wells unless otherwise authorized in writing by the Director.

4.9.11 If a representative groundwater sample cannot be collected because the groundwater monitoring well is damaged or is no longer capable of producing a representative groundwater sample, the approval holder shall:

(a) clean, repair or replace the groundwater monitoring well; and

(b) collect and analyse a representative groundwater sample prior to the next scheduled sampling event;

unless otherwise authorized in writing by the Director.

4.9.12 In addition to the sampling information recorded in 2.2.1, the approval holder shall record the following sampling information for all groundwater samples collected:

(a) a description of purging and sampling procedures;

(b) the static elevations above sea level, and depth below ground surface of fluid phases in the groundwater monitoring well prior to purging;

(c) the temperature of each sample at the time of sampling;

(d) the pH of each sample at the time of sampling; and

(e) the specific conductance of each sample at the time of sampling.

4.9.13 The approval holder shall carry out remediation of the groundwater in accordance with the following:

(a) *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*, Alberta Environment, February 2009, as amended; and

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(b) *Alberta Tier 2 Soil and Groundwater Remediation Guidelines*, Alberta Environment, February 2009, as amended.

REPORTING

4.9.14 The approval holder shall compile an Annual Groundwater Monitoring Program Report which shall include, at a minimum, all of the following information:

(a) a completed *Record of Site Condition Form*, Alberta Environment, 2009, as amended;

(b) a legal land description of the facility and a map illustrating the facility boundaries;

(c) a topographic map of the facility;

(d) a description of the industrial activity and processes;

(e) a map showing the location of all surface and groundwater users, and a listing describing surface water and water well use details, within at least a 1.6 kilometre radius of the facility;

(f) a general hydrogeological characterization of the region within a five kilometre radius of the facility;

(g) a detailed hydrogeological characterization of the facility, including an interpretation of groundwater flow patterns;

(h) cross-sections showing depth to water table, patterns of groundwater movement and hydraulic gradients at the facility;

(i) borehole logs and completion details for groundwater monitoring wells;

(j) a map showing locations of all known buried channels within at least five kilometre of the facility;

(k) a map of surface drainage within the facility and surrounding area to include nearby water bodies;

(l) a map of groundwater monitoring well locations and a table summarizing the existing groundwater monitoring program for the facility;

(m) a summary of any changes to the groundwater monitoring program made since the last groundwater monitoring report;

(n) analytical data recorded as required in 4.9.5 and 4.9.11(b);

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(o) a summary of fluid elevations recorded as required in 4.9.12(b) and an interpretation of changes in fluid elevations;

(p) an interpretation of QA/QC program results;

(q) an interpretation of all the data in this report, including the following:

  (i) diagrams indicating the location and extent of any contamination,

  (ii) a description of probable sources of contamination, and

  (iii) a site map showing the location and type of current and historical potential sources of groundwater contamination;

(r) a summary and interpretation of the data collected since the groundwater monitoring program began including:

  (i) control charts which indicate trends in concentrations of parameters, and

  (ii) the migration of contaminants;

(s) a description of the following:

  (i) contaminated groundwater remediation techniques employed,

  (ii) source elimination measures employed,

  (iii) risk assessment studies undertaken, and

  (iv) risk management studies undertaken;

(t) a proposed sampling schedule for the following year(s);

(u) a description of any contaminant remediation, risk assessment or risk management action conducted at the facility; and

(v) recommendations for:

  (i) changes to the groundwater monitoring program to make it more effective, and

  (ii) remediation, risk assessment or risk management of contamination identified.

4.9.15 The approval holder shall submit the Annual Groundwater Monitoring Program Report to the Director.

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4.9.16 If the Annual Groundwater Monitoring Program Report is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director, within the timeline specified in writing by the Director.

SECTION 4.10: SOIL

4.10.1 In addition to any other requirements specified in this approval, the approval holder shall conduct all of the following activities related to soil monitoring and soil management required by this approval in accordance with the *Soil Monitoring Directive,* Alberta Environment, 2009, as amended:

(a) designing and developing proposals for the Soil Monitoring Program;

(b) designing and developing proposals for the Soil Management Program;

(c) all other actions, including sampling, analysing, and reporting, associated with the Soil Monitoring Program; and

(d) all other actions, including sampling, analysing and reporting, associated with the Soil Management Program.

MONITORING AND REPORTING

4.10.2 The approval holder shall submit the Soil Monitoring Program proposal to the Director according to the following schedule:

(a) for the first soil monitoring event on or before January 31, 2019; and

(b) for the second soil monitoring event on or before January 31, 2024;

unless otherwise authorized in writing by the Director.

4.10.3 If any Soil Monitoring Program proposal is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

4.10.4 Subject to 4.10.3, the approval holder shall implement the Soil Monitoring Program as authorized in writing by the Director.

4.10.5 If an authorization or a deficiency letter is not issued within 120 days of the applicable date required by 4.10.2, the approval holder shall implement the Soil Monitoring Program:

(a) in accordance with the program as set out in the proposal submitted by the approval holder; and

(b) within 270 days after the applicable date required by 4.10.2.

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4.10.6 The approval holder shall submit to the Director each Soil Monitoring Program Report obtained from the soil monitoring referred to in 4.10.4 and 4.10.5 according to the following schedule:

(a) for the first Soil Monitoring Program Report on or before January 31, 2020; and

(b) for the second Soil Monitoring Program Report on or before January 31, 2025;

unless otherwise authorized in writing by the Director.

4.10.7 If any Soil Monitoring Program Report is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

SOIL MANAGEMENT PROGRAM

4.10.8 If the Soil Monitoring Program, or any other soil monitoring, reveals that there are substances present in the soil at concentrations greater than any of the applicable concentrations set out in the standards in the *Soil Monitoring Directive*, Alberta Environment, 2009, as amended, the approval holder shall develop a Soil Management Program Proposal.

4.10.9 If a Soil Management Program Proposal is required pursuant to 4.10.8, the approval holder shall submit a Soil Management Program Proposal to the Director according to the following schedule:

(a) for Soil Management Program Proposal that is triggered by the findings from the first soil monitoring event on or before the date in 4.10.6(a);

(b) for Soil Management Program Proposal that is triggered by the findings from a second soil monitoring event on or before the date in 4.10.6(b); or

(c) for any other soil monitoring event not specified in this approval within six months of completion of the soil monitoring event.

4.10.10 If any Soil Management Program Proposal is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

4.10.11 The approval holder shall implement the Soil Management Program as authorized in writing by the Director.

4.10.12 If the approval holder is required to implement a Soil Management Program pursuant to 4.10.11, the approval holder shall submit a written Soil Management Program

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Report to the Director on or before March 31 of each year following the year in which the information was collected.

4.10.13 If any Soil Management Program Report is found deficient by the Director, the approval holder shall correct all deficiencies identified by the Director by the date specified in writing by the Director.

PART 5: FINANCIAL SECURITY REQUIREMENTS

5.1.1 The approval holder shall annually review and revise the cost estimate for reclamation of the facility including decommissioning and land reclamation.

5.1.2 The annual revised cost estimate for the facility shall be submitted to the Director by March 31 of each year.

5.1.3 The approval holder shall review and revise the cost estimate for reclamation of the facility when one or more of the following occurs:

(a) the cost estimate of future conservation and reclamation of the facility changes;

(b) the extent of the operation of the facility is increased or reduced;

(c) the facility or any portion of it is conserved and reclaimed;

(d) the conservation and reclamation plan required by this approval is changed; or

(e) the activities conducted at the facility for which security is required is increased or decreased.

5.1.4 The approval holder shall submit the revised cost estimate arising from 5.1.3 to the Director within 30 days after the occurrence of any of the circumstances described in 5.1.3.

5.1.5 The approval holder shall provide additional financial security as required in writing by the Director.

5.1.6 The approval holder shall renew the financial security for the facility at least 30 days prior to the date it expires.

5.1.7 The approval holder shall maintain the financial security for the facility until returned in accordance with the Act or the regulations.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

PART 6: DECOMMISSIONING AND LAND RECLAMATION OF HWRSP FACILITY

SECTION 6.1: GENERAL

6.1.1 The approval holder shall apply for an amendment to this approval to reclaim the HWRSP Facility by submitting to the Director:

(a) a Decommissioning Plan; and

(b) a Land Reclamation Plan.

6.1.2 The approval holder shall submit the:

(a) Decommissioning Plan; and

(b) Land Reclamation Plan

referred to in 6.1.1 within six (6) months of the HWRSP Facility ceasing operation, except for repairs and maintenance, unless otherwise authorized in writing by the Director.

SECTION 6.2: DECOMMISSIONING

6.2.1 The Decommissioning Plan referred to in 6.1.1 shall include, at a minimum, all of the following:

(a) a plan for dismantling the HWRSP Facility;

(b) a comprehensive study to determine the nature, degree and extent of contamination at the HWRSP Facility and affected lands;

(c) a plan to manage all wastes at the HWRSP Facility;

(d) evaluation of remediation technologies proposed to be used at the HWRSP Facility and affected lands;

(e) a plan for decontamination of the HWRSP Facility and affected lands in accordance with the following:

(i) for soil or groundwater, *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*, Alberta Environment, February 2009, as amended,

(ii) for soil or groundwater, *Alberta Tier 2 Soil and Groundwater Remediation Guidelines*, Alberta Environment, February 2009, as amended,

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(iii) for drinking water, *Canadian Environmental Quality Guidelines*, Canadian Council of Ministers of the Environment, PN 1299, 1999, as amended, and

(iv) for surface water, *Surface Water Quality Guidelines for Use in Alberta*, Alberta Environment, November 1999, as amended;

(f) confirmatory testing to indicate compliance with the remediation objectives;

(g) a plan for maintaining and operating contaminant monitoring systems;

(h) a schedule for activities (a) through (g) above; and

(i) any other information as required in writing by the Director.

6.2.2 If the Decommissioning Plan is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

SECTION 6.3: LAND RECLAMATION

6.3.1 The Land Reclamation Plan referred to in 6.1.1 shall include, at a minimum, all of the following:

(a) the final use of the reclaimed area and how equivalent land capability will be achieved;

(b) removal of infrastructure;

(c) restoration of drainage;

(d) soil replacement;

(e) erosion control;

(f) revegetation and conditioning of the HWRSP Facility including:

(i) species list, seed source and quality, seeding rates and methods,

(ii) fertilization rates and methods, and

(iii) wildlife habitat plans where applicable;

(g) reclamation schedule; and

(h) any other information as required in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

6.3.2 If the Land Reclamation Plan is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

PART 7: FINAL LANDFILL CLOSURE AND POST-CLOSURE

SECTION 7.1: LANDFILL CELL CLOSURE AND MAINTENANCE

7.1.1 The approval holder shall submit a Landfill Cell Closure Plan for individual landfill cell closure to the Director on or before September 30, 2017, unless otherwise authorized in writing by the Director.

7.1.2 The Landfill Cell Closure Plan submitted pursuant to 7.1.1 shall be signed and stamped by a professional registered with APEGA.

7.1.3 If the Landfill Cell Closure Plan submitted pursuant to 7.1.1 is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within the timeline specified in writing by the Director.

7.1.4 The approval holder shall implement the Landfill Cell Closure Plan submitted pursuant to 7.1.1 as authorized in writing by the Director.

7.1.5 The approval holder shall maintain the closed landfill cells to:

(a) protect and maintain the integrity of the final cover and surface water drainage systems;

(b) prevent erosion;

(c) prevent surface water ponding;

(d) remediate areas affected by subsidence and differential settlement; and

(e) prevent leachate break out.

7.1.6 If the approval holder completes landfill cell closure in a year, the approval holder shall prepare an Annual Landfill Cell Closure Report, and include, at a minimum, all of the following information in the Report:

(a) as-built plans and details on the location of landfill cells that have been closed;

(b) certified construction QA/QC procedures employed during cover construction and installation; and

(c) survey reports showing the final cover depths.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

7.1.7 The approval holder shall submit the Annual Landfill Cell Closure Report with the Annual Landfill Operations Report required in 4.6.58.

SECTION 7.2: FINAL LANDFILL CLOSURE AND POST-CLOSURE

7.2.1 The approval holder shall apply for an amendment to this approval for final landfill closure by submitting to the Director:

(a) a Detailed Final Landfill Closure Plan ; and

(b) a Landfill Post-Closure Plan.

7.2.2 The approval holder shall submit the:

(a) Detailed Final Landfill Closure Plan; and

(b) Landfill Post-Closure Plan

referred to in 7.2.1 within six (6) months of the landfill ceasing operations, unless otherwise authorized in writing by the Director.

DETAILED FINAL LANDFILL CLOSURE PLAN

7.2.3 The Detailed Final Landfill Closure Plan shall be developed in accordance with sections 6.1(b) and 6.1(c) of the *Standards for Landfills in Alberta*, as amended.

7.2.4 In addition to 7.2.3, the Detailed Final Landfill Closure Plan shall include, at a minimum, all of the following:

(a) a plan for replacement of soil;

(b) a QA/QC Program; and

(c) any deviations from the most recently submitted closure plan.

7.2.5 The Detailed Final Landfill Closure Plan shall be signed and stamped by a professional registered with APEGA.

7.2.6 If the Detailed Final Landfill Closure Plan is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

7.2.7 The approval holder shall implement the Detailed Final Landfill Closure Plan as authorized in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

LANDFILL POST-CLOSURE PLAN

7.2.8 The Landfill Post-Closure Plan shall be developed in accordance with sections 6.2 and 6.3 of the *Standards for Landfills in Alberta*, as amended.

7.2.9 In addition to 7.2.8, the Landfill Post-Closure Plan shall include, at a minimum, all of the following:

(a) the groundwater monitoring program including performance standards and points of compliance;

(b) the subsurface landfill gas monitoring program and performance standards at points of compliance;

(c) a plan for erosion control;

(d) a plan for maintaining vegetative cover; and

(e) any other information requested in writing by the Director.

7.2.10 The Landfill Post-Closure Plan shall be signed and stamped by a professional registered with APEGA.

7.2.11 If the Landfill Post-Closure Plan is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

7.2.12 The approval holder shall implement the Landfill Post-Closure Plan as authorized in writing by the Director.

PART 8: DECOMMISSIONING AND LAND RECLAMATION OF OLD SURFACE WATER DETENTION POND

8.1.1 The approval holder shall:

(a) decommission; and

(b) reclaim

the old surface water detention pond prior to construction of Cell 4.

8.1.2 The approval holder shall submit a Decommissioning and Land Reclamation Plan for the old surface water detention pond to the Director a minimum of six (6) months prior to decommissioning and land reclamation of the pond.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

8.1.3 If the Decommissioning and Land Reclamation Plan is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

DATED March 31, 2017

DESIGNATED DIRECTOR UNDER THE ACT
Mohammad Habib, P. Eng.

APPENDIX C

GROUND DISTURBANCE INFORMATION

Ticket No: 20193616258

Excavator Details

Caller Id: 21608
Contact: Mark Fawcett
Company: Tetra Tech Canada Inc.
Phone: 780-818-6352
Mobile: Not Supplied
Email: mark.fawcett@tetratech.com

Dig Site and Ticket Details

Open Map

Hand augering to 2 m depth and collecting soil samples at various locations within the Ryley landfill area.

Ticket Status	Original
Ticket Type	Large Project
Previous Ticket No.	Not Supplied
User Reference	SE-09-50-17-4
Ticket Date	2019-09-07T13:48:52-06:00
Work Start Date	2019-09-16T01:00:00-06:00
Address	Range Road 173 rural
Nearest Cross Street	Twp Rd 502
Type of work	Poles/Holes
Activity	Soil Sample
Excavation Method	Drilling
Excavation Depth	1m to 3m
Public Property	None
Private Property	Commercial
Onsite Contact	Mark Fawcett
Onsite Phone	780-818-6352
Municipality	Not Supplied
Nearest Community	Not Supplied
Rural Subdivision	Not Supplied
Lot No.	
Block No.	
Plan No.	

Your Responsibilities

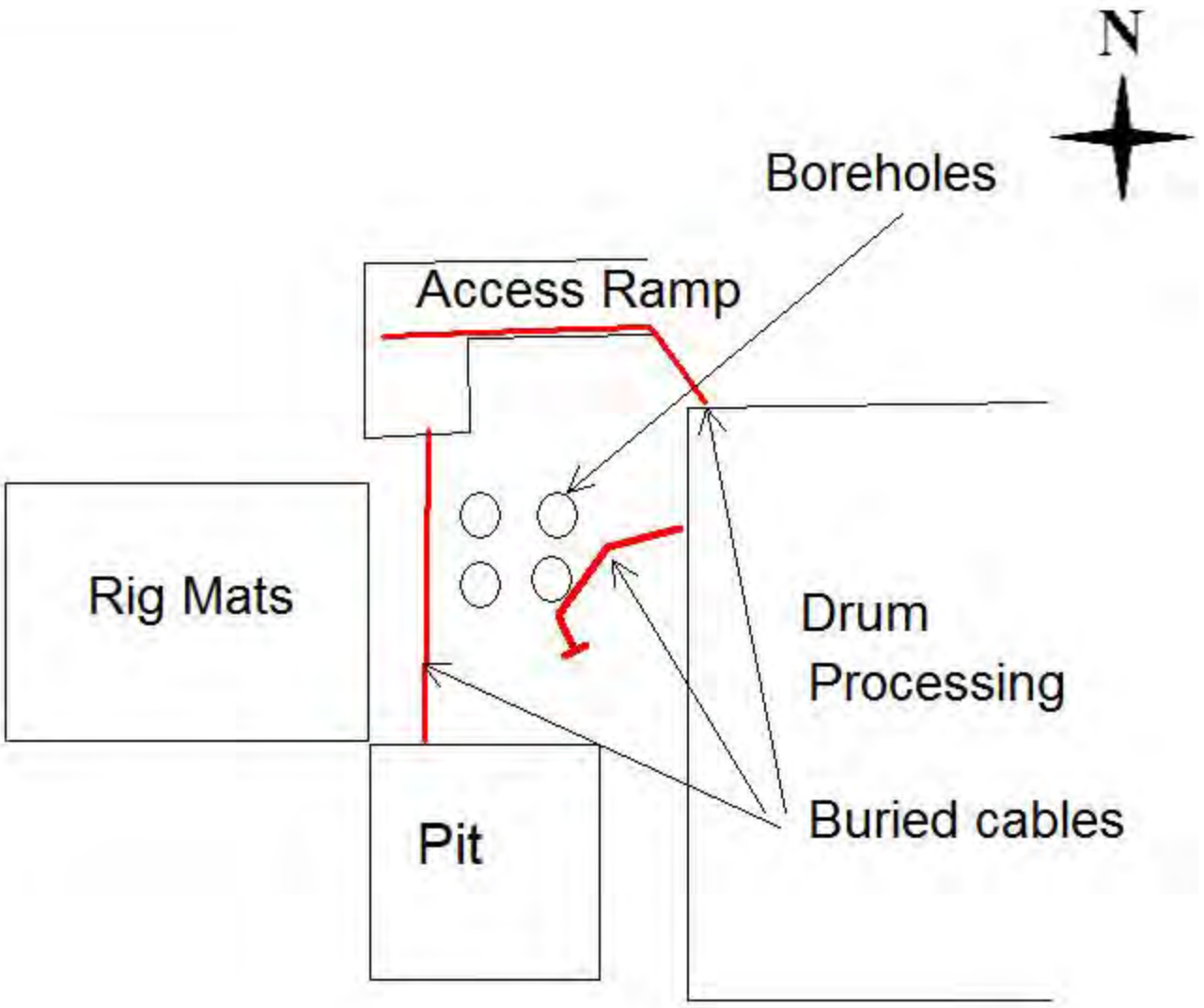
- Do not proceed with any excavation until all notified asset owners have responded by providing clearance, OR by identifying the location of their facilities with maps OR by placing locate marks on the ground.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using the Before You Dig Partners service, you agree to our privacy policy and the terms and conditions set out at on our web site.
- **For more information, visit www.BeforeYouDigPartners.com**

Utility Owner Details

The public utility owners listed below with a Status of "Notification Sent" have been requested to respond to your request. They may contact you directly for clarification of your request details.

Station Code	Authority Name	Status
AGNTOFCT	ATCOGAS, A DIVISION OF ATCOGAS AND PIPELINES LTD. (AGNTOFCT)	Notification Sent
FTAA1C30	FORTISALBERTA (FTAA1C30)	Notification Sent
HY14RWSC	HIGHWAY 14 REGIONAL WATER SERVICES COMMISSION	Notification Sent
TELCRYLY	TELUS COMMUNICATIONS INC (TELCRYLY)	Notification Sent
VRYLEY	VILLAGE OF RYLEY	Notification Sent

END OF UTILITIES LIST



Date: Sept. 19, 2019 Locator: Gerald Schram Facility Owner: Clean Harbors

Contractor: Tetra Tech Contact: Mark Fawcett Phone Number: (780) 818-6352

Legal Land Description: Riley Clean Harbors SE-9-50-17-W4 1st Call Ticket / Job #:

Comments: Met Mark on site and discussed work area and scope of work. Hand augering boreholes for soil samples. First area was a small area allowing for ghost signals and coupleing; also lots of concrete on edges. Located all known facilities with paint and lathe.

Legend:

- Well
- Survey Marker
- Building
- Tank
- Yard Light
- Power Pole
- Electric Panel
- Monitoring Well
- Work Area
- C---C---C Buried Cable
- Buried Pipe
- T---T---T Buried Telus

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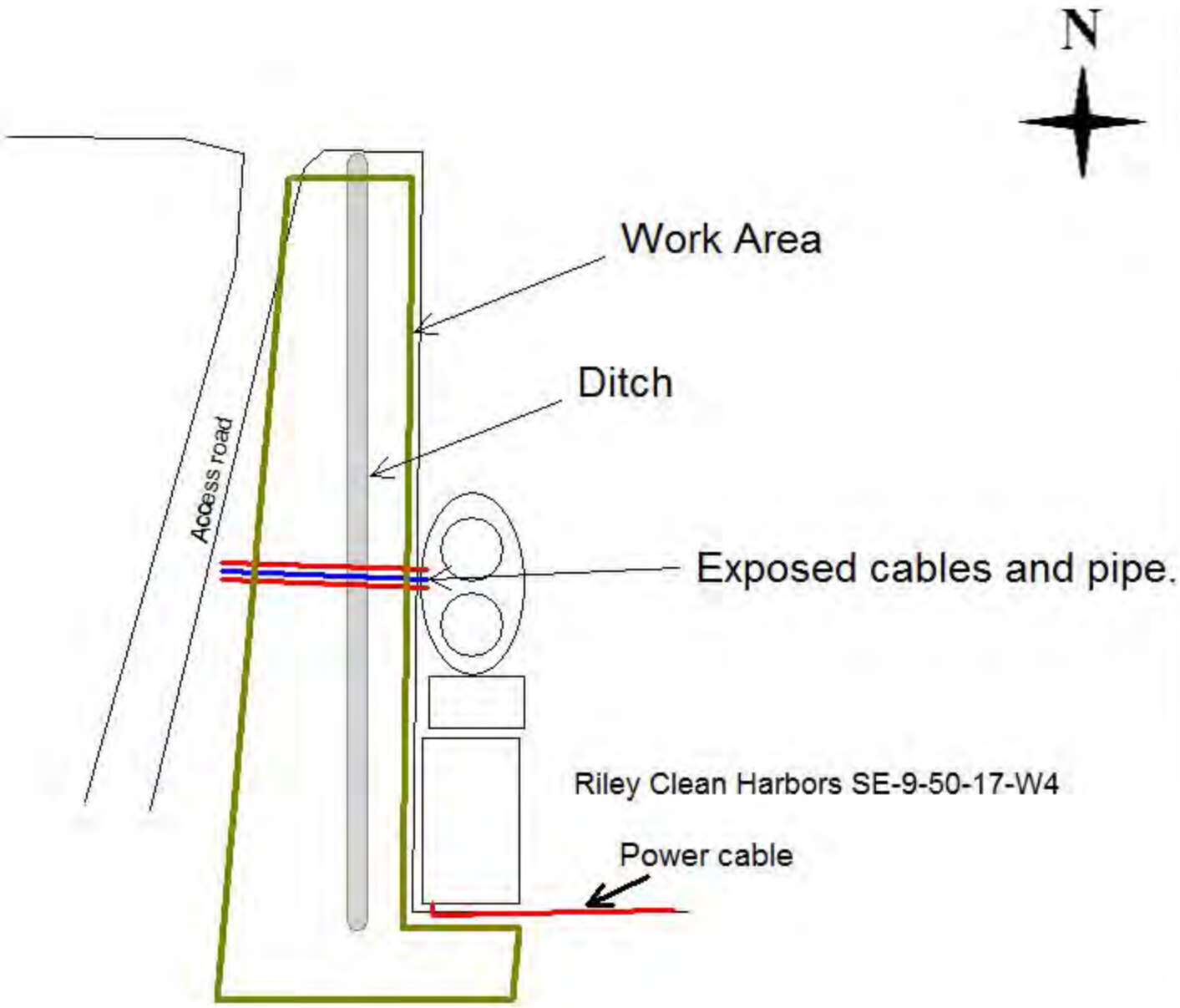
403.255.9399
403.258.3189
www.cleanharbors.com



Date: Sept. 19, 2019 Locator: Gerald Schram Facility Owner: Clean Harbors

Contractor: Tetra Tech Contact: Mark Fawcett Phone Number: (780) 818-6352

Legal Land Description: Riley Clean Harbors SE-9-50-17-W4 1st Call Ticket / Job #:

Comments: Met Mark on site and discussed work area and scope of work. Hand augering boreholes for soil samples. First area was a small area allowing for ghost signals and coupleing; also lots of concrete on edges. Located all known facilities with paint and lathe.

Legend:

- Well
- Survey Marker
- Building
- Tank
- Yard Light
- Power Pole
- Electric Panel
- Monitoring Well
- Work Area
- C---C---C Buried Cable
- Buried Pipe
- T---T---T Buried Telus

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N

Date	Sept. 19, 2019	Name	Gerald Schram	Facility Owner	Clean Harbors
Contractor	Tetra Tech	Contact	Mark Fawcett	Phone Number	(780) 818-6352
Type of Work	Boreholes	LLD	Riley Clean Harbors NE-9-50-17-W4	Aoc # / Job #	

Comments

Met Mark on site and discussed work area and scope of work. Hand augering boreholes for soil samples. Swept all borehole locations.

Legend

- Well
- Survey Monument
- Building
- Tank
- Yard Light
- Power Pole
- Elec Panel
- Moniter Well
- Work Area
- U/G Cable
- U/G Pipeline
- Forgien Owned Facility (One Call Locates)

Locate Equipment Used

Locate Frequency /Method

Work Area Marked (How)

Any mapping discrepencies or difficulties locating

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Date Sept. 19, 2019 Name Gerald Schram Facility Owner Clean Harbors

Contractor Tetra Tech Contact Mark Fawcett Phone Number (780) 818-6352

Type of Work Boreholes LLD Riley Clean Harbors NE-9-50-17-W4 Aoc # / Job #

Comments — Met Mark on site and discussed work area and scope of work. Hand augering boreholes for soil samples. Swept all borehole locations. —

Legend

- Well
- Survey Monument
- Building
- Tank
- Yard Light
- Power Pole
- Elec Panel
- Moniter Well
- Work Area
- U/G Cable
- U/G Pipeline
- Forgien Owned Facility (One Call Locates)

Locate Equipment Used

Locate Frequency /Method

Work Area Marked (How)

Any mapping discrepencies or difficulties locating

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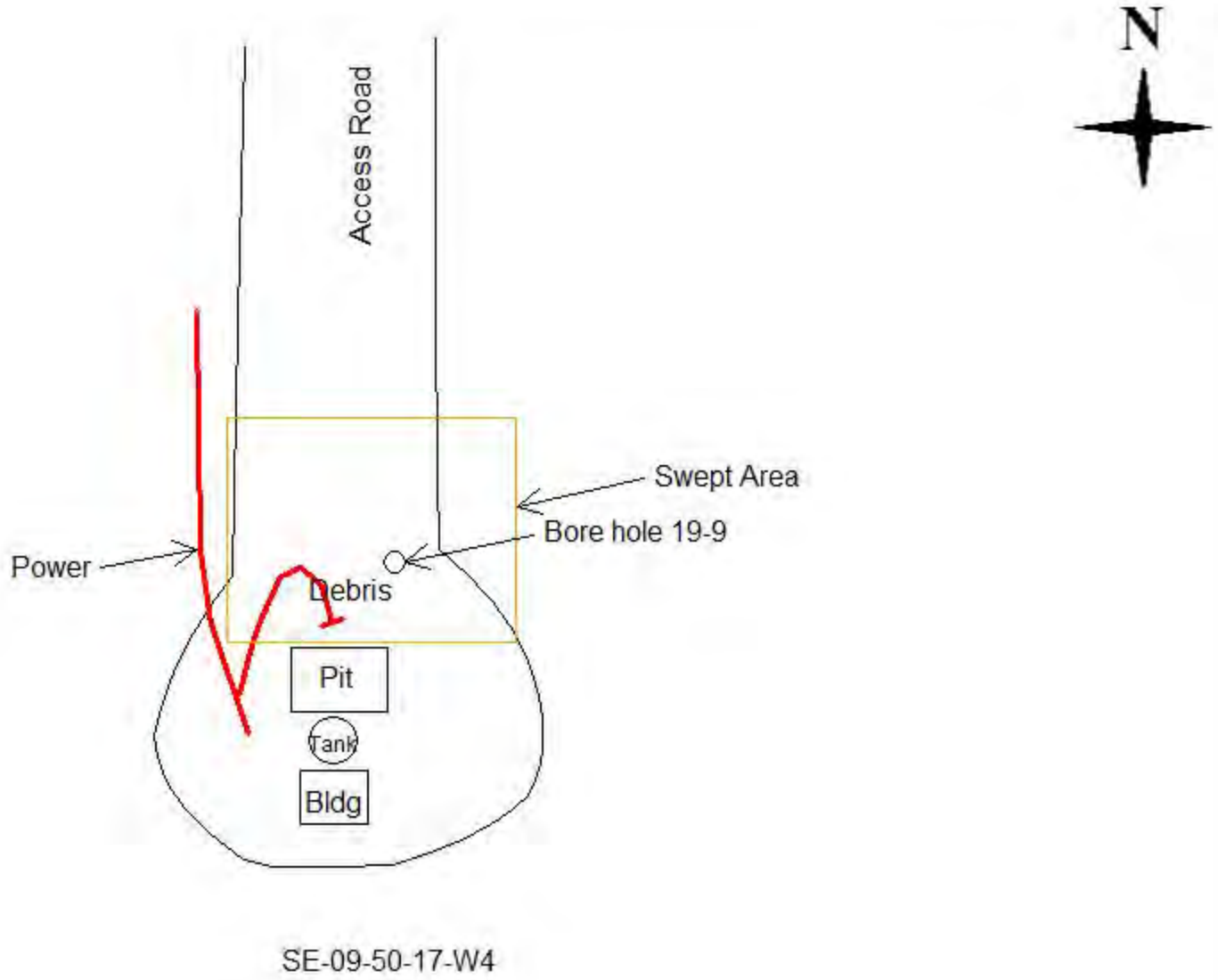

SE-09-50-17-W4

Date: Sept 19, 2019 Locator: Gerald Schram Facility Owner: Clean Harbors

Contractor: Tetra Tech Contact: Mark Fawcett Phone Number: (780) 818-6352

Legal Land Description: SE-09-50-17-W4 1st Call Ticket / Job #: Ryley Facility

Comments: Met Mark on site. Discussed work area and scope of work.

Located all known facilities with paint and lath. Difficulty with doing sweep due to debris and mud.

Legend:

- Well
- Survey Marker
- Building
- Tank
- Yard Light
- Power Pole
- Electric Panel
- Monitoring Well
- Work Area
- C---C---C Buried Cable
- Buried Pipe
- T---T---T Buried Telus

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APPENDIX D

BOREHOLE LOGS

Clean Harbors

Borehole No: **14-01**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405512.03 E; 5906792.77 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Disturbed topsoil, very dark greyish brown (10YR 3/2), clay loam, moderate granular, friable, moist, <1% coarse fragments				0.2, 0.4
0.2		Bntk horizon, dark yellowish brown (10YR 4/4), clay to clay loam, subangular blocky, friable, moist, <1% coarse fragments, moderate effervescence				0.6, 0.8, 1.0
0.4		BCk horizon, yellowish brown (10YR 5/4), clay, blocky to massive, friable, 2-3% coarse fragments, moderate effervescence				1.2, 1.4, 1.6, 1.8
0.6		Till (Cksa horizon), yellowish brown (10YR 5/4), clay, massive, white precipitates, ironstone inclusions				2.0, 2.2, 2.4
0.8						2.6, 2.8, 3.0, 3.2
1.0		END OF BOREHOLE (1.00 metre)				3.4, 3.6, 3.8, 4.0
1.2						4.2, 4.4
1.4						4.6, 4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 29
Logged By: BF	Completion Date: 2019 September 29
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **14-02**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405436.12 E; 5906326.89 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Topsoil (Ah horizon), clay loam, very dark greyish brown (10YR 3/2), fine to moderate granular, friable, moist, <1% coarse fragments, roots				0.2, 0.4
0.2		Bnt horizon, very dark greyish brown (10YR 4/4), clay loam, fine subangular blocky, friable, moist, <1% coarse fragments, weak effervescence				0.6, 0.8, 1.0
0.4		Csa1 horizon, dark yellowish brown (10YR 4/4), clay, friable, <1% coarse fragments, no visible effervescence, some white precipitates				1.2, 1.4, 1.6, 1.8
0.6						2.0, 2.2, 2.4
0.8		Csa2 horizon, dark yellowish brown (10YR 4/4), sandy clay, friable, loose, <1% coarse fragments, no visible effervescence, white precipitates				2.6, 2.8, 3.0, 3.2
1.0		END OF BOREHOLE (1.00 metre)				3.4
1.2						3.6, 3.8, 4.0, 4.2
1.4						4.4, 4.6
1.5						4.8

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-01**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 404892.1 E; 5906793.99 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Ah horizon, black (10YR 2/1), loam, moderate fine granular, friable, moist, <1% coarse fragments				0.2
						0.4
		Ae horizon, grey (10YR 5/1), silt loam, weak platy structure				
0.2		Bnt horizon, very dark greyish brown (10YR 3/2), clay, strong coarse columnar, moist, <1% coarse fragments, black staining				0.6
						0.8
						1.0
						1.2
0.4						1.4
		Cksa1 horizon, dark yellowish brown (10YR 4/4), clay loam to clay, massive, friable, moist, <1% coarse fragments, white crystal inclusions				1.6
						1.8
0.6		Cksa2 horizon, dark yellowish brown (10YR 3/4), clay, massive, friable to firm, moist, 2% coarse fragments, white crystal inclusions				2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 19
Logged By: BF	Completion Date: 2019 September 19
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-02**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405201.25 E; 5907043.29 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Topsoil (Ah horizon), black (10YR 2/1), clay loam, fine to moderate granular, friable, <1% coarse fragments				0.2
						0.4
0.2		Btnj horizon, dark yellowish brown (10YR 3/4), clay, friable, moist, 1% coarse fragments, moderate prismatic				0.6
						0.8
						1.0
		Till (Csa horizon), dark yellowish brown (10YR 3/4), sandy clay loam, massive, friable, <1% coarse fragments, few fine prominent mottles, white crystal inclusions				1.2
0.4						1.4
		Till (Cksa1 horizon), dark yellowish brown (10YR 3/4), sandy clay loam, massive, friable, <1% coarse fragments, few fine prominent mottled, white crystal inclusions				1.6
						1.8
0.6						2.0
		Till (Cksa2 horizon), dark yellowish brown (10YR 3/4), clay, massive, friable to firm, 5% coarse fragments, few faint fine mottles				2.2
						2.4
0.8		Till (Ck horizon), dark yellowish brown (10YR 3/4), clay to sandy clay loam, massive, 5% coarse fragments, few medium grey mottles				2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 19
Logged By: BF	Completion Date: 2019 September 19
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-03**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405388.88 E; 5906705.57 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, dark brown (10YR 3/3), clay loam, moderate subangular blocky, friable, wet, 25% coarse fragments (20-30 mm diameter)				0.2
		Fill, very dark greyish brown (10YR 3/2), clay, moderate subangular blocky, friable, wet, 25% coarse fragments (20-30 mm diameter)				0.4
0.2						0.6
		Till, dark yellowish brown (10YR 4/4), clay, massive, firm, wet, 3% coarse fragments (20-30 mm diameter), strong effervescence, white and orange precipitates				0.8
						1.0
0.4						1.2
						1.4
						1.6
0.6						1.8
						2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-03A**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405389.34 E; 5906711.53 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, dark brown (10YR 3/3), clay loam, moderate subangular blocky, friable, wet, 25% coarse fragments (20-30 mm diameter)				0.2
		Fill, very dark greyish brown (10YR 3/2), clay, moderate subangular blocky, friable, wet, 25% coarse fragments (20-30 mm diameter)				0.4
0.2						0.6
		Till, dark yellowish brown (10YR 4/4), clay, massive, firm, wet, 3% coarse fragments (20-30 mm diameter), strong effervescence, white and orange precipitates				0.8
						1.0
						1.2
0.4						1.4
						1.6
						1.8
0.6						2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-03B**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405393.96 E; 5906704 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, clay loam, friable, very wet, fibrous peaty				
		Fill, very dark greyish brown (10YR 3/2), clay, friable, very wet, 30% coarse fragments, fine and small roots				
0.2		Till, dark yellowish brown (10YR 4/4), sandy clay, massive, firm, very wet, 5% coarse fragments, white and orange precipitates, some mottles				
0.4						
0.6						
0.8						
1.0		END OF BOREHOLE (1.00 metre)				
1.2						
1.4						
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-03C**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405384.2 E; 5906701.6 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, very dark greyish brown (10YR 3/2), clay, massive, firm, moist, <2% coarse fragments				0.2, 0.4
0.2		Fill, very dark greyish brown (10YR 3/2), clay, friable, moist, 25% coarse fragments (20-30 mm diameter)				0.6, 0.8
		Till, dark yellowish brown (10YR 4/4), clay, massive, firm, white and orange precipitates, some coal, some ironstone				1.0, 1.2
0.4						1.4, 1.6
0.6						1.8, 2.0, 2.2
0.8						2.4, 2.6
1.0		END OF BOREHOLE (1.00 metre)				2.8, 3.0, 3.2
						3.4
1.2						3.6, 3.8, 4.0
						4.2
1.4						4.4, 4.6
1.5						4.8

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-03D**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405383.03 E; 5906708.02 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, dark brown (10YR 3/3), clay loam, moderate subangular blocky, friable, wet, 25% coarse fragments (20-30 mm diameter)				0.2
		Fill, very dark greyish brown (10YR 3/2), clay, moderate subangular blocky, friable, wet, 25% coarse fragments (20-30 mm diameter)				0.4
0.2						0.6
		Till, dark yellowish brown (10YR 4/4), clay, massive, firm, wet, 3% coarse fragments (20-30 mm diameter), strong effervescence, white and orange precipitates				0.8
						1.0
						1.2
0.4						1.4
						1.6
						1.8
0.6						2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-04**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405314.15 E; 5906704.47 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, very dark greyish brown (10YR 3/2), fine subangular blocky, friable, moist, <1% coarse fragments				0.2
						0.4
0.2		Fill, very dark greyish brown (10YR 3/2), clay, medium to coarse subangular blocky, friable, 2% coarse fragments, some darker mottles				0.6
						0.8
						1.0
						1.2
0.4						1.4
						1.6
						1.8
0.6						2.0
						2.2
		Till, dark yellowish brown (10YR 4/4), clay, 2% coarse fragments, strong effervescence, some white precipitates, some ironstone				2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-04A**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405301.79 E; 5906718.7 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, very dark greyish brown (10YR 3/2) to dark yellowish brown (10YR 4/4), fine subangular blocky, friable, moist, <1% coarse fragments				0.2
						0.4
0.2		Fill, very dark greyish brown (10YR 3/2), clay, medium to coarse subangular blocky, friable, 2% coarse fragments, some darker mottles				0.6
						0.8
						1.0
						1.2
0.4						1.4
						1.6
						1.8
0.6						2.0
						2.2
		Till, dark yellowish brown (10YR 4/4), clay, 2% coarse fragments, strong effervescence, some white precipitates, some ironstone				2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
Reviewed By:	Page 1 of 1

Clean Harbors

Borehole No: **19-04B**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405314.02 E; 5906714.16 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, very dark greyish brown (10YR 3/2), fine subangular blocky, friable, moist, <1% coarse fragments				0.2, 0.4
0.2		Fill, very dark greyish brown (10YR 3/2), clay, medium to coarse subangular blocky, friable, 5% coarse fragments (10-20 mm diameter), some darker mottles				0.6, 0.8, 1.0, 1.2
0.4						1.4, 1.6, 1.8
0.6		Till, dark yellowish brown (10YR 4/4), clay, 2% coarse fragments, strong effervescence, some white precipitates, some ironstone				2.0, 2.2, 2.4
0.8						2.6, 2.8
1.0		END OF BOREHOLE (1.00 metre)				3.0, 3.2, 3.4
1.2						3.6, 3.8, 4.0
1.4						4.2, 4.4, 4.6
1.5						4.8

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
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Clean Harbors

Borehole No: **19-04C**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405301.59 E; 5906708.63 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, very dark greyish brown (10YR 3/2), fine subangular blocky, friable, moist, <1% coarse fragments, some reddish brown inclusions				0.2, 0.4
0.2		Fill, very dark greyish brown (10YR 3/2), clay, medium to coarse subangular blocky, friable, <5% coarse fragments, some darker mottles				0.6, 0.8, 1.0, 1.2
0.4						1.4, 1.6, 1.8
0.6		Till, dark yellowish brown (10YR 4/4), clay, 2% coarse fragments, strong effervescence, some white precipitates, some ironstone				2.0, 2.2, 2.4
0.8						2.6, 2.8
1.0		END OF BOREHOLE (1.00 metre)				3.0, 3.2, 3.4
1.2						3.6, 3.8, 4.0
1.4						4.2, 4.4, 4.6
1.5						4.8

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
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Clean Harbors

Borehole No: **19-04D**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405301.87 E; 5906698.56 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, very dark greyish brown (10YR 3/2), fine subangular blocky, friable, moist, <1% coarse fragments				0.2, 0.4
0.2		Fill, very dark greyish brown (10YR 3/2), clay, medium to coarse subangular blocky, friable, <1% coarse fragments, some darker mottles				0.6, 0.8, 1.0, 1.2
0.4						1.4, 1.6, 1.8
0.6		Till, dark yellowish brown (10YR 4/4), clay, <1% coarse fragments, strong effervescence, some white precipitates, some ironstone				2.0, 2.2, 2.4
0.8						2.6, 2.8
1.0		END OF BOREHOLE (1.00 metre)				3.0, 3.2, 3.4
1.2						3.6, 3.8, 4.0
1.4						4.2, 4.4, 4.6
1.5						4.8

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
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Clean Harbors

Borehole No: **19-04E**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405313.93 E; 5906693.28 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil admixed with subsoil, very dark greyish brown (10YR 3/2), fine subangular blocky, friable, moist, <1% coarse fragments				0.2
						0.4
		Fill, very dark brown (10YR 2/2), clay, medium to coarse subangular blocky, friable, 2% coarse fragments, some darker mottles				0.6
0.2						0.8
						1.0
						1.2
0.4						1.4
		- 3% coarse fragments				1.6
						1.8
0.6						2.0
		Till, dark yellowish brown (10YR 4/4), clay, 2% coarse fragments, strong effervescence, some white precipitates, some ironstone				2.2
						2.4
0.8						2.6
		- very dark brown (10YR 2/2)				2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
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Clean Harbors

Borehole No: **19-05**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405120.09 E; 5906405.28 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil, very dark greyish brown (10YR 3/2), clay loam, moderate subangular blocky, friable, moist, <1% coarse fragments, some admixed subsoil				0.2
						0.4
		Fill (till), dark brown (10YR 3/3), clay, massive, friable, moist, <3% coarse fragments				0.6
0.2						0.8
		Till, dark yellowish brown (10YR 4/3), clay, sticky, massive, firm, moist to wet, <3% coarse fragments, some ironstone inclusions				1.0
						1.2
0.4						1.4
						1.6
						1.8
0.6						2.0
						2.2
						2.4
0.8						2.6
						2.8
		- dark yellowish brown (10YR 4/4)				3.0
1.0						3.2
		END OF BOREHOLE (1.00 metre)				3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 October 2
Logged By: BF	Completion Date: 2019 October 2
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Clean Harbors

Borehole No: **19-06**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405244.72 E; 5906751.21 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, very dark greyish brown (10YR 3/2), clay, moderate to coarse subangular blocky, friable to firm, roots, moist, <3% coarse fragments, moderate effervescence				0.2
0.2		Fill, dark yellowish brown, clay, massive, firm, moist to wet, no visible effervescence, white and brown precipitates, some gleying				0.4
						0.6
						0.8
						1.0
0.4						1.2
						1.4
						1.6
0.6						1.8
						2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
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Clean Harbors

Borehole No: **19-07**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405322.36 E; 5906640.74 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Admixed topsoil and clay (fill), dark yellowish brown (10YR 4/4), clay, massive, roots, strong effervescence, some gleying				0.2
0.2		Fill, yellowish brown (10YR 5/4), clay, massive, firm, moderate effervescence, some gleying				0.4
						0.6
0.4						0.8
						1.0
						1.2
						1.4
0.6						1.6
						1.8
						2.0
		Till (Cksa horizon), dark yellowish brown (10YR 4/4), clay, massive, firm, moderate effervescence, white and brown precipitates				2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
						3.8
1.2						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
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Clean Harbors

Borehole No: **19-08**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405195.19 E; 5906753.27 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, dark brown (10YR 3/3), clay, massive breaking into fine to medium fragments, friable to firm, weak effervescence, some gleying				0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2
0.2						
0.4						
0.6		Fill, dark yellowish brown (10YR 4/4), clay, massive, firm, no visible effervescence, some ironstone				
0.8						
1.0		END OF BOREHOLE (1.00 metre)				3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8
1.2						
1.4						
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
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Clean Harbors

Borehole No: **19-09**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405029.7 E; 5906604.38 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, brown (10YR 5/3), clay, massive, firm, moist, <2% coarse fragments, moderate effervescence, ironstone and coal inclusions				
0.2		- salts				0.2 / 0.4 / 0.6 / 0.8 / 1.0
		Fill, brown (10YR 5/3), clay, massive, firm, moist, 3% coarse fragments, moderate effervescence, few fine faint mottles, pockets of gleying, ironstone and coal inclusions				
0.4						1.2 / 1.4 / 1.6 / 1.8 / 2.0
0.6						2.2 / 2.4
0.8						2.6 / 2.8 / 3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2 / 3.4 / 3.6 / 3.8 / 4.0
1.2						4.2 / 4.4
1.4						4.6 / 4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 19
Logged By: BF	Completion Date: 2019 September 19
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Clean Harbors

Borehole No: **19-10**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405045.05 E; 5906753.72 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Replaced topsoil (Ah horizon), very dark greyish brown (10YR 3/2), clay loam, moderate granular, roots, <1% coarse fragments, no visible effervescence				0.2
0.2		Fill, dark yellowish brown (10YR 4/4), clay, friable, <1% coarse fragments, weak effervescence, some white and brown precipitates, some ironstone				0.4, 0.6, 0.8, 1.0, 1.2
0.4		Fill, yellowish brown (10YR 5/4), clay, massive breaking into fine fragments, friable, <3% coarse fragments, strong effervescence, some ironstone				1.4, 1.6, 1.8, 2.0, 2.2, 2.4
0.6						
0.8		Fill, yellowish brown (10YR 5/4), clay, massive, firm, moderate effervescence, some white precipitates, some ironstone				2.6, 2.8, 3.0, 3.2
1.0		END OF BOREHOLE (1.00 metre)				3.4, 3.6, 3.8, 4.0, 4.2, 4.4
1.2						
1.4						4.6, 4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
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Clean Harbors

Borehole No: **19-11**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 404783.22 E; 5906513.43 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Topsoil (Ap horizon), very dark greyish brown (10YR 3/2), clay loam, moderate granular, friable				0.2
						0.4
		Bnt horizon, dark brown (10YR 3/3), clay to clay loam, fine subangular blocky, friable, <1% coarse fragments				0.6
0.2						0.8
		BC horizon, dark yellowish brown (10YR 4/4), clay to clay loam, prismatic to massive, friable, <1% coarse fragments, no visible effervescence, ironstone				1.0
						1.2
0.4						1.4
		Till (Cksa horizon), yellowish brown (10YR 5/4), clay, massive, firm, <3% coarse fragments, strong effervescence, white and brown precipitates, ironstone inclusions				1.6
						1.8
0.6						2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 24
Logged By: BF	Completion Date: 2019 September 24
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Clean Harbors

Borehole No: **19-12**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 404937.41 E; 5906392.47 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, very dark greyish brown (10YR 3/2), clay, massive, firm, 3% coarse fragments, weak effervescence, some white and orange precipitates				0.2, 0.4
0.2		Till (Ccasa horizon), dark yellowish brown (10YR 4/4), clay, massive, firm, moist, weak effervescence, more white precipitates, some greyish				0.6, 0.8, 1.0, 1.2
0.4						1.4, 1.6
		Till (Cksa horizon), dark yellowish brown (10YR 4/4), clay, massive, strong effervescence, white precipitates				1.8, 2.0, 2.2
0.6						2.4
		Till (Csa horizon), yellowish brown (10YR 5/4), clay, massive, firm, no effervescence				2.6, 2.8
0.8						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2, 3.4, 3.6, 3.8
1.2						4.0, 4.2, 4.4
1.4						4.6
1.5						4.8

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 24
Logged By: BF	Completion Date: 2019 September 24
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Clean Harbors

Borehole No: **19-13**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 404809.91 E; 5906350.5 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, very dark greyish brown (10YR 3/2), clay, massive, firm, moist, <1% coarse fragments, some black streaks, trace coal, ironstone, no discernible odour				0.2
0.2						0.4
						0.6
						0.8
		Till, dark brown (10YR 3/3), clay, massive, firm to friable, moist, weak effervescence, white precipitates, ironstone				1.0
0.4						1.2
						1.4
						1.6
0.6						1.8
						2.0
		Till (Csa horizon), dark yellowish brown (10YR 4/4), clay, massive, firm to friable, moist, <1% coarse fragments, ironstone				2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 24
Logged By: BF	Completion Date: 2019 September 24
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Clean Harbors

Borehole No: **19-14**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405534.49 E; 5906580.89 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, dark greyish brown (10YR 4/2), clay, subangular blocky, friable, roots, <1% coarse fragments, no visible effervescence, some white precipitates				0.2
0.2						0.4
						0.6
						0.8
		Till (Csa horizon), dark brown to brown (10YR 4/3), fine angular to subangular blocky, friable, some darker mottles, some ironstone				1.0
0.4						1.2
						1.4
						1.6
0.6						1.8
						2.0
						2.2
						2.4
0.8						2.6
						2.8
						3.0
1.0		END OF BOREHOLE (1.00 metre)				3.2
						3.4
						3.6
1.2						3.8
						4.0
						4.2
						4.4
1.4						4.6
						4.8
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 24
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Clean Harbors

Borehole No: **19-15**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 405532.06 E; 5906458.53 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, dark brown to brown (10YR 4/3), clay loam, fine subangular blocky, friable, some gleying				0.2, 0.4
0.2		Till (Cksa1 horizon), dark yellowish brown (10YR 4/4), clay, massive breaking into medium fragments, friable, moderate effervescence, some gleying				0.6, 0.8, 1.0, 1.2
0.4		Till (Cksa2 horizon), dark yellowish brown (10YR 4/4), clay, massive, firm to friable, some roots, strong effervescence, brown and white precipitates				1.4, 1.6, 1.8, 2.0, 2.2, 2.4
0.8		Till (Cksa3 horizon), yellowish brown (10YR 5/4), sandy clay, moderate granular, friable, strong effervescence				2.6, 2.8, 3.0, 3.2
1.0		END OF BOREHOLE (1.00 metre)				3.4, 3.6, 3.8, 4.0, 4.2, 4.4
1.2						4.6, 4.8
1.4						
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
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Clean Harbors

Borehole No: **19-16**

Project: 2019 Soil Monitoring Program	Project No: SWM.SWOP04076-02
Location:	
Ryley, Alberta	UTM: 404790.59 E; 5906718.12 N; Z 12

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	Depth (ft)
0						0
	Shovel and hand auger	Fill, dark brown to brown (10YR 4/3), clay, massive to prismatic, friable, roots, moist, 1% coarse fragments, no effervescence				0.2, 0.4
0.2		Till (BCk horizon), dark greyish brown (10YR 4/2), clay, massive, firm, weak effervescence, some gleying, some ironstone				0.6, 0.8, 1.0, 1.2
0.4		Till (Cksa horizon), dark yellowish brown (10YR 4/4), clay, massive, firm, strong effervescence, white and orange precipitates				1.4, 1.6, 1.8, 2.0, 2.2, 2.4
0.8						2.6, 2.8, 3.0, 3.2
1.0		END OF BOREHOLE (1.00 metre)				3.4, 3.6, 3.8, 4.0, 4.2, 4.4
1.2						4.6, 4.8
1.4						
1.5						

TETRA TECH

Contractor:	Completion Depth: 1 m
Drilling Rig Type:	Start Date: 2019 September 25
Logged By: BF	Completion Date: 2019 September 25
Reviewed By:	Page 1 of 1

APPENDIX E

LABORATORY DATA

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Report Transmission Cover Page

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Contact	Company	Address
Accounts Payable	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: EBA.accounts.Payable@tetratech.

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

Contact	Company	Address
Data Management	**Tetra Tech EBA Inc**	100, 140 Quarry Park Blvd SE Calgary, AB T2C 3G3 Phone: (403) 203-3355 Fax: Email: EBA.labdata@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Multiple Reports By Lot	EBA ESDAT Sample File	Test Report
Email - Multiple Reports By Lot	Legacy Reverse Crosstab in CSV	Test Report
Email - Multiple Reports By Lot	PDF	COC / Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report

Contact	Company	Address
Mark Fawcett	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email: mark.fawcett@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	AB Tier 1 Custom Excel	Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report
Email - Single Report	EBA ESDAT Sample File	Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	Invoice

Notes To Clients:

- Sep 26, 2019 - Low level VOC-Soil-ABT1 analyses were performed on samples prepped from a jar.
- Oct 01, 2019 - Report was issued to include addition of VOC6 (Alberta Landfill Solvent Screen) analysis on sample #11 as requested by Mark Fawcett of Tetra Tech on Oct.1,2019. Previous report 2443726.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

	Reference Number	1378374-1	1378374-2	1378374-3	
	Sample Date	Sep 19, 2019	Sep 19, 2019	Sep 19, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-1 / 0-13	19-1 / 15-30	19-1 / 45-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Classification						
Cation Exchange Capacity		meq/100 g	29.1	27	18	4
Carbon	Total Organic	%	6.03	1.55	0.27	0.04
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.11	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	<0.2	0.4	0.4	0.2
Arsenic	Strong Acid Extractable	mg/kg	4.0	6.2	5.8	0.2
Barium	Strong Acid Extractable	mg/kg	65	199	83	1
Beryllium	Strong Acid Extractable	mg/kg	0.3	0.7	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.18	0.16	0.13	0.01
Chromium	Strong Acid Extractable	mg/kg	9.0	19.0	15.4	0.5
Cobalt	Strong Acid Extractable	mg/kg	3.5	8.8	7.2	0.1
Copper	Strong Acid Extractable	mg/kg	11.6	15.3	14.5	1
Lead	Strong Acid Extractable	mg/kg	7.3	7.2	6.8	0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05	<0.05	0.06	0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.8	<1.0	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	7.4	18.9	27.6	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	0.5	0.3	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.09	0.15	0.17	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.7	2.3	1.1	0.5
Vanadium	Strong Acid Extractable	mg/kg	23.5	28.5	20.7	0.1
Zinc	Strong Acid Extractable	mg/kg	63	53	42	1
Physical and Aggregate Properties						
Texture			Sandy Loam	Clay	Sandy Clay Loam	
Sand	50 µm - 2 mm	% by weight	45	38	47	0.1
Silt	2 µm - 50 µm	% by weight	49	22	27	0.1
Clay	<2 µm	% by weight	6	40	26	0.1
Particle Size Analysis - Wet Sieve						
Texture			Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve	% Retained	% by weight	43.7	32.8	39.4	0.1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	0.31	2.73	11.1	0.01
SAR	Saturated Paste		5.1	28	22.9	
% Saturation		%	85	126	71	
Calcium	Saturated Paste	mg/kg	6.0	21	361	
Magnesium	Saturated Paste	mg/kg	2.4	24	279	
Sodium	Saturated Paste	mg/kg	54	883	2010	

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7217 Roper Road NW
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Sampled By: MF/BF/KM
Company: Tetra Tech

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	Reference Number	1378374-1	1378374-2	1378374-3	
	Sample Date	Sep 19, 2019	Sep 19, 2019	Sep 19, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-1 / 0-13	19-1 / 15-30	19-1 / 45-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity - Continued						
Potassium	Saturated Paste	mg/kg	14	<13	13	
Chloride	Saturated Paste	mg/L	14	29	38	2
Chloride	Saturated Paste	mg/kg	12	37	27	
Sulfate (SO4)	Saturated Paste	mg/kg	56.4	1500	5910	
Nitrate and Nitrite - N	Saturated Paste	mg/L	<5	<5	<5	0.5
Nitrate and Nitrite - N	Saturated Paste	meq/L	<0.4	<0.4	<0.4	0.05
Nitrate and Nitrite - N	Saturated Paste	mg/kg	<4	<6	<4	
TGR	Saturated Paste	T/ac	<0.1	1.8	>20.0	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	4.6	6.9	8.1	
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Subcontracted Analysis						
Total Sulfur	SRC	%	0.07	0.08	1.52	
Subcontractor Report Id	SRC		G-2019-1848	G-2019-1848	G-2019-1848	

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Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

	Reference Number	1378374-4	1378374-5	1378374-6	
	Sample Date	Sep 19, 2019	Sep 19, 2019	Sep 19, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-1 / 60-100	19-2 / 0-18	19-2 / 18-30	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Classification						
Cation Exchange Capacity		meq/100 g	18	25	21	4
Carbon	Total Organic	%	0.30	3.87	1.13	0.04
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	0.14	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	<0.2	0.2	0.2
Arsenic	Strong Acid Extractable	mg/kg	5.6	4.2	5.8	0.2
Barium	Strong Acid Extractable	mg/kg	152	101	102	1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.3	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.17	0.24	0.08	0.01
Chromium	Strong Acid Extractable	mg/kg	15.6	10.4	19.7	0.5
Cobalt	Strong Acid Extractable	mg/kg	7.2	5.9	8.1	0.1
Copper	Strong Acid Extractable	mg/kg	13.7	9.3	10.1	1
Lead	Strong Acid Extractable	mg/kg	7.1	8.1	6.6	0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05	<0.05	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	20.9	9.8	16.8	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	0.5	1.0	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.14	0.10	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	1.3	1.0	1.4	0.5
Vanadium	Strong Acid Extractable	mg/kg	20.2	22.6	27.7	0.1
Zinc	Strong Acid Extractable	mg/kg	45	60	50	1
Physical and Aggregate Properties						
Texture			Clay Loam	Loam	Clay Loam	
Sand	50 µm - 2 mm	% by weight	42	44	39	0.1
Silt	2 µm - 50 µm	% by weight	30	42	31	0.1
Clay	<2 µm	% by weight	28	14	30	0.1
Particle Size Analysis - Wet Sieve						
Texture			Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve	% Retained	% by weight	38.4	36.1	31.5	0.1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	9.77	0.75	3.11	0.01
SAR	Saturated Paste		20.7	9.4	27	
% Saturation		%	95	64	74	
Calcium	Saturated Paste	mg/kg	450	8.7	21	
Magnesium	Saturated Paste	mg/kg	289	3.0	16	
Sodium	Saturated Paste	mg/kg	2230	101	582	

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7217 Roper Road NW
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Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

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Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

	Reference Number	1378374-4	1378374-5	1378374-6	
	Sample Date	Sep 19, 2019	Sep 19, 2019	Sep 19, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-1 / 60-100	19-2 / 0-18	19-2 / 18-30	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity - Continued						
Potassium	Saturated Paste	mg/kg	16	1	<7	
Chloride	Saturated Paste	mg/L	10	9	18	2
Chloride	Saturated Paste	mg/kg	10	6	14	
Sulfate (SO4)	Saturated Paste	mg/kg	6530	187	1140	
Nitrate and Nitrite - N	Saturated Paste	mg/L	<5	<5	<5	0.5
Nitrate and Nitrite - N	Saturated Paste	meq/L	<0.4	<0.4	<0.4	0.05
Nitrate and Nitrite - N	Saturated Paste	mg/kg	<5	<3	<4	
TGR	Saturated Paste	T/ac	18.9	<0.1	2.2	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	8.5	5.0	6.6	
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Subcontracted Analysis						
Total Sulfur	SRC	%	0.33	0.08	0.03	
Subcontractor Report Id	SRC		G-2019-1848	G-2019-1848	G-2019-1848	

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Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Reference Number		1378374-8	1378374-10	1378374-11
Sample Date		Sep 19, 2019	Sep 19, 2019	Sep 19, 2019
Sample Time		NA	NA	NA
Sample Location				
Sample Description		19-2 / 45-60	19-2 / 80-100	19-09 / 0-15
Matrix		Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Classification						
Cation Exchange Capacity		meq/100 g	16	14	18	4
Carbon	Total Organic	%	0.22	0.34	0.45	0.04
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	0.4	0.4	0.2
Arsenic	Strong Acid Extractable	mg/kg	6.1	4.8	5.9	0.2
Barium	Strong Acid Extractable	mg/kg	82	105	138	1
Beryllium	Strong Acid Extractable	mg/kg	0.4	0.4	0.4	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.16	0.18	0.21	0.01
Chromium	Strong Acid Extractable	mg/kg	15.4	15.8	17.6	0.5
Cobalt	Strong Acid Extractable	mg/kg	6.7	6.0	8.0	0.1
Copper	Strong Acid Extractable	mg/kg	13.6	11.7	15.8	1
Lead	Strong Acid Extractable	mg/kg	5.7	5.7	7.8	0.1
Mercury	Strong Acid Extractable	mg/kg	0.06	<0.05	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	27.1	19.8	25.0	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	<0.3	<0.3	0.3
Silver	Strong Acid Extractable	mg/kg	0.1	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.14	0.12	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.7	0.9	0.8	0.5
Vanadium	Strong Acid Extractable	mg/kg	22.5	19.3	22.6	0.1
Zinc	Strong Acid Extractable	mg/kg	40	38	55	1
Physical and Aggregate Properties						
Texture			Sandy Clay Loam	Sandy Clay Loam	Clay Loam	
Sand	50 µm - 2 mm	% by weight	58	47	42	0.1
Silt	2 µm - 50 µm	% by weight	17	27	27	0.1
Clay	<2 µm	% by weight	25	26	30	0.1
Particle Size Analysis - Wet Sieve						
Texture			Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve	% Retained	% by weight	45.3	39.5	30.7	0.1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	12.5	8.29	6.61	0.01
SAR	Saturated Paste		27.9	19.5	13.5	
% Saturation		%	54	78	72	
Calcium	Saturated Paste	mg/kg	275	369	359	
Magnesium	Saturated Paste	mg/kg	172	126	118	
Sodium	Saturated Paste	mg/kg	1770	1510	977	

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Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Reference Number		1378374-8	1378374-10	1378374-11
Sample Date		Sep 19, 2019	Sep 19, 2019	Sep 19, 2019
Sample Time		NA	NA	NA
Sample Location				
Sample Description		19-2 / 45-60	19-2 / 80-100	19-09 / 0-15
Matrix		Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Salinity - Continued						
Potassium	Saturated Paste	mg/kg	10	11	8	
Chloride	Saturated Paste	mg/L	26	5	43	2
Chloride	Saturated Paste	mg/kg	14	4	31	
Sulfate (SO4)	Saturated Paste	mg/kg	4870	4330	3170	
Nitrate and Nitrite - N	Saturated Paste	mg/L	8	<5	<5	0.5
Nitrate and Nitrite - N	Saturated Paste	meq/L	0.6	<0.4	<0.4	0.05
Nitrate and Nitrite - N	Saturated Paste	mg/kg	5	<4	<4	
TGR	Saturated Paste	T/ac	>20.0	12.5	5.2	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.7	7.8	7.7	
Sulfur	Elemental	µg/g			<10	10
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Subcontracted Analysis						
Total Sulfur	SRC	%	0.38	0.16	0.23	
Subcontractor Report Id	SRC		G-2019-1848	G-2019-1848	G-2019-1848	

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Reference Number	1378374-11
Sample Date	Sep 19, 2019
Sample Time	NA
Sample Location	
Sample Description	19-09 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Soil						
Benzene	Dry Weight	mg/kg	<0.005			0.005
Toluene	Dry Weight	mg/kg	<0.02			0.02
Ethylbenzene	Dry Weight	mg/kg	<0.005			0.005
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<0.03			0.03
Volatile Petroleum Hydrocarbons - Soil						
Methanol Field Preservation			Yes			
F1 C6-C10	Dry Weight	mg/kg	<10			10
F1 -BTEX	Dry Weight	mg/kg	<10			10
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date	Total Extractables		24-Sep-19			
F2c C10-C16	Dry Weight	mg/kg	<25			25
F3c C16-C34	Dry Weight	mg/kg	<50			50
F4c C34-C50	Dry Weight	mg/kg	<100			100
F4HTGCc C34-C50+	Dry Weight	mg/kg	<100			100
% C50+		%	<5			
Silica Gel Cleanup						
Silica Gel Cleanup			Done			
Soil % Moisture						
Moisture	Soil % Moisture	% by weight	15.90			
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01			0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05			0.05
Acenaphthene	Dry Weight	mg/kg	<0.05			0.05
Fluorene	Dry Weight	mg/kg	<0.05			0.05
Phenanthrene	Dry Weight	mg/kg	<0.01			0.01
Anthracene	Dry Weight	mg/kg	<0.003			0.003
Fluoranthene	Dry Weight	mg/kg	<0.01			0.010
Pyrene	Dry Weight	mg/kg	<0.01			0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01			0.01
Chrysene	Dry Weight	mg/kg	<0.05			0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05			0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05			0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05			0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05			0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05			0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05			0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	<0.001			0.001
IACR_Coarse	Index of Additive Cancer		<0.001			0.001

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Reference Number	1378374-11
Sample Date	Sep 19, 2019
Sample Time	NA
Sample Location	
Sample Description	19-09 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydrocarbons - Soil - Continued						
IACR_Fine	Risk Index of Additive Cancer Risk		<0.001			0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	70			50-140
2-Fluorobiphenyl	PAH - Surrogate	%	75			50-140
p-Terphenyl-d14	PAH - Surrogate	%	79			50-140
Polychlorinated Biphenyls - Soil						
Aroclor 1016	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1221	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1232	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1242	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1248	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1254	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1260	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1262	Dry Weight	mg/kg	<0.1			0.1
Aroclor 1268	Dry Weight	mg/kg	<0.1			0.1
Total PCBs	Dry Weight	mg/kg	<0.1			0.1
Polychlorinated Biphenyls - Soil - Surrogate						
Decachlorobiphenyl	Surrogate	%	125			50-140
Halogenated Aliphatics - Soil						
Vinyl Chloride	Dry Weight	mg/kg	<0.00030			0.00030
1,2-Dichloroethane	Dry Weight	mg/kg	<0.0020			0.0020
Methylene Chloride	Dry Weight	mg/kg	<0.010			0.010
Chloroform	Dry Weight	mg/kg	<0.0010			0.0010
Carbon Tetrachloride	Dry Weight	mg/kg	<0.00050			0.00050
VOC Screen - Soil						
Acetone	Dry Weight	mg/kg	<0.25			0.25
Acetonitrile	Dry Weight	mg/kg	<0.25			0.25
Acrylonitrile	Dry Weight	mg/kg	<0.25			0.25
Allyl Chloride	Dry Weight	mg/kg	<0.25			0.25
Benzene	Dry Weight	mg/kg	<0.01			0.01
Bromobenzene	Dry Weight	mg/kg	<0.01			0.01
Bromochloromethane	Dry Weight	mg/kg	<0.01			0.01
Bromodichloromethane	Dry Weight	mg/kg	<0.01			0.01
Bromoform	Dry Weight	mg/kg	<0.01			0.01
Bromomethane	Dry Weight	mg/kg	<0.10			0.10
2-Butanone (MEK)	Dry Weight	mg/kg	<0.25			0.25
n-Butylbenzene	Dry Weight	mg/kg	<0.01			0.01

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Reference Number	1378374-11
Sample Date	Sep 19, 2019
Sample Time	NA
Sample Location	
Sample Description	19-09 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
VOC Screen - Soil - Continued						
sec-Butylbenzene	Dry Weight	mg/kg	<0.01			0.01
tert-Butylbenzene	Dry Weight	mg/kg	<0.01			0.01
Chlorobenzene	Dry Weight	mg/kg	<0.01			0.01
Chloroethane	Dry Weight	mg/kg	<0.10			0.10
Chloromethane	Dry Weight	mg/kg	<0.10			0.10
2-Chlorotoluene	Dry Weight	mg/kg	<0.01			0.01
4-Chlorotoluene	Dry Weight	mg/kg	<0.01			0.01
Dibromochloromethane	Dry Weight	mg/kg	<0.01			0.01
1,2-Dibromo-3-Chloropropane	Dry Weight	mg/kg	<0.01			0.01
1,2-Dibromoethane	Dry Weight	mg/kg	<0.01			0.01
Dibromomethane	Dry Weight	mg/kg	<0.01			0.01
1,4-Dichloro-2-Butene(cis)	Dry Weight	mg/kg	<0.25			0.25
1,4-Dichloro-2-Butene(trans)	Dry Weight	mg/kg	<0.25			0.25
1,2-Dichlorobenzene	Dry Weight	mg/kg	<0.01			0.01
1,3-Dichlorobenzene	Dry Weight	mg/kg	<0.01			0.01
1,4-Dichlorobenzene	Dry Weight	mg/kg	<0.01			0.01
1,1-Dichloroethane	Dry Weight	mg/kg	<0.01			0.01
1,1-Dichloroethene	Dry Weight	mg/kg	<0.01			0.01
1,2-Dichloroethene(cis)	Dry Weight	mg/kg	<0.01			0.01
1,2-Dichloroethene(trans)	Dry Weight	mg/kg	<0.01			0.01
Dichlorodifluoromethane	Dry Weight	mg/kg	<0.10			0.10
1,2-Dichloropropane	Dry Weight	mg/kg	<0.01			0.01
1,3-Dichloropropane	Dry Weight	mg/kg	<0.01			0.01
1,1-Dichloropropene	Dry Weight	mg/kg	<0.01			0.01
1,3-Dichloropropene(cis)	Dry Weight	mg/kg	<0.01			0.01
1,3-Dichloropropene(trans)	Dry Weight	mg/kg	<0.01			0.01
Ethylbenzene	Dry Weight	mg/kg	<0.01			0.01
Ethyl Methacrylate	Dry Weight	mg/kg	<0.25			0.25
Hexachlorobutadiene	Dry Weight	mg/kg	<0.01			0.01
Hexachloroethane	Dry Weight	mg/kg	<0.01			0.01
2-Hexanone	Dry Weight	mg/kg	<0.25			0.25
Iodomethane	Dry Weight	mg/kg	<0.1			0.1
p-Isopropyltoluene	Dry Weight	mg/kg	<0.01			0.01
Methacrylonitrile	Dry Weight	mg/kg	<0.25			0.25
Methyl t-Butyl Ether	Dry Weight	mg/kg	<0.01			0.01
Methyl Methacrylate	Dry Weight	mg/kg	<0.25			0.25
4-Methyl-2-Pentanone	Dry Weight	mg/kg	<0.25			0.25

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Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Reference Number	1378374-11
Sample Date	Sep 19, 2019
Sample Time	NA
Sample Location	
Sample Description	19-09 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
VOC Screen - Soil - Continued						
(MIBK)						
Pentachloroethane	Dry Weight	mg/kg	<0.01			0.01
Propionitrile	Dry Weight	mg/kg	<0.25			0.25
iso-Propylbenzene	Dry Weight	mg/kg	<0.01			0.01
n-Propylbenzene	Dry Weight	mg/kg	<0.01			0.01
Styrene	Dry Weight	mg/kg	<0.01			0.01
1,1,1,2-Tetrachloroethane	Dry Weight	mg/kg	<0.01			0.01
1,1,2,2-Tetrachloroethane	Dry Weight	mg/kg	<0.01			0.01
Tetrachloroethene	Dry Weight	mg/kg	<0.01			0.01
Toluene	Dry Weight	mg/kg	<0.01			0.01
1,2,3-Trichlorobenzene	Dry Weight	mg/kg	<0.01			0.01
1,2,4-Trichlorobenzene	Dry Weight	mg/kg	<0.01			0.01
1,1,1-Trichloroethane	Dry Weight	mg/kg	<0.01			0.01
1,1,2-Trichloroethane	Dry Weight	mg/kg	<0.01			0.01
Trichloroethene	Dry Weight	mg/kg	<0.01			0.01
Trichlorofluoromethane	Dry Weight	mg/kg	<0.01			0.01
1,2,3-Trichloropropane	Dry Weight	mg/kg	<0.01			0.01
1,2,4-Trimethylbenzene	Dry Weight	mg/kg	<0.01			0.01
1,3,5-Trimethylbenzene	Dry Weight	mg/kg	<0.01			0.01
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<0.01			0.01
VOC - Soil - Surrogate Recovery						
Dibromofluoromethane	EPA Surrogate	%	83			50-140
Toluene-d8	EPA Surrogate	%	100			50-140
Bromofluorobenzene	EPA Surrogate	%	103			50-140
Alberta Landfill Solvent Scan - Soil						
Acetone	Dry Weight	mg/kg	<10			10
Benzene	Dry Weight	mg/kg	<10			10
iso-Butanol	Dry Weight	mg/kg	<10			10
n-Butanol	Dry Weight	mg/kg	<10			10
Cresol-m&p	Dry Weight	mg/kg	<10			10
Cresol-o	Dry Weight	mg/kg	<10			10
Carbon Disulfide	Dry Weight	mg/kg	<10			10
Cyclohexanone	Dry Weight	mg/kg	<10			10
Ethyl Acetate	Dry Weight	mg/kg	<10			10
Ethylbenzene	Dry Weight	mg/kg	<10			10
Ethyl Ether	Dry Weight	mg/kg	<10			10
Methanol	Dry Weight	mg/kg	<10			10
4-Methyl-2-Pentanone (MIBK)	Dry Weight	mg/kg	<10			10

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Company: Tetra Tech

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Reference Number	1378374-11
Sample Date	Sep 19, 2019
Sample Time	NA
Sample Location	
Sample Description	19-09 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Alberta Landfill Solvent Scan - Soil - Continued						
2-Butanone (MEK)	Dry Weight	mg/kg	<10			10
Nitrobenzene	Dry Weight	mg/kg	<10			10
2-Nitropropane	Dry Weight	mg/kg	<10			10
Pyridine	Dry Weight	mg/kg	<10			10
Toluene	Dry Weight	mg/kg	<10			10
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<10			10
Total		mg/kg	<500			500
Alberta Landfill Solvents - Soil - Surrogates						
Bromofluorobenzene	EPA Surrogate	%	88			74-121
Dibromofluoromethane	EPA Surrogate	%	116			80-120
Toluene-d8	EPA Surrogate	%	100			81-117

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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Reference Number	1378374-13
Sample Date	Sep 19, 2019
Sample Time	NA
Sample Location	
Sample Description	19-09 / 30-60
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	8.22			0.01
SAR	Saturated Paste		18.0			
% Saturation		%	74			
Calcium	Saturated Paste	mg/kg	382			
Magnesium	Saturated Paste	mg/kg	132			
Sodium	Saturated Paste	mg/kg	1380			
Potassium	Saturated Paste	mg/kg	12			
Chloride	Saturated Paste	mg/L	121			2
Chloride	Saturated Paste	mg/kg	89			
Sulfate (SO4)	Saturated Paste	mg/kg	4000			
TGR	Saturated Paste	T/ac	11.4			
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.7			

Approved by:

Darlene Lintott, MSc
Consulting Scientist

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Classification

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Carbon	%	-0.0005	-0.020	0.020		yes
Date Acquired:	September 27, 2019					
Ammonium - N	mg/L	3.272	-3	8		yes
Date Acquired:	September 23, 2019					
Client Sample Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
Cation Exchange Capacity	meq/100 g	<4.0	<4.0	10	0.1	yes
Date Acquired:	September 23, 2019					
Carbon	%	2.38	2.41	20	6.000	yes
Loss on Ignition @ 500C	%	4.14	4.69	20	0.10	yes
Carbon	%	1.61	1.64	20	0.100	yes
Date Acquired:	September 27, 2019					
Control Sample	**Units**	**Measured**	**Lower Limit**	**Upper Limit**		**Passed QC**
Ammonium - N	mg/kg	4200	3417	5151		yes
Cation Exchange Capacity	meq/100 g	30	21.6	39.6		yes
Date Acquired:	September 23, 2019					
Ammonium - N	mg/kg	3	3	3		yes
Date Acquired:	September 23, 2019					
Carbon	%	0.31	0.231	0.591		yes
Date Acquired:	September 27, 2019					

Extractable Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F2c C10-C16	µg/mL	0	-10	10	yes
F3c C16-C34	µg/mL	0	-30	30	yes
F4c C34-C50	µg/mL	0	-20	20	yes
F4HTGCc C34-C50+	µg/mL	0	-20	20	yes
Date Acquired:	September 22, 2019				
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**	**Passed QC**
F2c C10-C16	µg/mL	101.50	80	120	yes
F3c C16-C34	µg/mL	105.40	80	120	yes
F4c C34-C50	µg/mL	103.57	80	120	yes
F4HTGCc C34-C50+	µg/mL	96.11	80	120	yes
Date Acquired:	September 22, 2019				

Halogenated Aliphatics - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Vinyl Chloride	ng	0	-0.00030	0.00030	yes
1,1-Dichloroethene	ng	0	-0.010	0.010	yes
Trichloroethene	ng	0	-0.010	0.010	yes
Tetrachloroethene	ng	0	-0.010	0.010	yes
1,2-Dichloroethane	ng	0	-0.0020	0.0020	yes
Methylene Chloride	ng	0	-0.010	0.010	yes

Element
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T6B 3J4, Canada

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F: +1 (780) 434-8586
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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Halogenated Aliphatics - Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloroform	ng	0	-0.0010	0.0010	yes
Carbon Tetrachloride	ng	0	-0.00050	0.00050	yes
Dibromochloromethane	ng	0	-0.010	0.010	yes

Date Acquired: September 24, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Vinyl Chloride	ng	96.80	80	120	yes
1,1-Dichloroethene	ng	96.40	80	120	yes
Trichloroethene	ng	98.60	80	120	yes
Tetrachloroethene	ng	99.20	80	120	yes
1,2-Dichloroethane	ng	100.20	80	120	yes
Methylene Chloride	ng	89.20	80	120	yes
Chloroform	ng	103.20	80	120	yes
Carbon Tetrachloride	ng	92.60	80	120	yes
Dibromochloromethane	ng	95.20	80	120	yes

Date Acquired: September 24, 2019

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Vinyl Chloride	mg/kg	<0.00030	<0.00030	50	0.00060	yes
1,1-Dichloroethene	mg/kg	<0.010	<0.010	50	0.020	yes
Tetrachloroethene	mg/kg	<0.010	<0.010	50	0.020	yes
1,2-Dichloroethane	mg/kg	<0.0020	<0.0020	50	0.0040	yes
Methylene Chloride	mg/kg	<0.010	<0.010	50	0.020	yes
Chloroform	mg/kg	<0.0010	<0.0010	50	0.0020	yes
Carbon Tetrachloride	mg/kg	<0.00050	<0.00050	50	0.00100	yes
Dibromochloromethane	mg/kg	<0.010	<0.010	50	0.020	yes

Date Acquired: September 24, 2019

Metals Strong Acid Digestion

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Boron	mg/L	-0.0004	-0.05	0.07	yes
Antimony	µg/L	0.00339174	-0.1	0.2	yes
Arsenic	µg/L	0.0043929	-0.2	0.2	yes
Barium	µg/L	0.0489637	-1	1	yes
Beryllium	µg/L	-0.00656047	-0.1	0.1	yes
Cadmium	µg/L	0.000564426	-0.01	0.01	yes
Chromium	µg/L	0.00478577	-0.5	0.5	yes
Cobalt	µg/L	0.00471929	-0.1	0.1	yes
Copper	µg/L	0.0505439	-0.6	1.2	yes
Lead	µg/L	0.00747948	-5.0	5.0	yes
Mercury	µg/L	0.00224636	-0.04	0.04	yes
Molybdenum	µg/L	0.0470805	-1.0	1.0	yes
Nickel	µg/L	0.151167	-0.4	0.7	yes
Selenium	µg/L	-0.0139471	-0.3	0.3	yes
Silver	µg/L	0.00234029	-0.09	0.14	yes
Thallium	µg/L	0.00361085	-0.04	0.04	yes

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Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Metals Strong Acid Digestion - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Tin	µg/L	0.0328494	-0.4	0.4	yes
Uranium	µg/L	0.0191489	-0.5	0.5	yes
Vanadium	µg/L	-0.0200319	-0.1	0.1	yes
Zinc	µg/L	0.184308	-1	1	yes

Date Acquired: September 23, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Antimony	mg/kg	<0.2	<0.2	20	0.4	yes
Arsenic	mg/kg	4.0	3.8	20	0.4	yes
Barium	mg/kg	65	66	20	2	yes
Beryllium	mg/kg	0.3	0.3	20	0.2	yes
Cadmium	mg/kg	0.18	0.18	20	0.02	yes
Chromium	mg/kg	9.0	9.0	20	1.1	yes
Cobalt	mg/kg	3.5	3.4	20	0.2	yes
Copper	mg/kg	11.6	11.4	20	2.2	yes
Lead	mg/kg	7.3	8.2	20	0.2	yes
Mercury	mg/kg	<0.05	<0.05	20	0.05	yes
Molybdenum	mg/kg	1.8	1.8	20	2.2	yes
Nickel	mg/kg	7.4	6.7	20	1.1	yes
Selenium	mg/kg	<0.3	<0.3	20	0.7	yes
Silver	mg/kg	<0.10	<0.10	20	0.22	yes
Thallium	mg/kg	0.09	0.08	20	0.11	yes
Tin	mg/kg	<1.0	<1.0	20	2.2	yes
Uranium	mg/kg	0.7	0.7	20	1.1	yes
Vanadium	mg/kg	23.5	21.6	20	0.2	yes
Zinc	mg/kg	63	61	20	2	yes

Date Acquired: September 23, 2019

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Antimony	mg/kg	39.6	36.1	43.9	yes
Arsenic	mg/kg	38.6	36.3	43.9	yes
Barium	mg/kg	194	183	225	yes
Beryllium	mg/kg	19.5	17.4	22.2	yes
Cadmium	mg/kg	2.07	1.88	2.28	yes
Chromium	mg/kg	96.7	93.6	105.6	yes
Cobalt	mg/kg	19.4	17.0	23.0	yes
Copper	mg/kg	190	183.1	212.7	yes
Lead	mg/kg	20.2	18.3	21.5	yes
Mercury	mg/kg	3.08	2.64	3.36	yes
Molybdenum	mg/kg	204	174.8	234.8	yes
Nickel	mg/kg	96.3	91.6	108.4	yes
Selenium	mg/kg	38.8	34.0	46.0	yes
Silver	mg/kg	19.5	18.20	22.40	yes
Thallium	mg/kg	10.0	8.76	10.74	yes
Tin	mg/kg	200	188.0	218.0	yes
Uranium	mg/kg	102	86.0	116.0	yes

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P.O.:
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Date Reported: Oct 7, 2019
Report Number: 2446919

Metals Strong Acid Digestion - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Vanadium	mg/kg	19.3	18.0	21.6	yes
Zinc	mg/kg	193	170	230	yes
Date Acquired:	September 23, 2019				
Antimony	mg/kg	3.2	2.3	6.0	yes
Arsenic	mg/kg	3.2	2.6	6.8	yes
Barium	mg/kg	91	58	154	yes
Beryllium	mg/kg	0.2	0.2	0.5	yes
Cadmium	mg/kg	0.79	0.73	1.15	yes
Chromium	mg/kg	71.1	48.8	128.8	yes
Cobalt	mg/kg	5.9	3.9	10.4	yes
Copper	mg/kg	110	76.1	200.5	yes
Lead	mg/kg	220	198.7	305.5	yes
Mercury	mg/kg	0.05	0.05	0.07	yes
Molybdenum	mg/kg	<1.0	0.6	1.5	yes
Nickel	mg/kg	22.9	15.8	41.5	yes
Selenium	mg/kg	<0.3	0.1	0.4	yes
Silver	mg/kg	2.6	2.28	6.00	yes
Thallium	mg/kg	0.06	0.04	0.11	yes
Tin	mg/kg	9.8	4.0	16.0	yes
Uranium	mg/kg	<0.5	0.3	0.7	yes
Vanadium	mg/kg	25.4	17.8	46.9	yes
Zinc	mg/kg	266	260	350	yes
Date Acquired:	September 23, 2019				

Mono-Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.005	0.005	yes
Toluene	ng	0	-0.06	0.06	yes
Ethylbenzene	ng	0	-0.030	0.030	yes
Total Xylenes (m,p,o)	ng	0	-0.09	0.09	yes
Styrene	ng	0	-0.030	0.030	yes
Date Acquired:	September 22, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	ng	108.40	80	120	yes
Toluene	ng	85.80	80	120	yes
Ethylbenzene	ng	82.60	80	120	yes
Total Xylenes (m,p,o)	ng	84.00	80	120	yes
Styrene	ng	87.40	80	120	yes
Date Acquired:	September 22, 2019				

PAH - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	84.09	50	140	yes
2-Fluorobiphenyl	%	79.68	50	140	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
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PAH - Soil - Surrogate Recovery - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
p-Terphenyl-d14	%	84.21	50	140	yes
Date Acquired:	September 22, 2019				

Particle Size Analysis - Wet Sieve

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
75 micron sieve	% by weight	31.5	33.6	10	3.0	yes
Date Acquired:	September 23, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
75 micron sieve	% by weight	18.1	12.2	26.0	yes
Date Acquired:	September 23, 2019				
75 micron sieve	% by weight	30.6	24.6	33.4	yes
Date Acquired:	September 23, 2019				

Physical and Aggregate Properties

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sand	% by weight	29	24	34	yes
Clay	% by weight	30	26	36	yes
Date Acquired:	September 24, 2019				

Polychlorinated Biphenyls - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aroclor 1016	µg/mL	0	-0.3	0.3	yes
Aroclor 1221	µg/mL	0	-0.3	0.3	yes
Aroclor 1232	µg/mL	0	-0.3	0.3	yes
Aroclor 1242	µg/mL	0	-0.3	0.3	yes
Aroclor 1248	µg/mL	0	-0.3	0.3	yes
Aroclor 1254	µg/mL	0	-0.3	0.3	yes
Aroclor 1260	µg/mL	0	-0.3	0.3	yes
Aroclor 1262	µg/mL	0	-0.3	0.3	yes
Aroclor 1268	µg/mL	0	-0.3	0.3	yes
Date Acquired:	September 22, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aroclor 1260	µg/mL	100.00	80	120	yes
Date Acquired:	September 22, 2019				

Polychlorinated Biphenyls - Soil - Surrogate

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Decachlorobiphenyl	%	101.338	50	140	yes
Date Acquired:	September 22, 2019				

Polycyclic Aromatic Hydrocarbons - Soil

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
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Polycyclic Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.010	0.010	yes
Acenaphthylene	ng/mL	0	-0.05	0.05	yes
Acenaphthene	ng/mL	0	-0.05	0.05	yes
Fluorene	ng/mL	0	-0.05	0.05	yes
Phenanthrene	ng/mL	0	-0.01	0.01	yes
Anthracene	ng/mL	0	-0.003	0.003	yes
Fluoranthene	ng/mL	0	-0.010	0.010	yes
Pyrene	ng/mL	0	-0.010	0.010	yes
Benzo(a)anthracene	ng/mL	0	-0.01	0.01	yes
Chrysene	ng/mL	0	-0.05	0.05	yes
Benzo(b)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(b+j)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(k)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(a)pyrene	ng/mL	0	-0.05	0.05	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.05	0.05	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.05	0.05	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.05	0.05	yes

Date Acquired: September 22, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	103.80	80	120	yes
Acenaphthylene	ng/mL	86.60	80	120	yes
Acenaphthene	ng/mL	89.20	80	120	yes
Fluorene	ng/mL	92.60	80	120	yes
Phenanthrene	ng/mL	114.20	80	120	yes
Anthracene	ng/mL	106.80	80	120	yes
Fluoranthene	ng/mL	116.60	80	120	yes
Pyrene	ng/mL	116.60	80	120	yes
Benzo(a)anthracene	ng/mL	115.60	80	120	yes
Chrysene	ng/mL	95.80	80	120	yes
Benzo(b)fluoranthene	ng/mL	101.60	80	120	yes
Benzo(k)fluoranthene	ng/mL	115.00	80	120	yes
Benzo(a)pyrene	ng/mL	107.40	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	87.60	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	82.40	80	120	yes
Benzo(g,h,i)perylene	ng/mL	112.80	80	120	yes

Date Acquired: September 22, 2019

Salinity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	-0.0544	-0.4	0.5	yes
Magnesium	mg/L	0.0159	-0.1	0.1	yes
Sodium	mg/L	-0.0648	-0	2	yes
Potassium	mg/L	-0.0334	-0.5	0.7	yes
Chloride	mg/L	2.5233	0	5	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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Lot ID: **1378374**
Control Number:
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Report Number: 2446919

Salinity - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sulfate-S	mg/L	0.0831	-0	1	yes
Date Acquired:	September 23, 2019				

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Electrical Conductivity	dS/m	1.96	-0.07	4.13	yes
% Saturation	%	52	46	57	yes
Calcium	mg/L	391	301.9	468.7	yes
Magnesium	mg/L	82.8	68.5	103.3	yes
Sodium	mg/L	42	32	53	yes
Potassium	mg/L	19.0	15.6	22.8	yes
Chloride	mg/L	39	32	45	yes
Sulfate-S	mg/L	239	178	294	yes
Date Acquired:	September 23, 2019				
Electrical Conductivity	dS/m	31.7	26.80	35.20	yes
Calcium	mg/L	255	230.2	261.4	yes
Magnesium	mg/L	97.6	92.1	104.1	yes
Sodium	mg/L	248	225	264	yes
Potassium	mg/L	252	222.6	270.6	yes
Chloride	mg/L	2060	1871	2231	yes
Sulfate-S	mg/L	147	138	156	yes
Date Acquired:	September 23, 2019				

Soil Acidity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	0.356691	-20.010	20.010	yes
Date Acquired:	September 30, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	98.73	91	110	yes
Date Acquired:	September 30, 2019				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH	pH	4.2	4.2	0	0.3	yes
Date Acquired:	September 23, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
pH	pH	5.6	5.3	6.5	yes
Date Acquired:	September 23, 2019				
Sulfur	µg/g	16000	14101.100	17360.900	yes
Date Acquired:	September 30, 2019				

VOC - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Dibromofluoromethane	%	97.85	50	140	yes
Toluene-d8	%	98.36	50	140	yes
Bromofluorobenzene	%	100.26	50	140	yes
Date Acquired:	September 24, 2019				

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

VOC - Soil - Surrogate Recovery - Continued

VOC Screen - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Acetone	ng	0	-0.38	0.38	yes
Acetonitrile	ng	0	-0.38	0.38	yes
Acrylonitrile	ng	0	-0.38	0.38	yes
Allyl Chloride	ng	0	-0.38	0.38	yes
Benzene	ng	0	-0.02	0.02	yes
Bromobenzene	ng	0	-0.02	0.02	yes
Bromochloromethane	ng	0	-0.02	0.02	yes
Bromodichloromethane	ng	0	-0.02	0.02	yes
Bromoform	ng	0	-0.02	0.02	yes
Bromomethane	ng	0	-0.15	0.15	yes
2-Butanone (MEK)	ng	0	-0.38	0.38	yes
n-Butylbenzene	ng	0	-0.02	0.02	yes
sec-Butylbenzene	ng	0	-0.02	0.02	yes
tert-Butylbenzene	ng	0	-0.02	0.02	yes
Carbon Tetrachloride	ng	0	-0.02	0.02	yes
Chlorobenzene	ng	0	-0.02	0.02	yes
Chloroethane	ng	0	-0.15	0.15	yes
Chloroform	ng	0	-0.02	0.02	yes
Chloromethane	ng	0	-0.15	0.15	yes
2-Chlorotoluene	ng	0	-0.02	0.02	yes
4-Chlorotoluene	ng	0	-0.02	0.02	yes
Dibromochloromethane	ng	0	-0.02	0.02	yes
1,2-Dibromo-3-	ng	0	-0.02	0.02	yes
1,2-Dibromoethane	ng	0	-0.02	0.02	yes
Dibromomethane	ng	0	-0.02	0.02	yes
1,4-Dichloro-2-Butene(cis)	ng	0	-0.38	0.38	yes
1,4-Dichloro-2-Butene	ng	0	-0.38	0.38	yes
1,2-Dichlorobenzene	ng	0	-0.02	0.02	yes
1,3-Dichlorobenzene	ng	0	-0.02	0.02	yes
1,4-Dichlorobenzene	ng	0	-0.02	0.02	yes
1,1-Dichloroethane	ng	0	-0.02	0.02	yes
1,2-Dichloroethane	ng	0	-0.015	0.015	yes
1,1-Dichloroethene	ng	0	-0.02	0.02	yes
1,2-Dichloroethene(cis)	ng	0	-0.02	0.02	yes
1,2-Dichloroethene(trans)	ng	0	-0.02	0.02	yes
Dichlorodifluoromethane	ng	0	-0.15	0.15	yes
1,2-Dichloropropane	ng	0	-0.02	0.02	yes
1,3-Dichloropropane	ng	0	-0.02	0.02	yes
1,1-Dichloropropene	ng	0	-0.02	0.02	yes
1,3-Dichloropropene(cis)	ng	0	-0.02	0.02	yes
1,3-Dichloropropene(trans)	ng	0	-0.02	0.02	yes
Ethylbenzene	ng	0	-0.02	0.02	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

VOC Screen - Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Ethyl Methacrylate	ng	0	-0.38	0.38	yes
Hexachlorobutadiene	ng	0	-0.02	0.02	yes
Hexachloroethane	ng	0	-0.02	0.02	yes
2-Hexanone	ng	0	-0.38	0.38	yes
Iodomethane	ng	0	-0.0	0.0	yes
p-Isopropyltoluene	ng	0	-0.02	0.02	yes
Methacrylonitrile	ng	0	-0.38	0.38	yes
Methyl t-Butyl Ether	ng	0	-0.02	0.02	yes
Methylene Chloride	ng	0	-0.15	0.15	yes
Methyl Methacrylate	ng	0	-0.38	0.38	yes
4-Methyl-2-Pentanone	ng	0	-0.38	0.38	yes
Pentachloroethane	ng	0	-0.02	0.02	yes
Propionitrile	ng	0	-0.38	0.38	yes
iso-Propylbenzene	ng	0	-0.02	0.02	yes
n-Propylbenzene	ng	0	-0.02	0.02	yes
Styrene	ng	0	-0.02	0.02	yes
1,1,1,2-Tetrachloroethane	ng	0	-0.02	0.02	yes
1,1,2,2-Tetrachloroethane	ng	0	-0.02	0.02	yes
Tetrachloroethene	ng	0	-0.02	0.02	yes
Toluene	ng	0	-0.02	0.02	yes
1,2,3-Trichlorobenzene	ng	0	-0.02	0.02	yes
1,2,4-Trichlorobenzene	ng	0	-0.02	0.02	yes
1,1,1-Trichloroethane	ng	0	-0.02	0.02	yes
1,1,2-Trichloroethane	ng	0	-0.02	0.02	yes
Trichloroethene	ng	0	-0.02	0.02	yes
Trichlorofluoromethane	ng	0	-0.02	0.02	yes
1,2,3-Trichloropropane	ng	0	-0.02	0.02	yes
1,2,4-Trimethylbenzene	ng	0	-0.02	0.02	yes
1,3,5-Trimethylbenzene	ng	0	-0.02	0.02	yes
Vinyl Chloride	ng	0	-0.15	0.15	yes
Total Xylenes (m,p,o)	ng	0	-0.02	0.02	yes

Date Acquired: September 24, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Acetone	ng	103.81	80	120	yes
Acetonitrile	ng	100.98	80	120	yes
Acrylonitrile	ng	113.64	80	120	yes
Allyl Chloride	ng	97.52	60	140	yes
Benzene	ng	99.92	80	120	yes
Bromobenzene	ng	101.16	80	120	yes
Bromochloromethane	ng	107.83	80	120	yes
Bromodichloromethane	ng	98.40	80	120	yes
Bromoform	ng	96.66	80	120	yes
Bromomethane	ng	106.04	80	120	yes
2-Butanone (MEK)	ng	109.47	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
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Report Number: 2446919

VOC Screen - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
n-Butylbenzene	ng	89.16	80	120	yes
sec-Butylbenzene	ng	89.62	80	120	yes
tert-Butylbenzene	ng	91.34	80	120	yes
Carbon Tetrachloride	ng	97.40	80	120	yes
Chlorobenzene	ng	99.88	80	120	yes
Chloroethane	ng	100.30	80	120	yes
Chloroform	ng	99.46	80	120	yes
Chloromethane	ng	111.59	80	120	yes
2-Chlorotoluene	ng	98.54	80	120	yes
4-Chlorotoluene	ng	98.52	80	120	yes
Dibromochloromethane	ng	98.28	80	120	yes
1,2-Dibromo-3-	ng	85.87	80	120	yes
1,2-Dibromoethane	ng	107.81	80	120	yes
Dibromomethane	ng	106.09	80	120	yes
1,4-Dichloro-2-Butene(cis)	ng	99.53	60	140	yes
1,4-Dichloro-2-Butene	ng	99.07	60	140	yes
1,2-Dichlorobenzene	ng	99.20	80	120	yes
1,3-Dichlorobenzene	ng	100.70	80	120	yes
1,4-Dichlorobenzene	ng	103.19	80	120	yes
1,1-Dichloroethane	ng	99.36	80	120	yes
1,2-Dichloroethane	ng	105.33	80	120	yes
1,1-Dichloroethene	ng	100.40	80	120	yes
1,2-Dichloroethene(cis)	ng	101.34	80	120	yes
1,2-Dichloroethene(trans)	ng	99.08	80	120	yes
Dichlorodifluoromethane	ng	97.60	80	120	yes
1,2-Dichloropropane	ng	103.25	80	120	yes
1,3-Dichloropropane	ng	106.75	80	120	yes
1,1-Dichloropropene	ng	94.54	80	120	yes
1,3-Dichloropropene(cis)	ng	100.12	80	120	yes
1,3-Dichloropropene(trans)	ng	104.71	80	120	yes
Ethylbenzene	ng	89.42	80	120	yes
Ethyl Methacrylate	ng	92.69	80	120	yes
Hexachlorobutadiene	ng	89.92	80	120	yes
2-Hexanone	ng	92.56	80	120	yes
Iodomethane	ng	82.59	80	120	yes
p-Isopropyltoluene	ng	92.18	80	120	yes
Methacrylonitrile	ng	109.33	80	120	yes
Methyl t-Butyl Ether	ng	103.97	60	140	yes
Methylene Chloride	ng	109.23	80	120	yes
Methyl Methacrylate	ng	93.85	80	120	yes
4-Methyl-2-Pentanone	ng	97.11	80	120	yes
Pentachloroethane	ng	119.16	80	120	yes
Propionitrile	ng	109.00	80	120	yes
iso-Propylbenzene	ng	89.60	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
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T5V 1B4
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Lot ID: **1378374**
Control Number:
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VOC Screen - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
n-Propylbenzene	ng	93.28	80	120	yes
Styrene	ng	91.82	80	120	yes
1,1,1,2-Tetrachloroethane	ng	94.82	80	120	yes
1,1,2,2-Tetrachloroethane	ng	97.34	80	120	yes
Tetrachloroethene	ng	101.78	80	120	yes
Toluene	ng	110.03	80	120	yes
1,2,3-Trichlorobenzene	ng	91.24	80	120	yes
1,2,4-Trichlorobenzene	ng	93.18	80	120	yes
1,1,1-Trichloroethane	ng	98.36	80	120	yes
1,1,2-Trichloroethane	ng	104.23	80	120	yes
Trichloroethene	ng	100.66	80	120	yes
Trichlorofluoromethane	ng	96.62	80	120	yes
1,2,3-Trichloropropane	ng	108.29	80	120	yes
1,2,4-Trimethylbenzene	ng	92.64	80	120	yes
1,3,5-Trimethylbenzene	ng	93.68	80	120	yes
Vinyl Chloride	ng	117.19	80	120	yes
Total Xylenes (m,p,o)	ng	94.69	80	120	yes

Date Acquired: September 24, 2019

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Acetone	mg/kg	<0.25	<0.25	50	0.50	yes
Acetonitrile	mg/kg	<0.25	<0.25	50	0.50	yes
Acrylonitrile	mg/kg	<0.25	<0.25	50	0.50	yes
Allyl Chloride	mg/kg	<0.25	<0.25	50	0.50	yes
Benzene	mg/kg	<0.01	<0.01	50	0.02	yes
Bromobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
Bromochloromethane	mg/kg	<0.01	<0.01	50	0.02	yes
Bromodichloromethane	mg/kg	<0.01	<0.01	50	0.02	yes
Bromoform	mg/kg	<0.01	<0.01	50	0.02	yes
Bromomethane	mg/kg	<0.10	<0.10	50	0.20	yes
2-Butanone (MEK)	mg/kg	<0.25	<0.25	50	0.50	yes
n-Butylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
sec-Butylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
tert-Butylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
Carbon Tetrachloride	mg/kg	<0.01	<0.01	50	0.02	yes
Chlorobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
Chloroethane	mg/kg	<0.10	<0.10	50	0.20	yes
Chloroform	mg/kg	<0.01	<0.01	50	0.02	yes
Chloromethane	mg/kg	<0.10	<0.10	50	0.20	yes
2-Chlorotoluene	mg/kg	<0.01	<0.01	50	0.02	yes
4-Chlorotoluene	mg/kg	<0.01	<0.01	50	0.02	yes
Dibromochloromethane	mg/kg	<0.01	<0.01	50	0.02	yes
1,2-Dibromo-3-	mg/kg	<0.01	<0.01	50	0.02	yes
1,2-Dibromoethane	mg/kg	<0.01	<0.01	50	0.02	yes
Dibromomethane	mg/kg	<0.01	<0.01	50	0.02	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

VOC Screen - Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
1,4-Dichloro-2-Butene(cis)	mg/kg	<0.25	<0.25	50	0.50	yes
1,4-Dichloro-2-Butene	mg/kg	<0.25	<0.25	50	0.50	yes
1,2-Dichlorobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
1,3-Dichlorobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
1,4-Dichlorobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
1,1-Dichloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
1,2-Dichloroethane	mg/kg	<0.01	<0.01	50	0.020	yes
1,1-Dichloroethene	mg/kg	<0.01	<0.01	50	0.02	yes
1,2-Dichloroethene(cis)	mg/kg	<0.01	<0.01	50	0.02	yes
1,2-Dichloroethene(trans)	mg/kg	<0.01	<0.01	50	0.02	yes
Dichlorodifluoromethane	mg/kg	<0.10	<0.10	50	0.20	yes
1,2-Dichloropropane	mg/kg	<0.01	<0.01	50	0.02	yes
1,3-Dichloropropane	mg/kg	<0.01	<0.01	50	0.02	yes
1,1-Dichloropropene	mg/kg	<0.01	<0.01	50	0.02	yes
1,3-Dichloropropene(cis)	mg/kg	<0.01	<0.01	50	0.02	yes
1,3-Dichloropropene(trans)	mg/kg	<0.01	<0.01	50	0.02	yes
Ethylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
Ethyl Methacrylate	mg/kg	<0.25	<0.25	50	0.50	yes
Hexachlorobutadiene	mg/kg	<0.01	<0.01	50	0.02	yes
Hexachloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
2-Hexanone	mg/kg	<0.25	<0.25	50	0.50	yes
Iodomethane	mg/kg	<0.1	<0.1	50	0.0	yes
p-Isopropyltoluene	mg/kg	<0.01	<0.01	50	0.02	yes
Methacrylonitrile	mg/kg	<0.25	<0.25	50	0.50	yes
Methyl t-Butyl Ether	mg/kg	<0.01	<0.01	50	0.02	yes
Methylene Chloride	mg/kg	<0.1	<0.1	50	0.20	yes
Methyl Methacrylate	mg/kg	<0.25	<0.25	50	0.50	yes
4-Methyl-2-Pentanone	mg/kg	<0.25	<0.25	50	0.50	yes
Pentachloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
Propionitrile	mg/kg	<0.25	<0.25	50	0.50	yes
iso-Propylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
n-Propylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
Styrene	mg/kg	<0.01	<0.01	50	0.02	yes
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
Tetrachloroethene	mg/kg	<0.01	<0.01	50	0.02	yes
Toluene	mg/kg	<0.01	<0.01	50	0.02	yes
1,2,3-Trichlorobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
1,2,4-Trichlorobenzene	mg/kg	<0.01	<0.01	50	0.02	yes
1,1,1-Trichloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
1,1,2-Trichloroethane	mg/kg	<0.01	<0.01	50	0.02	yes
Trichloroethene	mg/kg	<0.01	<0.01	50	0.02	yes
Trichlorofluoromethane	mg/kg	<0.01	<0.01	50	0.02	yes
1,2,3-Trichloropropane	mg/kg	<0.01	<0.01	50	0.02	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

VOC Screen - Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
1,2,4-Trimethylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
1,3,5-Trimethylbenzene	mg/kg	<0.01	<0.01	50	0.02	yes
Vinyl Chloride	mg/kg	<0.10	<0.10	50	0.20	yes
Total Xylenes (m,p,o)	mg/kg	<0.01	<0.01	50	0.02	yes

Date Acquired: September 24, 2019

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Acetone	mg/kg	104	50	140	yes
Acetonitrile	mg/kg	96	60	130	yes
Acrylonitrile	mg/kg	98	60	130	yes
Allyl Chloride	mg/kg	92	60	130	yes
Benzene	mg/kg	93	60	130	yes
Bromobenzene	mg/kg	98	60	130	yes
Bromochloromethane	mg/kg	98	60	130	yes
Bromodichloromethane	mg/kg	91	60	130	yes
Bromoform	mg/kg	90	60	130	yes
Bromomethane	mg/kg	98	50	140	yes
2-Butanone (MEK)	mg/kg	96	50	140	yes
n-Butylbenzene	mg/kg	86	60	130	yes
sec-Butylbenzene	mg/kg	91	60	130	yes
tert-Butylbenzene	mg/kg	89	60	130	yes
Carbon Tetrachloride	mg/kg	90	60	130	yes
Chlorobenzene	mg/kg	95	60	130	yes
Chloroethane	mg/kg	78	50	140	yes
Chloroform	mg/kg	98	60	130	yes
Chloromethane	mg/kg	77	50	140	yes
2-Chlorotoluene	mg/kg	91	60	130	yes
4-Chlorotoluene	mg/kg	94	60	130	yes
Dibromochloromethane	mg/kg	91	60	130	yes
1,2-Dibromo-3-	mg/kg	78	60	130	yes
1,2-Dibromoethane	mg/kg	100	60	130	yes
Dibromomethane	mg/kg	101	60	130	yes
1,4-Dichloro-2-Butene(cis)	mg/kg	93	60	130	yes
1,4-Dichloro-2-Butene	mg/kg	92	60	130	yes
1,2-Dichlorobenzene	mg/kg	94	60	130	yes
1,3-Dichlorobenzene	mg/kg	95	60	130	yes
1,4-Dichlorobenzene	mg/kg	94	60	130	yes
1,1-Dichloroethane	mg/kg	98	60	130	yes
1,2-Dichloroethane	mg/kg	97	60	130	yes
1,1-Dichloroethene	mg/kg	86	60	130	yes
1,2-Dichloroethene(cis)	mg/kg	103	60	130	yes
1,2-Dichloroethene(trans)	mg/kg	91	60	130	yes
1,2-Dichloropropane	mg/kg	94	60	130	yes
1,3-Dichloropropane	mg/kg	95	60	130	yes
1,1-Dichloropropene	mg/kg	90	60	130	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

VOC Screen - Soil - Continued

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
1,3-Dichloropropene(cis)	mg/kg	94	60	130	yes
1,3-Dichloropropene(trans)	mg/kg	98	60	130	yes
Ethylbenzene	mg/kg	87	60	130	yes
Ethyl Methacrylate	mg/kg	86	60	130	yes
Hexachlorobutadiene	mg/kg	92	60	130	yes
Hexachloroethane	mg/kg	78	60	130	yes
2-Hexanone	mg/kg	85	50	140	yes
Iodomethane	mg/kg	81	60	130	yes
p-Isopropyltoluene	mg/kg	90	60	130	yes
Methacrylonitrile	mg/kg	100	60	130	yes
Methyl t-Butyl Ether	mg/kg	93	60	130	yes
Methylene Chloride	mg/kg	113	60	130	yes
Methyl Methacrylate	mg/kg	87	60	130	yes
4-Methyl-2-Pentanone	mg/kg	89	50	140	yes
Pentachloroethane	mg/kg	114	60	130	yes
Propionitrile	mg/kg	98	60	130	yes
iso-Propylbenzene	mg/kg	91	60	130	yes
n-Propylbenzene	mg/kg	92	60	130	yes
Styrene	mg/kg	89	60	130	yes
1,1,1,2-Tetrachloroethane	mg/kg	93	60	130	yes
1,1,2,2-Tetrachloroethane	mg/kg	91	60	130	yes
Tetrachloroethene	mg/kg	99	60	130	yes
Toluene	mg/kg	99	60	130	yes
1,2,3-Trichlorobenzene	mg/kg	91	60	130	yes
1,2,4-Trichlorobenzene	mg/kg	89	60	130	yes
1,1,1-Trichloroethane	mg/kg	92	60	130	yes
1,1,2-Trichloroethane	mg/kg	96	60	130	yes
Trichloroethene	mg/kg	94	60	130	yes
Trichlorofluoromethane	mg/kg	76	50	140	yes
1,2,3-Trichloropropane	mg/kg	97	60	130	yes
1,2,4-Trimethylbenzene	mg/kg	91	60	130	yes
1,3,5-Trimethylbenzene	mg/kg	90	60	130	yes
Vinyl Chloride	mg/kg	68	50	140	yes
Total Xylenes (m,p,o)	mg/kg	93	60	130	yes

Date Acquired: September 24, 2019

Volatile Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F1 C6-C10	ng	0	-10	10	yes

Date Acquired: September 22, 2019

Water Soluble Parameters

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chromium (VI)	mg/L	0	-0.10	0.10	yes

Date Acquired: September 23, 2019

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Water Soluble Parameters - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Chromium (VI)	mg/kg	<0.05	<0.05	10	0.01	yes
Date Acquired:	September 23, 2019					

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
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Proj. Acct. code:

Lot ID: **1378374**
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Date Received: Sep 20, 2019
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Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Sep 23, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Sep 23, 2019	Element Edmonton - Roper Road
BTEX-CCME - Soil	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Sep 22, 2019	Element Calgary
BTEX-CCME - Soil	US EPA	*	Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	Sep 22, 2019	Element Calgary
Cation Exchange Capacity (CEC) - Ammonium	McKeague	*	CEC and Exchangeable Cations by NH4OAc at pH 7, 3.32	Sep 23, 2019	Element Edmonton - Roper Road
Landfill VOC - Soil (DV)	US EPA	*	Volatile Organic Compounds by GCMS / VOC in Various Sample matricies using Equilibrium Head Space Analysis, 8260B/5021A	Oct 2, 2019	Element Drayton Valley
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Sep 23, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Sep 23, 2019	Element Edmonton - Roper Road
PAH - Soil	AEP		Index of Additive Cancer Risk (IACR), IACR	Sep 22, 2019	Element Calgary
PAH - Soil	US EPA	*	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Sep 22, 2019	Element Calgary
Particle Size Analysis - GS	Carter	*	Hydrometer Method, 55.3	Sep 24, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	ASTM	*	Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing, C 117-17	Sep 23, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	Carter	*	Procedure for Particle Size Separation, 55.2.3	Sep 23, 2019	Element Edmonton - Roper Road
PCB - Soil	US EPA	*	Polychlorinated Biphenyls (PCBs) by Gas Chromatography, 8082A	Sep 22, 2019	Element Calgary
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Sep 23, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Sep 23, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Single-Column Ion Chromatography with Electronic Suppression, 4110 C	Sep 23, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Sep 23, 2019	Element Edmonton - Roper Road
Sublet to SRC Geoanalytical	Ext. Lab		Analysis performed by external laboratory, .	Sep 23, 2019	Saskatchewan Research Council Geoanalyti

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: MF/BF/KM
Company: Tetra Tech

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1378374**
Control Number:
Date Received: Sep 20, 2019
Date Reported: Oct 7, 2019
Report Number: 2446919

Method Name	Reference		Method	Date Analysis Started	Location
Sublet to SRC Geoanalytical	Ext. Lab				
Sublet to SRC Geoanalytical	Ext. Lab		See attached test report,	Sep 23, 2019	Saskatchewan Research Council Geoanalyti
Sulfur (Elemental) - VAN	Element-in house		Elemental sulfur, TM SOIL 004-60	Sep 30, 2019	Element Vancouver
TEH-CCME-Soil (Shake)	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Sep 22, 2019	Element Calgary
Total Carbon, Nitrogen by Leco Combustion (VAN)	SSSA Book Series 5	*	Total Carbon, Organic Carbon, and Organic Matter, Ch 34	Sep 27, 2019	Element Vancouver
VOC - Soil	US EPA	*	US EPA method, 8260B/5035	Sep 24, 2019	Element Calgary
VOC - Soil - ABT1	US EPA	*	US EPA method, 8260B/5035	Sep 24, 2019	Element Calgary

** Reference Method Modified*

References

AEP	Alberta Tier 1 Soil and Groundwater Remediation Guidelines
APHA	Standard Methods for the Examination of Water and Wastewater
ASTM	Annual Book of ASTM Standards
Carter	Soil Sampling and Methods of Analysis.
CCME	Canadian Council of Ministers of the Environment
Element-in house	In house method
EPA	Environmental Protection Agency Test Methods - US
Ext. Lab	External Laboratory
McKeague	Manual on Soil Sampling and Methods of Analysis
SSSA Book Series 5	Methods of Soil Analysis, Part 3
US EPA	US Environmental Protection Agency Test Methods

Comments:

- Sep 26, 2019 - Low level VOC-Soil-ABT1 analyses were performed on samples prepped from a jar.
- Oct 01, 2019 - Report was issued to include addition of VOC6 (Alberta Landfill Solvent Screen) analysis on sample #11 as requested by Mark Fawcett of Tetra Tech on Oct.1,2019. Previous report 2443726.

Element
Attention: Edmonton Office
PO #/Project: POC120411
Samples: 11

SRC Geoanalytical Laboratories

125 - 15 Innovation Blvd., Saskatoon, Saskatchewan, S7N 2X8
Tel: (306) 933-8118 Fax: (306) 933-5656 Email: geolab@src.sk.ca

Report No: G-2019-1848

Date of Report: Sep 27, 2019

LECO Induction Furnace

Column Header Details

Sulfur by LECO in wt % (S)

Sample Number	S wt %
MA1B	1.16
1378374-1	0.07
1378374-2	0.08
1378374-3	1.52
1378374-4	0.33
1378374-5	0.08
1378374-6	0.03
1378374-8	0.38
1378374-10	0.16
1378374-11	0.23
1378374-11 R	0.22

Sulfur: a 0.2 g pulp is analyzed in a Leco SC144DR C/S analyzer for Sulfur.
The standard is MA1B.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Report Transmission Cover Page

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Contact	Company	Address
Accounts Payable	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: EBA.accounts.Payable@tetratech.

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

Contact	Company	Address
Brent Finnestad	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: brent.finnestad@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Chemistry File	Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Sample File	Test Report

Contact	Company	Address
Data Management	**Tetra Tech EBA Inc**	100, 140 Quarry Park Blvd SE Calgary, AB T2C 3G3 Phone: (403) 203-3355 Fax: Email: EBA.labdata@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Multiple Reports By Lot	EBA ESDAT Sample File	Test Report
Email - Multiple Reports By Lot	Legacy Reverse Crosstab in CSV	Test Report
Email - Multiple Reports By Lot	PDF	COC / Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report

Contact	Company	Address
Mark Fawcett	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email: mark.fawcett@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	AB Tier 1 Custom Excel	Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report
Email - Single Report	EBA ESDAT Sample File	Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	Invoice

Notes To Clients:

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

		Reference Number	1379359-1	1379359-2	1379359-3	
		Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	14-1 / 0-15	14-1 / 15-30	14-1 / 30-60	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	<0.5	0.05
Salinity						
% Saturation		%	68	62	60	

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Reference Number	1379359-4	1379359-5	1379359-6
Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	14-1 / 60-100	19-11 / 0-15	19-11 / 15-30
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	0.09	0.12	0.05
Antimony	Strong Acid Extractable	mg/kg		0.5	0.2	0.2
Arsenic	Strong Acid Extractable	mg/kg		7.1	6.0	0.2
Barium	Strong Acid Extractable	mg/kg		174	153	1
Beryllium	Strong Acid Extractable	mg/kg		0.5	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg		0.28	0.23	0.01
Chromium	Strong Acid Extractable	mg/kg		16.8	12.6	0.5
Cobalt	Strong Acid Extractable	mg/kg		8.4	7.9	0.1
Copper	Strong Acid Extractable	mg/kg		20.0	12.5	1
Lead	Strong Acid Extractable	mg/kg		14.1	8.6	0.1
Mercury	Strong Acid Extractable	mg/kg		0.05	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg		1.4	1.0	1
Nickel	Strong Acid Extractable	mg/kg		29.8	13.0	0.5
Selenium	Strong Acid Extractable	mg/kg		0.6	1.0	0.3
Silver	Strong Acid Extractable	mg/kg		0.1	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg		0.14	0.12	0.05
Tin	Strong Acid Extractable	mg/kg		<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg		0.7	0.7	0.5
Vanadium	Strong Acid Extractable	mg/kg		39.7	25.0	0.1
Zinc	Strong Acid Extractable	mg/kg		107	62	1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m		0.45		0.01
SAR	Saturated Paste			0.7		
% Saturation		%	107	66	67	
Calcium	Saturated Paste	mg/kg		38.0		
Magnesium	Saturated Paste	mg/kg		10.1		
Sodium	Saturated Paste	mg/kg		15		
Potassium	Saturated Paste	mg/kg		12		
Chloride	Saturated Paste	mg/L		9		2
Chloride	Saturated Paste	mg/kg		6		
Sulfate (SO4)	Saturated Paste	mg/kg		44.4		
TGR	Saturated Paste	T/ac		<0.1		

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T6B 3J4, Canada

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W: element.com

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Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Reference Number	1379359-5
Sample Date	Sep 24, 2019
Sample Time	NA
Sample Location	
Sample Description	19-11 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Physical and Aggregate Properties						
Texture			Sandy Clay Loam			
Sand	50 µm - 2 mm	% by weight	46			0.1
Silt	2 µm - 50 µm	% by weight	28			0.1
Clay	<2 µm	% by weight	26			0.1

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Lot ID: **1379359**
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	Reference Number	1379359-5	1379359-6	1379359-7	
	Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-11 / 0-15	19-11 / 15-30	19-11 / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05

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		Reference Number	1379359-5	1379359-7	1379359-9	
		Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-11 / 0-15	19-11 / 30-60	19-12 / 0-15	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.5	5.8	6.9	
Sulfur	Elemental	µg/g	<10		<10	10

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Reference Number	1379359-5	1379359-9
Sample Date	Sep 24, 2019	Sep 24, 2019
Sample Time	NA	NA
Sample Location		
Sample Description	19-11 / 0-15	19-12 / 0-15
Matrix	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polychlorinated Biphenyls - Soil						
Aroclor 1016	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1221	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1232	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1242	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1248	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1254	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1260	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1262	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1268	Dry Weight	mg/kg	<0.1	<0.1		0.1
Total PCBs	Dry Weight	mg/kg	<0.1	<0.1		0.1
Polychlorinated Biphenyls - Soil - Surrogate						
Decachlorobiphenyl	Surrogate	%	104	110		50-140
Alberta Landfill Solvent Scan - Soil						
Acetone	Dry Weight	mg/kg	<10	<10		10
Benzene	Dry Weight	mg/kg	<10	<10		10
iso-Butanol	Dry Weight	mg/kg	<10	<10		10
n-Butanol	Dry Weight	mg/kg	<10	<10		10
Cresol-m&p	Dry Weight	mg/kg	<10	<10		10
Cresol-o	Dry Weight	mg/kg	<10	<10		10
Carbon Disulfide	Dry Weight	mg/kg	<10	<10		10
Cyclohexanone	Dry Weight	mg/kg	<10	<10		10
Ethyl Acetate	Dry Weight	mg/kg	<10	<10		10
Ethylbenzene	Dry Weight	mg/kg	<10	<10		10
Ethyl Ether	Dry Weight	mg/kg	<10	<10		10
Methanol	Dry Weight	mg/kg	<10	<10		10
4-Methyl-2-Pentanone (MIBK)	Dry Weight	mg/kg	<10	<10		10
2-Butanone (MEK)	Dry Weight	mg/kg	<10	<10		10
Nitrobenzene	Dry Weight	mg/kg	<10	<10		10
2-Nitropropane	Dry Weight	mg/kg	<10	<10		10
Pyridine	Dry Weight	mg/kg	<10	<10		10
Toluene	Dry Weight	mg/kg	<10	<10		10
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<10	<10		10
Total		mg/kg	<500	<500		500
Alberta Landfill Solvents - Soil - Surrogates						
Bromofluorobenzene	EPA Surrogate	%	81	79		74-121
Dibromofluoromethane	EPA Surrogate	%	118	120		80-120
Toluene-d8	EPA Surrogate	%	100	99		81-117

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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F: +1 (780) 434-8586
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W: element.com

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Edmonton, AB, Canada
T5V 1B4
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Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

		Reference Number	1379359-5	1379359-9		
		Sample Date	Sep 24, 2019	Sep 24, 2019		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	19-11 / 0-15	19-12 / 0-15		
		Matrix	Soil	Soil		
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Subcontracted Analysis						
Total Sulfur	SRC	%	0.01	1.39		
Subcontractor Report Id	SRC		G-2019-1876	G-2019-1876		

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Edmonton, AB, Canada
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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
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	Reference Number	1379359-5	1379359-9	1379359-17	
	Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-11 / 0-15	19-12 / 0-15	19-14 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Soil						
Benzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Toluene	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Ethylbenzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<0.03	<0.03	<0.03	0.03
Volatile Petroleum Hydrocarbons - Soil						
Methanol Field Preservation			Yes	Yes	Yes	
F1 C6-C10	Dry Weight	mg/kg	<10	<10	<10	10
F1 -BTEX	Dry Weight	mg/kg	<10	<10	<10	10
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date	Total Extractables		26-Sep-19	26-Sep-19	26-Sep-19	
F2c C10-C16	Dry Weight	mg/kg	<25	<25	<25	25
F3c C16-C34	Dry Weight	mg/kg	<50	<50	<50	50
F4c C34-C50	Dry Weight	mg/kg	<100	<100	<100	100
F4HTGCc C34-C50+	Dry Weight	mg/kg	<100	<100	<100	100
% C50+		%	<5	<5	<5	
Silica Gel Cleanup						
Silica Gel Cleanup			Done	Done	Done	
Soil % Moisture						
Moisture	Soil % Moisture	% by weight	15.00	23.70	18.50	
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.01
Anthracene	Dry Weight	mg/kg	<0.003	<0.003	<0.003	0.003
Fluoranthene	Dry Weight	mg/kg	0.016	<0.01	<0.01	0.010
Pyrene	Dry Weight	mg/kg	0.018	<0.01	<0.01	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.01
Chrysene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	<0.001	<0.001	<0.001	0.001
IACR_Coarse	Index of Additive Cancer		<0.001	<0.001	<0.001	0.001

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Edmonton, Alberta
T6B 3J4, Canada

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Project Location: Ryley, AB
LSD:
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Lot ID: **1379359**
Control Number:
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	Reference Number	1379359-5	1379359-9	1379359-17	
	Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-11 / 0-15	19-12 / 0-15	19-14 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Polycyclic Aromatic Hydrocarbons - Soil - Continued						
IACR_Fine	Risk Index of Additive Cancer Risk		<0.001	<0.001	<0.001	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	110	101	120	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	102	100	67	50-140
p-Terphenyl-d14	PAH - Surrogate	%	67	102	132	50-140

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		Reference Number	1379359-5	1379359-17		
		Sample Date	Sep 24, 2019	Sep 24, 2019		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	19-11 / 0-15	19-14 / 0-15		
		Matrix	Soil	Soil		
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Particle Size Analysis - Wet Sieve						
Texture			Coarse-Grained	Fine-Grained		
75 micron sieve	% Retained	% by weight	84.0	19.7		0.1

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Reference Number	1379359-7	1379359-8	1379359-9
Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-11 / 30-60	19-11 / 60-100	19-12 / 0-15
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.13	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.5	0.4	0.5	0.2
Arsenic	Strong Acid Extractable	mg/kg	9.6	7.2	8.8	0.2
Barium	Strong Acid Extractable	mg/kg	205	192	146	1
Beryllium	Strong Acid Extractable	mg/kg	0.8	0.5	0.6	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.15	0.19	0.21	0.01
Chromium	Strong Acid Extractable	mg/kg	20.0	20.0	18.0	0.5
Cobalt	Strong Acid Extractable	mg/kg	10.5	8.6	11.0	0.1
Copper	Strong Acid Extractable	mg/kg	17.9	18.7	26.9	1
Lead	Strong Acid Extractable	mg/kg	10.8	8.1	12.5	0.1
Mercury	Strong Acid Extractable	mg/kg	0.05	<0.05	0.06	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	<1.0	1.0	1
Nickel	Strong Acid Extractable	mg/kg	26.8	29.7	31.1	0.5
Selenium	Strong Acid Extractable	mg/kg	1.1	0.4	0.4	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.17	0.16	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.6	0.6	1.3	0.5
Vanadium	Strong Acid Extractable	mg/kg	32.5	21.7	28.7	0.1
Zinc	Strong Acid Extractable	mg/kg	70	54	87	1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	1.18		8.11	0.01
SAR	Saturated Paste		4.5		18.2	
% Saturation		%	63	62	112	
Calcium	Saturated Paste	mg/kg	48.5		528	
Magnesium	Saturated Paste	mg/kg	13.7		179	
Sodium	Saturated Paste	mg/kg	110		2010	
Potassium	Saturated Paste	mg/kg	3		22	
Chloride	Saturated Paste	mg/L	6		24	2
Chloride	Saturated Paste	mg/kg	4		27	
Sulfate (SO4)	Saturated Paste	mg/kg	344		5760	
TGR	Saturated Paste	T/ac	<0.1		10.6	

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Reference Number		1379359-8	1379359-9	1379359-17	
Sample Date		Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
Sample Time		NA	NA	NA	
Sample Location					
Sample Description		19-11 / 60-100	19-12 / 0-15	19-14 / 0-15	
Matrix		Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

		Reference Number	1379359-9	1379359-11	1379359-13	
		Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-12 / 0-15	19-12 / 30-60	19-13 / 0-15	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Available Nutrients						
Nitrate - N	Available	µg/g	<2	<2	<2	2

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

	Reference Number	1379359-11	1379359-13	1379359-14	
	Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-12 / 30-60	19-13 / 0-15	19-13 / 15-30	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	8.61	5.29	7.23	0.01
SAR	Saturated Paste		19.6	9.8	15.4	
% Saturation		%	90	76	74	
Calcium	Saturated Paste	mg/kg	420	380	369	
Magnesium	Saturated Paste	mg/kg	156	85.5	122	
Sodium	Saturated Paste	mg/kg	1760	711	1160	
Potassium	Saturated Paste	mg/kg	15	22	15	
Chloride	Saturated Paste	mg/L	10	16	23	2
Chloride	Saturated Paste	mg/kg	9	12	17	
Sulfate (SO4)	Saturated Paste	mg/kg	5130	2490	3560	
TGR	Saturated Paste	T/ac	12.8	1.7	7.4	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	6.8	7.8	7.9	

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

		Reference Number	1379359-14	1379359-15	1379359-16	
		Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-13 / 15-30	19-13 / 30-60	19-13 / 60-100	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Available Nutrients						
Nitrate - N	Available	µg/g	<2	<2	<2	2

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

		Reference Number	1379359-15	1379359-16	1379359-17	
		Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-13 / 30-60	19-13 / 60-100	19-14 / 0-15	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	8.57	2.06	6.53	0.01
SAR	Saturated Paste		19.8	30	14.8	
% Saturation		%	104	134	81	
Calcium	Saturated Paste	mg/kg	461	10	339	
Magnesium	Saturated Paste	mg/kg	187	6	104	
Sodium	Saturated Paste	mg/kg	2030	657	1090	
Potassium	Saturated Paste	mg/kg	30	<13	9	
Chloride	Saturated Paste	mg/L	43	8	30	2
Chloride	Saturated Paste	mg/kg	45	11	24	
Sulfate (SO4)	Saturated Paste	mg/kg	5760	1140	3220	
TGR	Saturated Paste	T/ac	12.9	0.9	5.5	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.3	7.8	7.7	

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Reference Number	1379359-17	1379359-19
Sample Date	Sep 24, 2019	Sep 24, 2019
Sample Time	NA	NA
Sample Location		
Sample Description	19-14 / 0-15	19-14 / 30-60
Matrix	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5		0.05
Antimony	Strong Acid Extractable	mg/kg	0.3	0.4		0.2
Arsenic	Strong Acid Extractable	mg/kg	7.8	13.8		0.2
Barium	Strong Acid Extractable	mg/kg	161	158		1
Beryllium	Strong Acid Extractable	mg/kg	0.6	0.8		0.1
Cadmium	Strong Acid Extractable	mg/kg	0.18	0.13		0.01
Chromium	Strong Acid Extractable	mg/kg	14.9	11.4		0.5
Cobalt	Strong Acid Extractable	mg/kg	8.8	9.7		0.1
Copper	Strong Acid Extractable	mg/kg	15.3	19.8		1
Lead	Strong Acid Extractable	mg/kg	8.1	10.6		0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05	<0.05		0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	<1.0		1
Nickel	Strong Acid Extractable	mg/kg	19.6	25.4		0.5
Selenium	Strong Acid Extractable	mg/kg	0.5	0.4		0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	0.10		0.1
Thallium	Strong Acid Extractable	mg/kg	0.14	0.15		0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0		1
Uranium	Strong Acid Extractable	mg/kg	0.9	1.4		0.5
Vanadium	Strong Acid Extractable	mg/kg	27.8	19.5		0.1
Zinc	Strong Acid Extractable	mg/kg	64	75		1

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

	Reference Number	1379359-18	1379359-19	1379359-20	
	Sample Date	Sep 24, 2019	Sep 24, 2019	Sep 24, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-14 / 15-30	19-14 / 30-60	19-14 / 60-100	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	7.57	3.95	5.17	0.01
SAR	Saturated Paste		18.3	37	33	
% Saturation		%	102	156	135	
Calcium	Saturated Paste	mg/kg	449	57	120	
Magnesium	Saturated Paste	mg/kg	123	10	18	
Sodium	Saturated Paste	mg/kg	1720	1510	1690	
Potassium	Saturated Paste	mg/kg	20	20	25	
Chloride	Saturated Paste	mg/L	17	12	17	2
Chloride	Saturated Paste	mg/kg	18	18	23	
Sulfate (SO4)	Saturated Paste	mg/kg	4820	3050	3530	
TGR	Saturated Paste	T/ac	9.4	3.5	5.8	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.8	8.0	7.9	

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T5V 1B4
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Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Reference Number	1379359-19
Sample Date	Sep 24, 2019
Sample Time	NA
Sample Location	
Sample Description	19-14 / 30-60
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05			0.05

Approved by:

Mathieu Simoneau
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Available Nutrients

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Nitrate - N	mg/L	0.07	-1	1		yes
Date Acquired:	September 26, 2019					
Client Sample Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
Nitrate - N	µg/g	78	78	10	2	yes
Date Acquired:	September 26, 2019					
Control Sample	**Units**	**Measured**	**Lower Limit**	**Upper Limit**		**Passed QC**
Nitrate - N	µg/g	28	23	35		yes
Date Acquired:	September 26, 2019					
Nitrate - N	µg/g	4	4	4		yes
Date Acquired:	September 26, 2019					

Extractable Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F2c C10-C16	µg/mL	0	-10	10	yes
F3c C16-C34	µg/mL	0	-30	30	yes
F4c C34-C50	µg/mL	0	-20	20	yes
F4HTGCc C34-C50+	µg/mL	0	-20	20	yes
Date Acquired:	September 26, 2019				
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**	**Passed QC**
F2c C10-C16	µg/mL	104.36	80	120	yes
F3c C16-C34	µg/mL	105.22	80	120	yes
F4c C34-C50	µg/mL	101.64	80	120	yes
F4HTGCc C34-C50+	µg/mL	99.27	80	120	yes
Date Acquired:	September 26, 2019				
Matrix Spike	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**	**Passed QC**
F2c C10-C16	mg/kg	110	70	130	yes
F3c C16-C34	mg/kg	116	70	130	yes
F4c C34-C50	mg/kg	113	70	130	yes
F4HTGCc C34-C50+	mg/kg	113	70	130	yes
Date Acquired:	September 26, 2019				

Metals Strong Acid Digestion

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Boron	mg/L	-0.00292031	-0.05	0.07	yes
Antimony	µg/L	0.0251105	-0.1	0.2	yes
Arsenic	µg/L	0.0444961	-0.2	0.2	yes
Barium	µg/L	-0.0164866	-1	1	yes
Beryllium	µg/L	0.00847258	-0.1	0.1	yes
Cadmium	µg/L	0.00057657	-0.01	0.01	yes
Chromium	µg/L	0.144824	-0.5	0.5	yes
Cobalt	µg/L	0.00698285	-0.1	0.1	yes
Copper	µg/L	0.261991	-0.6	1.2	yes

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Metals Strong Acid Digestion - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Lead	µg/L	0.0226196	-5.0	5.0	yes
Mercury	µg/L	0.00138968	-0.04	0.04	yes
Molybdenum	µg/L	0.246715	-1.0	1.0	yes
Nickel	µg/L	0.0630195	-0.4	0.7	yes
Selenium	µg/L	0.0142216	-0.3	0.3	yes
Silver	µg/L	0.00869023	-0.09	0.14	yes
Thallium	µg/L	0.00481018	-0.04	0.04	yes
Tin	µg/L	0.0347363	-0.4	0.4	yes
Uranium	µg/L	0.000207694	-0.5	0.5	yes
Vanadium	µg/L	0.0300447	-0.1	0.1	yes
Zinc	µg/L	0.0957937	-1	1	yes

Date Acquired: September 27, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Antimony	mg/kg	1.3	1.2	20	0.4	yes
Arsenic	mg/kg	7.7	7.3	20	0.4	yes
Barium	mg/kg	189	183	20	2	yes
Beryllium	mg/kg	0.5	0.4	20	0.2	yes
Cadmium	mg/kg	1.62	1.66	20	0.02	yes
Chromium	mg/kg	44.0	40.0	20	1.1	yes
Cobalt	mg/kg	9.4	8.9	20	0.2	yes
Copper	mg/kg	46.9	46.0	20	2.2	yes
Lead	mg/kg	86.6	87.1	20	0.2	yes
Mercury	mg/kg	0.13	0.13	20	0.05	yes
Molybdenum	mg/kg	10.0	9.2	20	2.2	yes
Nickel	mg/kg	55.0	52.8	20	1.1	yes
Selenium	mg/kg	0.8	0.7	20	0.7	yes
Silver	mg/kg	0.4	0.4	20	0.22	yes
Thallium	mg/kg	0.14	0.13	20	0.11	yes
Tin	mg/kg	2.8	3.4	20	2.2	yes
Uranium	mg/kg	0.9	0.9	20	1.1	yes
Vanadium	mg/kg	91.1	88.0	20	0.2	yes
Zinc	mg/kg	638	634	20	2	yes

Date Acquired: September 27, 2019

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Antimony	mg/kg	40.3	36.1	43.9	yes
Arsenic	mg/kg	40.1	36.3	43.9	yes
Barium	mg/kg	202	183	225	yes
Beryllium	mg/kg	19.5	17.4	22.2	yes
Cadmium	mg/kg	2.09	1.88	2.28	yes
Chromium	mg/kg	100	93.6	105.6	yes
Cobalt	mg/kg	20.5	17.0	23.0	yes
Copper	mg/kg	195	183.1	212.7	yes
Lead	mg/kg	20.9	18.3	21.5	yes
Mercury	mg/kg	3.16	2.64	3.36	yes

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Quality Control

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Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
Date Received: Sep 25, 2019
Date Reported: Oct 3, 2019
Report Number: 2445147

Metals Strong Acid Digestion - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Molybdenum	mg/kg	195	174.8	234.8	yes
Nickel	mg/kg	100	91.6	108.4	yes
Selenium	mg/kg	40.3	34.0	46.0	yes
Silver	mg/kg	21.5	18.20	22.40	yes
Thallium	mg/kg	10.4	8.76	10.74	yes
Tin	mg/kg	194	188.0	218.0	yes
Uranium	mg/kg	101	86.0	116.0	yes
Vanadium	mg/kg	20.1	18.0	21.6	yes
Zinc	mg/kg	200	170	230	yes
Date Acquired:	September 27, 2019				
Antimony	mg/kg	3.4	2.3	6.0	yes
Arsenic	mg/kg	3.9	2.6	6.8	yes
Barium	mg/kg	104	58	154	yes
Beryllium	mg/kg	0.3	0.2	0.5	yes
Cadmium	mg/kg	0.92	0.73	1.15	yes
Chromium	mg/kg	79.1	48.8	128.8	yes
Cobalt	mg/kg	6.8	3.9	10.4	yes
Copper	mg/kg	125	76.1	200.5	yes
Lead	mg/kg	232	198.7	305.5	yes
Mercury	mg/kg	0.06	0.05	0.07	yes
Molybdenum	mg/kg	1.1	0.6	1.5	yes
Nickel	mg/kg	26.1	15.8	41.5	yes
Selenium	mg/kg	<0.3	0.1	0.4	yes
Silver	mg/kg	3.9	2.28	6.00	yes
Thallium	mg/kg	0.07	0.04	0.11	yes
Tin	mg/kg	10.4	4.0	16.0	yes
Uranium	mg/kg	<0.5	0.3	0.7	yes
Vanadium	mg/kg	29.7	17.8	46.9	yes
Zinc	mg/kg	303	260	350	yes
Date Acquired:	September 27, 2019				

Mono-Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.005	0.005	yes
Toluene	ng	0	-0.06	0.06	yes
Ethylbenzene	ng	0	-0.030	0.030	yes
Total Xylenes (m,p,o)	ng	0	-0.09	0.09	yes
Styrene	ng	0	-0.030	0.030	yes
Date Acquired:	September 26, 2019				
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**	**Passed QC**
Benzene	ng	85.80	80	120	yes
Toluene	ng	82.20	80	120	yes
Ethylbenzene	ng	90.40	80	120	yes
Total Xylenes (m,p,o)	ng	86.00	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379359**
Control Number:
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Mono-Aromatic Hydrocarbons - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Styrene	ng	89.80	80	120	yes
Date Acquired:	September 26, 2019				

PAH - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	96.87	50	140	yes
2-Fluorobiphenyl	%	99.32	50	140	yes
p-Terphenyl-d14	%	113.43	50	140	yes
Date Acquired:	September 26, 2019				

Particle Size Analysis - Wet Sieve

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
75 micron sieve	% by weight	18.1	12.2	26.0	yes
Date Acquired:	September 27, 2019				
75 micron sieve	% by weight	30.6	24.6	33.4	yes
Date Acquired:	September 27, 2019				

Physical and Aggregate Properties

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Sand	% by weight	41	41	10	0	yes
Silt	% by weight	32	32	10	0	yes
Clay	% by weight	27	27	10	0	yes
Date Acquired:	September 27, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sand	% by weight	30	24	34	yes
Clay	% by weight	30	26	36	yes
<50 um	% by weight	70.0	63.400	80.800	yes
Date Acquired:	September 27, 2019				

Polychlorinated Biphenyls - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aroclor 1016	µg/mL	0	-0.3	0.3	yes
Aroclor 1221	µg/mL	0	-0.3	0.3	yes
Aroclor 1232	µg/mL	0	-0.3	0.3	yes
Aroclor 1242	µg/mL	0	-0.3	0.3	yes
Aroclor 1248	µg/mL	0	-0.3	0.3	yes
Aroclor 1254	µg/mL	0	-0.3	0.3	yes
Aroclor 1260	µg/mL	0	-0.3	0.3	yes
Aroclor 1262	µg/mL	0	-0.3	0.3	yes
Aroclor 1268	µg/mL	0	-0.3	0.3	yes
Date Acquired:	September 26, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Polychlorinated Biphenyls - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aroclor 1260	µg/mL	120.00	80	120	yes

Date Acquired: September 26, 2019

Polychlorinated Biphenyls - Soil - Surrogate

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Decachlorobiphenyl	%	92.9604	50	140	yes

Date Acquired: September 26, 2019

Polycyclic Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.010	0.010	yes
Acenaphthylene	ng/mL	0	-0.05	0.05	yes
Acenaphthene	ng/mL	0	-0.05	0.05	yes
Fluorene	ng/mL	0	-0.05	0.05	yes
Phenanthrene	ng/mL	0	-0.01	0.01	yes
Anthracene	ng/mL	0	-0.003	0.003	yes
Fluoranthene	ng/mL	0	-0.010	0.010	yes
Pyrene	ng/mL	0	-0.010	0.010	yes
Benzo(a)anthracene	ng/mL	0	-0.01	0.01	yes
Chrysene	ng/mL	0	-0.05	0.05	yes
Benzo(b)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(b+j)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(k)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(a)pyrene	ng/mL	0	-0.05	0.05	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.05	0.05	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.05	0.05	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.05	0.05	yes

Date Acquired: September 26, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	99.00	80	120	yes
Acenaphthylene	ng/mL	98.80	80	120	yes
Acenaphthene	ng/mL	98.00	80	120	yes
Fluorene	ng/mL	104.40	80	120	yes
Phenanthrene	ng/mL	86.00	80	120	yes
Anthracene	ng/mL	98.00	80	120	yes
Fluoranthene	ng/mL	95.80	80	120	yes
Pyrene	ng/mL	96.60	80	120	yes
Benzo(a)anthracene	ng/mL	102.80	80	120	yes
Chrysene	ng/mL	101.00	80	120	yes
Benzo(b)fluoranthene	ng/mL	102.80	80	120	yes
Benzo(k)fluoranthene	ng/mL	94.80	80	120	yes
Benzo(a)pyrene	ng/mL	98.80	80	120	yes

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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W: element.com

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Polycyclic Aromatic Hydrocarbons - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Indeno(1,2,3-c,d)pyrene	ng/mL	90.60	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	86.40	80	120	yes
Benzo(g,h,i)perylene	ng/mL	88.80	80	120	yes

Date Acquired: September 26, 2019

Salinity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	-0.00801864	-0.4	0.5	yes
Magnesium	mg/L	0.010729	-0.1	0.1	yes
Sodium	mg/L	0.0902896	-0	2	yes
Potassium	mg/L	0.0213116	-0.5	0.7	yes
Chloride	mg/L	2.5255	0	5	yes
Sulfate-S	mg/L	0.0146467	-0	1	yes

Date Acquired: September 27, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Electrical Conductivity	dS/m	0.10	0.09	20	0.01	yes
Calcium	mg/kg	3.7	3.6	20	0.6	yes
Magnesium	mg/kg	1.2	1.2	20	0.6	yes
Sodium	mg/kg	1	1	20	1	yes
Potassium	mg/kg	2	2	20	1	yes
Chloride	mg/kg	4	4	15	3	yes
Sulfate-S	mg/kg	1.9	2.1	20	1.2	yes

Date Acquired: September 27, 2019

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Electrical Conductivity	dS/m	1.15	0.60	1.50	yes
% Saturation	%	59	52	70	yes
Calcium	mg/L	166	87.8	195.8	yes
Magnesium	mg/L	38.8	20.5	44.5	yes
Sodium	mg/L	18	12	22	yes
Potassium	mg/L	16.4	9.5	18.5	yes
Chloride	mg/L	27	10	43	yes
Sulfate-S	mg/L	28	16	34	yes

Date Acquired: September 27, 2019

Electrical Conductivity	dS/m	2.11	-0.07	4.13	yes
% Saturation	%	52	46	57	yes
Calcium	mg/L	383	301.9	468.7	yes
Magnesium	mg/L	89	68.5	103.3	yes
Sodium	mg/L	43	32	53	yes
Potassium	mg/L	19	15.6	22.8	yes
Chloride	mg/L	38	32	45	yes
Sulfate-S	mg/L	245	178	294	yes

Date Acquired: September 27, 2019

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

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Salinity - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Electrical Conductivity	dS/m	31.8	26.80	35.20	yes
Calcium	mg/L	255	230.2	261.4	yes
Magnesium	mg/L	101	92.1	104.1	yes
Sodium	mg/L	248	225	264	yes
Potassium	mg/L	250	222.6	270.6	yes
Chloride	mg/L	2110	1871	2231	yes
Sulfate-S	mg/L	146	138	156	yes
Date Acquired:	September 27, 2019				

Soil Acidity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	0.363587	-20.010	20.010	yes
Date Acquired:	October 01, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	95.60	91	110	yes
Date Acquired:	October 01, 2019				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH	pH	5.3	5.4	0	0.3	yes
Date Acquired:	September 27, 2019					
Sulfur	µg/g	10	10	30	5.000	yes
Date Acquired:	October 01, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
pH	pH	5.9	5.3	6.5	yes
Date Acquired:	September 26, 2019				
Sulfur	µg/g	16000	14101.100	17360.900	yes
Date Acquired:	October 01, 2019				

Volatile Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F1 C6-C10	ng	0	-10	10	yes
Date Acquired:	September 26, 2019				

Water Soluble Parameters

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chromium (VI)	mg/L	0.002	-0.10	0.10	yes
Date Acquired:	September 27, 2019				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Chromium (VI)	mg/kg	<0.05	<0.05	10	0.01	yes
Date Acquired:	September 27, 2019					

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

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Date Reported: Oct 3, 2019
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Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Sep 27, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Sep 27, 2019	Element Edmonton - Roper Road
BTEX-CCME - Soil	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Sep 26, 2019	Element Calgary
BTEX-CCME - Soil	US EPA	*	Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	Sep 26, 2019	Element Calgary
Landfill VOC - Soil (DV)	US EPA	*	Volatile Organic Compounds by GCMS / VOC in Various Sample matricies using Equilibrium Head Space Analysis, 8260B/5021A	Oct 2, 2019	Element Drayton Valley
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Sep 27, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Sep 27, 2019	Element Edmonton - Roper Road
Nutrients in General Soil	Comm. Soil Sci. Pl. Anal.	*	Modified Kelowna Soil Test, Vol 26, 1995	Sep 26, 2019	Element Edmonton - Roper Road
PAH - Soil	AEP		Index of Additive Cancer Risk (IACR), IACR	Sep 26, 2019	Element Calgary
PAH - Soil	US EPA	*	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Sep 26, 2019	Element Calgary
Particle Size Analysis - GS	Carter	*	Hydrometer Method, 55.3	Sep 27, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	ASTM	*	Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing, C 117-17	Sep 27, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	Carter	*	Procedure for Particle Size Separation, 55.2.3	Sep 27, 2019	Element Edmonton - Roper Road
PCB - Soil	US EPA	*	Polychlorinated Biphenyls (PCBs) by Gas Chromatography, 8082A	Sep 26, 2019	Element Calgary
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Sep 26, 2019	Element Edmonton - Roper Road
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Sep 27, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Sep 27, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Sep 27, 2019	Element Edmonton - Roper Road
Sublet to SRC Geoanalytical	Ext. Lab		Analysis performed by external laboratory, .	Sep 27, 2019	Saskatchewan Research Council Geoanalyti

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
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Method Name	Reference		Method	Date Analysis Started	Location
Sublet to SRC Geoanalytical	Ext. Lab				
Sublet to SRC Geoanalytical	Ext. Lab		See attached test report,	Sep 27, 2019	Saskatchewan Research Council Geoanalyti
Sulfur (Elemental) - VAN	Element-in house		Elemental sulfur, TM SOIL 004-60	Oct 1, 2019	Element Vancouver
TEH-CCME-Soil (Shake)	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Sep 26, 2019	Element Calgary

** Reference Method Modified*

References

AEP	Alberta Tier 1 Soil and Groundwater Remediation Guidelines
APHA	Standard Methods for the Examination of Water and Wastewater
ASTM	Annual Book of ASTM Standards
Carter	Soil Sampling and Methods of Analysis.
CCME	Canadian Council of Ministers of the Environment
Comm. Soil Sci. Pl.	Communications in Soil Science and Plant Analysis
Element-in house	In house method
EPA	Environmental Protection Agency Test Methods - US
Ext. Lab	External Laboratory
McKeague	Manual on Soil Sampling and Methods of Analysis
US EPA	US Environmental Protection Agency Test Methods

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
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Report Transmission Cover Page

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Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Contact	Company	Address
Accounts Payable	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: EBA.accounts.Payable@tetratech.

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

Contact	Company	Address
Brent Finnestad	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: brent.finnestad@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Chemistry File	Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Sample File	Test Report

Contact	Company	Address
Data Management	**Tetra Tech EBA Inc**	100, 140 Quarry Park Blvd SE Calgary, AB T2C 3G3 Phone: (403) 203-3355 Fax: Email: EBA.labdata@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Multiple Reports By Lot	EBA ESDAT Sample File	Test Report
Email - Multiple Reports By Lot	Legacy Reverse Crosstab in CSV	Test Report
Email - Multiple Reports By Lot	PDF	COC / Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report

Contact	Company	Address
Mark Fawcett	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email: mark.fawcett@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	AB Tier 1 Custom Excel	Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report
Email - Single Report	EBA ESDAT Sample File	Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	Invoice

Notes To Clients:

- Oct 16, 2019 - Report was issued to include addition of Metals analysis on samples 6,8,10-12 Salinity analysis on samples 26-28 and PAH analysis on samples 6,8,11 and 12 as requested by Brent Finnestad of Tetratech on Oct.16,2019. Previous report

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

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	Reference Number	1379633-1	1379633-2	1379633-3	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	14-2 / 0-15	14-2 / 15-30	14-2 / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	<0.5	0.05
Salinity						
% Saturation		%	69	74	56	

Element
7217 Roper Road NW
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Reference Number		1379633-4	1379633-5	1379633-6
Sample Date		Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time		NA	NA	NA
Sample Location				
Sample Description		14-2 / 60-100	19-6 / 0-15	19-6 / 15-30
Matrix		Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	0.6	0.55	0.05
Antimony	Strong Acid Extractable	mg/kg				0.2
Arsenic	Strong Acid Extractable	mg/kg				0.2
Barium	Strong Acid Extractable	mg/kg				1
Beryllium	Strong Acid Extractable	mg/kg				0.1
Cadmium	Strong Acid Extractable	mg/kg				0.01
Chromium	Strong Acid Extractable	mg/kg				0.5
Cobalt	Strong Acid Extractable	mg/kg				0.1
Copper	Strong Acid Extractable	mg/kg				1
Lead	Strong Acid Extractable	mg/kg				0.1
Mercury	Strong Acid Extractable	mg/kg				0.05
Molybdenum	Strong Acid Extractable	mg/kg				1
Nickel	Strong Acid Extractable	mg/kg				0.5
Selenium	Strong Acid Extractable	mg/kg				0.3
Silver	Strong Acid Extractable	mg/kg				0.1
Thallium	Strong Acid Extractable	mg/kg				0.05
Tin	Strong Acid Extractable	mg/kg				1
Uranium	Strong Acid Extractable	mg/kg				0.5
Vanadium	Strong Acid Extractable	mg/kg				0.1
Zinc	Strong Acid Extractable	mg/kg				1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m				0.01
SAR	Saturated Paste					
% Saturation		%	56	70	70	
Calcium	Saturated Paste	mg/kg				
Magnesium	Saturated Paste	mg/kg				
Sodium	Saturated Paste	mg/kg				
Potassium	Saturated Paste	mg/kg				
Chloride	Saturated Paste	mg/L				2
Chloride	Saturated Paste	mg/kg				
Sulfate (SO4)	Saturated Paste	mg/kg				
TGR	Saturated Paste	T/ac				

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-5	1379633-6	1379633-7	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-6 / 0-15	19-6 / 15-30	19-6 / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.7	7.6	7.9	
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.06	0.1	0.05	0.05
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	0.032	0.010	0.016	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.19	0.03	0.07	0.01
Anthracene	Dry Weight	mg/kg	0.068	0.005	0.016	0.003
Fluoranthene	Dry Weight	mg/kg	0.397	0.041	0.110	0.010
Pyrene	Dry Weight	mg/kg	0.379	0.046	0.117	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	0.26	0.02	0.05	0.01
Chrysene	Dry Weight	mg/kg	0.34	<0.05	0.08	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	0.49	<0.05	0.11	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	0.18	<0.05	0.06	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	0.35	<0.05	0.06	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	0.22	<0.05	<0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	0.06	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	0.21	<0.05	0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	0.523	0.022	0.088	0.001
IACR_Coarse	Index of Additive Cancer Risk		0.294	0.003	0.078	0.001
IACR_Fine	Index of Additive Cancer Risk		0.560	0.007	0.148	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	100	77	85	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	89	84	83	50-140
p-Terphenyl-d14	PAH - Surrogate	%	102	118	90	50-140

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T6B 3J4, Canada

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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-5	1379633-9	1379633-10	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-6 / 0-15	19-8 / 0-15	19-8 / 15-30	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Particle Size Analysis - Wet Sieve					
Texture		Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve % Retained	% by weight	47.9	42.5	40.8	0.1

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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

		Reference Number	1379633-5	1379633-9	1379633-13	
		Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-6 / 0-15	19-8 / 0-15	19-10 / 0-15	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Physical and Aggregate Properties						
Texture			Loam	Loam	Loam	
Sand	50 µm - 2 mm	% by weight	48	47	41	0.1
Silt	2 µm - 50 µm	% by weight	29	29	37	0.1
Clay	<2 µm	% by weight	23	24	22	0.1
Mono-Aromatic Hydrocarbons - Soil						
Benzene	Dry Weight	mg/kg	0.016	<0.005	<0.005	0.005
Toluene	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Ethylbenzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<0.03	<0.03	<0.03	0.03
Volatile Petroleum Hydrocarbons - Soil						
Methanol Field Preservation			Yes	Yes	Yes	
F1 C6-C10	Dry Weight	mg/kg	<10	<10	<10	10
F1 -BTEX	Dry Weight	mg/kg	<10	<10	<10	10
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date	Total Extractables		30-Sep-19	30-Sep-19	30-Sep-19	
F2c C10-C16	Dry Weight	mg/kg	<25	<25	<25	25
F3c C16-C34	Dry Weight	mg/kg	305	83	<50	50
F4c C34-C50	Dry Weight	mg/kg	221	<100	<100	100
F4HTGCc C34-C50+	Dry Weight	mg/kg	373	<100	<100	100
% C50+		%	15.4	<5	<5	
Silica Gel Cleanup						
Silica Gel Cleanup			Done	Done	Done	
Soil % Moisture						
Moisture	Soil % Moisture	% by weight	21.80	21.30	14.10	

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7217 Roper Road NW
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T6B 3J4, Canada

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W: element.com

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-5	1379633-9	1379633-24
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-6 / 0-15	19-8 / 0-15	19-16 / 60-100
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Organochlorine Pesticides in Soil						
Aldrin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
BHC (alpha isomer)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
BHC (beta isomer)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
BHC (delta isomer)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Captan	Dry Weight	mg/kg	<3.0	<3.0	<3.0	3.0
Chlorbenside	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlordane-cis	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlordane-trans	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorfenson	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorothalonil	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorthal-dimethyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDD-o,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDD-p,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDE-o,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDE-p,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.50
DDT-o,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDT-p,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Dichlofluanid	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Dieldrin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endosulfan I	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endosulfan II	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endosulfan sulfate	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endrin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Folpet	Dry Weight	mg/kg	<3.0	<3.0	<3.0	3.0
Heptachlor	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Heptachlor Epoxide	Dry Weight	mg/kg	<0.2	<0.2	<0.2	0.2
Hexachlorobenzene	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Lindane	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Methoxychlor	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Mirex	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Permethrin-cis	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Permethrin-trans	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Procymidone	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Propachlor	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Quintozene	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Tecnazene	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Tetradifon	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Tolyfluanid	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-5	1379633-9	1379633-24
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-6 / 0-15	19-8 / 0-15	19-16 / 60-100
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Organochlorine Pesticides in Soil - Continued						
Triadimefon	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Vinclozolin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Organochlorine Pesticides -Soil- Surrogate Rec.						
TPP	Surrogate	%	114	116	108	50-140
Neutral Herbicides in Soil						
Alachlor	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Benfluralin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Butylate	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorpropham	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Diallate	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Dichlobenil	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Diclofop-methyl	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Diphenylamine	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Eptam (EPTC)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Ethalfluralin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Fenoxaprop-ethyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Fluazifop-p-butyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Hexazinone	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Metalaxyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Metolachlor	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Metribuzin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Pirimicarb	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Profluralin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Prometryn	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Propazine	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Propyzamide	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Quizalofop-ethyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Simetryn	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Terbuthylazine	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Terbutryn	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Triallate	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Trifluralin	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Neutral Herbicides - Soil - Surrogate Recovery						
TPP	Surrogate	%	114	116	108	50-140
Acid Herbicides in Soil						
2,4,5-T	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
2,4,5-TP	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
2,4-D	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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F: +1 (780) 434-8586
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W: element.com

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Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-5	1379633-9	1379633-24	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-6 / 0-15	19-8 / 0-15	19-16 / 60-100	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Acid Herbicides in Soil - Continued						
2,4-DB	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Bromoxynil	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Clopyralid	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Dicamba	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Dichlorprop	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Dinoseb	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Imazamox	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Imazapyr	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Imazethapyr	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
MCPA	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
MCPB	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Mecoprop	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Picloram	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Triclopyr	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Acid Herbicides - Soil - Surrogate Recovery						
3,5-DCBA	Surrogate	%	101	99	118	50-140

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Project Location: Ryley, AB
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P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-7	1379633-8	1379633-9
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-6 / 30-60	19-6 / 60-100	19-8 / 0-15
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.58	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	1.2	0.7	0.8	0.2
Arsenic	Strong Acid Extractable	mg/kg	7.2	7.1	6.4	0.2
Barium	Strong Acid Extractable	mg/kg	176	202	198	1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.5	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	1.79	0.25	1.04	0.01
Chromium	Strong Acid Extractable	mg/kg	43.3	16.8	29.2	0.5
Cobalt	Strong Acid Extractable	mg/kg	9.4	10.6	8.0	0.1
Copper	Strong Acid Extractable	mg/kg	44.4	16.4	31.9	1
Lead	Strong Acid Extractable	mg/kg	88.1	11.2	52.6	0.1
Mercury	Strong Acid Extractable	mg/kg	0.10	<0.05	0.12	0.05
Molybdenum	Strong Acid Extractable	mg/kg	8.6	<1.0	6.5	1
Nickel	Strong Acid Extractable	mg/kg	51.5	23.2	42.8	0.5
Selenium	Strong Acid Extractable	mg/kg	0.8	0.6	0.6	0.3
Silver	Strong Acid Extractable	mg/kg	0.5	<0.10	0.3	0.1
Thallium	Strong Acid Extractable	mg/kg	0.14	0.13	0.13	0.05
Tin	Strong Acid Extractable	mg/kg	3.2	<1.0	1.8	1
Uranium	Strong Acid Extractable	mg/kg	0.8	0.8	0.8	0.5
Vanadium	Strong Acid Extractable	mg/kg	85.0	30.7	72.7	0.1
Zinc	Strong Acid Extractable	mg/kg	656	82	380	1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	1.83	2.58	3.73	0.01
SAR	Saturated Paste		7.6	14	8.7	
% Saturation		%	58	66	61	
Calcium	Saturated Paste	mg/kg	46.8	46	176	
Magnesium	Saturated Paste	mg/kg	17.1	19	59	
Sodium	Saturated Paste	mg/kg	184	353	412	
Potassium	Saturated Paste	mg/kg	6	<7	8	
Chloride	Saturated Paste	mg/L	201	59	100	2
Chloride	Saturated Paste	mg/kg	118	39	61	
Sulfate (SO4)	Saturated Paste	mg/kg	334	743	1270	
TGR	Saturated Paste	T/ac	<0.1	0.8	0.6	

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-8	1379633-9	1379633-10	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-6 / 60-100	19-8 / 0-15	19-8 / 15-30	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.7	7.8	7.7	
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.09	<0.05	<0.05	0.05
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	0.015	0.024	0.016	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.05	0.12	0.06	0.01
Anthracene	Dry Weight	mg/kg	0.009	0.047	0.012	0.003
Fluoranthene	Dry Weight	mg/kg	0.064	0.244	0.095	0.010
Pyrene	Dry Weight	mg/kg	0.072	0.230	0.095	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	0.03	0.15	0.06	0.01
Chrysene	Dry Weight	mg/kg	<0.05	0.20	0.07	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	0.28	0.12	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	0.09	<0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	0.17	0.07	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	0.13	0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	0.10	0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	0.039	0.233	0.092	0.001
IACR_Coarse	Index of Additive Cancer Risk		0.013	0.154	0.031	0.001
IACR_Fine	Index of Additive Cancer Risk		0.026	0.293	0.060	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	95	112	125	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	78	88	92	50-140
p-Terphenyl-d14	PAH - Surrogate	%	90	99	100	50-140

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Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

	Reference Number	1379633-10	1379633-11	1379633-12	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-8 / 15-30	19-8 / 30-60	19-8 / 60-100	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.8	0.7	<0.2	0.2
Arsenic	Strong Acid Extractable	mg/kg	6.7	5.7	3.4	0.2
Barium	Strong Acid Extractable	mg/kg	188	167	126	1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.4	0.6	0.1
Cadmium	Strong Acid Extractable	mg/kg	1.02	0.87	0.31	0.01
Chromium	Strong Acid Extractable	mg/kg	28.1	28.3	16.2	0.5
Cobalt	Strong Acid Extractable	mg/kg	9.0	7.6	4.5	0.1
Copper	Strong Acid Extractable	mg/kg	33.0	27.9	11.0	1
Lead	Strong Acid Extractable	mg/kg	52.5	45.6	8.2	0.1
Mercury	Strong Acid Extractable	mg/kg	0.10	0.09	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	7.2	4.6	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	41.3	38.5	13.4	0.5
Selenium	Strong Acid Extractable	mg/kg	0.6	0.5	0.5	0.3
Silver	Strong Acid Extractable	mg/kg	0.3	0.2	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.12	0.11	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	1.7	1.5	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.9	1.0	1.6	0.5
Vanadium	Strong Acid Extractable	mg/kg	72.0	58.1	23.4	0.1
Zinc	Strong Acid Extractable	mg/kg	382	405	76	1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	3.72	5.42	2.95	0.01
SAR	Saturated Paste		9.2	10.3	12	
% Saturation		%	63	63	79	
Calcium	Saturated Paste	mg/kg	160	258	74	
Magnesium	Saturated Paste	mg/kg	55	96.6	41	
Sodium	Saturated Paste	mg/kg	420	610	468	
Potassium	Saturated Paste	mg/kg	11	13	<8	
Chloride	Saturated Paste	mg/L	115	231	102	2
Chloride	Saturated Paste	mg/kg	72	145	81	
Sulfate (SO4)	Saturated Paste	mg/kg	1200	1900	994	
TGR	Saturated Paste	T/ac	0.7	2.0	0.9	

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Project Location: Ryley, AB
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P.O.:
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Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

Reference Number	1379633-11	1379633-12	1379633-13
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-8 / 30-60	19-8 / 60-100	19-10 / 0-15
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.9	6.9	7.0	
Sulfur	Elemental	µg/g			<10	10
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	0.08	0.08	0.05
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	0.013	<0.01	<0.01	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.04	0.02	<0.01	0.01
Anthracene	Dry Weight	mg/kg	0.009	0.005	<0.003	0.003
Fluoranthene	Dry Weight	mg/kg	0.049	0.033	<0.01	0.010
Pyrene	Dry Weight	mg/kg	0.047	0.031	<0.01	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	0.03	0.02	<0.01	0.01
Chrysene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	0.041	0.019	<0.001	0.001
IACR_Coarse	Index of Additive Cancer Risk		0.014	0.003	<0.001	0.001
IACR_Fine	Index of Additive Cancer Risk		0.026	0.006	<0.001	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	84	94	99	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	77	84	86	50-140
p-Terphenyl-d14	PAH - Surrogate	%	86	90	113	50-140

Element
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Project Location: Ryley, AB
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Proj. Acct. code:

Lot ID: **1379633**
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	Reference Number	1379633-13	1379633-15	1379633-17	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-10 / 0-15	19-10 / 30-60	19-15 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	2.06	5.38	1.62	0.01
SAR	Saturated Paste		8.2	13.8	10.9	
% Saturation		%	66	96	63	
Calcium	Saturated Paste	mg/kg	61	271	28.8	
Magnesium	Saturated Paste	mg/kg	25	104	10.2	
Sodium	Saturated Paste	mg/kg	246	1030	211	
Potassium	Saturated Paste	mg/kg	<7	14	4	
Chloride	Saturated Paste	mg/L	8	28	15	2
Chloride	Saturated Paste	mg/kg	5	27	9	
Sulfate (SO4)	Saturated Paste	mg/kg	641	3000	289	
TGR	Saturated Paste	T/ac	0.1	3.3	0.3	

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Edmonton, Alberta
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Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

Reference Number		1379633-13	1379633-17	1379633-18
Sample Date		Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time		NA	NA	NA
Sample Location				
Sample Description		19-10 / 0-15	19-15 / 0-15	19-15 / 15-30
Matrix		Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	0.15	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	<0.2	0.3	0.3	0.2
Arsenic	Strong Acid Extractable	mg/kg	5.2	6.2	6.3	0.2
Barium	Strong Acid Extractable	mg/kg	154	139	137	1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.5	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.24	0.26	0.20	0.01
Chromium	Strong Acid Extractable	mg/kg	12.5	13.3	12.6	0.5
Cobalt	Strong Acid Extractable	mg/kg	9.8	7.1	6.6	0.1
Copper	Strong Acid Extractable	mg/kg	12.3	14.4	13.9	1
Lead	Strong Acid Extractable	mg/kg	8.2	10.4	9.3	0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05	<0.05	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	2.0	1.0	1
Nickel	Strong Acid Extractable	mg/kg	15.7	17.2	17.1	0.5
Selenium	Strong Acid Extractable	mg/kg	0.5	0.6	0.4	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.12	0.11	0.12	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.8	1.0	0.8	0.5
Vanadium	Strong Acid Extractable	mg/kg	23.0	30.5	25.0	0.1
Zinc	Strong Acid Extractable	mg/kg	64	74	62	1

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Project Location: Ryley, AB
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Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
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		Reference Number	1379633-13	1379633-17	1379633-21
		Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
		Sample Time	NA	NA	NA
		Sample Location			
		Sample Description	19-10 / 0-15	19-15 / 0-15	19-16 / 0-15
		Matrix	Soil	Soil	Soil
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Particle Size Analysis - Wet Sieve						
Texture			Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve	% Retained	% by weight	34.3	34.9	30.8	0.1

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Report Number: 2450080

Reference Number	1379633-13	1379633-21	1379633-33
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-10 / 0-15	19-16 / 0-15	Duplicate 5
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polychlorinated Biphenyls - Soil						
Aroclor 1016	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1221	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1232	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1242	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1248	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1254	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1260	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1262	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Aroclor 1268	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Total PCBs	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Polychlorinated Biphenyls - Soil - Surrogate						
Decachlorobiphenyl	Surrogate	%	106	109	109	50-140
Alberta Landfill Solvent Scan - Soil						
Acetone	Dry Weight	mg/kg	<10	<10	<10	10
Benzene	Dry Weight	mg/kg	<10	<10	<10	10
iso-Butanol	Dry Weight	mg/kg	<10	<10	<10	10
n-Butanol	Dry Weight	mg/kg	<10	<10	<10	10
Cresol-m&p	Dry Weight	mg/kg	<10	<10	<10	10
Cresol-o	Dry Weight	mg/kg	<10	<10	<10	10
Carbon Disulfide	Dry Weight	mg/kg	<10	<10	<10	10
Cyclohexanone	Dry Weight	mg/kg	<10	<10	<10	10
Ethyl Acetate	Dry Weight	mg/kg	<10	<10	<10	10
Ethylbenzene	Dry Weight	mg/kg	<10	<10	<10	10
Ethyl Ether	Dry Weight	mg/kg	<10	<10	<10	10
Methanol	Dry Weight	mg/kg	<10	<10	<10	10
4-Methyl-2-Pentanone (MIBK)	Dry Weight	mg/kg	<10	<10	<10	10
2-Butanone (MEK)	Dry Weight	mg/kg	<10	<10	<10	10
Nitrobenzene	Dry Weight	mg/kg	<10	<10	<10	10
2-Nitropropane	Dry Weight	mg/kg	<10	<10	<10	10
Pyridine	Dry Weight	mg/kg	<10	<10	<10	10
Toluene	Dry Weight	mg/kg	<10	<10	<10	10
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<10	<10	<10	10
Total		mg/kg	<500	<500	<500	500
Alberta Landfill Solvents - Soil - Surrogates						
Bromofluorobenzene	EPA Surrogate	%	87	85	85	74-121
Dibromofluoromethane	EPA Surrogate	%	111	113	120	80-120
Toluene-d8	EPA Surrogate	%	99	88	100	81-117

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		Reference Number	1379633-13	1379633-21	1379633-33
		Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
		Sample Time	NA	NA	NA
		Sample Location			
		Sample Description	19-10 / 0-15	19-16 / 0-15	Duplicate 5
		Matrix	Soil	Soil	Soil
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Subcontracted Analysis						
Total Sulfur	SRC	%	0.04	0.10	0.16	
Subcontractor Report Id	SRC		G-2019-1877	G-2019-1877	G-2019-1877	

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Reference Number	1379633-14	1379633-17	1379633-21
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-10 / 15-30	19-15 / 0-15	19-16 / 0-15
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.01
Anthracene	Dry Weight	mg/kg	<0.003	<0.003	<0.003	0.003
Fluoranthene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Pyrene	Dry Weight	mg/kg	<0.01	<0.01	0.010	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.01
Chrysene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	<0.001	<0.001	0.005	0.001
IACR_Coarse	Index of Additive Cancer Risk		<0.001	<0.001	<0.001	0.001
IACR_Fine	Index of Additive Cancer Risk		<0.001	<0.001	<0.001	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	104	108	109	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	93	94	86	50-140
p-Terphenyl-d14	PAH - Surrogate	%	96	96	113	50-140

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number		1379633-15	1379633-17	1379633-18
Sample Date		Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time		NA	NA	NA
Sample Location				
Sample Description		19-10 / 30-60	19-15 / 0-15	19-15 / 15-30
Matrix		Soil	Soil	Soil
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity					
pH 1:2 Soil:CaCl2 sol.	pH	7.7	7.2	7.7	

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7217 Roper Road NW
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T6B 3J4, Canada

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-17	1379633-18	1379633-19	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-15 / 0-15	19-15 / 15-30	19-15 / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Water Soluble Parameters					
Chromium (VI) Dry Weight	mg/kg	<0.05	0.1	<0.05	0.05

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-18	1379633-19	1379633-20	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-15 / 15-30	19-15 / 30-60	19-15 / 60-100	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	3.96		3.77	0.01
SAR	Saturated Paste		16.6		27	
% Saturation		%	65	68	89	
Calcium	Saturated Paste	mg/kg	91.5		37	
Magnesium	Saturated Paste	mg/kg	31		23	
Sodium	Saturated Paste	mg/kg	581		804	
Potassium	Saturated Paste	mg/kg	<6		<9	
Chloride	Saturated Paste	mg/L	24		16	2
Chloride	Saturated Paste	mg/kg	16		14	
Sulfate (SO4)	Saturated Paste	mg/kg	1270		1600	
TGR	Saturated Paste	T/ac	2.6		3.0	

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number		1379633-19	1379633-21	1379633-25
Sample Date		Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time		NA	NA	NA
Sample Location				
Sample Description		19-15 / 30-60	19-16 / 0-15	19-7 / 0-15
Matrix		Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.5	0.4	0.4	0.2
Arsenic	Strong Acid Extractable	mg/kg	7.6	8.6	6.2	0.2
Barium	Strong Acid Extractable	mg/kg	170	153	131	1
Beryllium	Strong Acid Extractable	mg/kg	0.6	0.5	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.16	0.25	0.30	0.01
Chromium	Strong Acid Extractable	mg/kg	17.3	13.2	15.2	0.5
Cobalt	Strong Acid Extractable	mg/kg	8.4	7.7	7.9	0.1
Copper	Strong Acid Extractable	mg/kg	16.4	16.4	14.8	1
Lead	Strong Acid Extractable	mg/kg	7.8	12.4	12.1	0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05	<0.05	0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	2.6	2.4	1
Nickel	Strong Acid Extractable	mg/kg	25.3	20.6	20.6	0.5
Selenium	Strong Acid Extractable	mg/kg	0.7	0.6	0.4	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.15	0.16	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.8	1.1	0.5	0.5
Vanadium	Strong Acid Extractable	mg/kg	27.2	24.1	25.0	0.1
Zinc	Strong Acid Extractable	mg/kg	52	92	91	1

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

		Reference Number	1379633-20	1379633-21	1379633-23	
		Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-15 / 60-100	19-16 / 0-15	19-16 / 30-60	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	8.2	7.6	7.8	
Sulfur	Elemental	µg/g		<10		10

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Date Received: Sep 26, 2019
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	Reference Number	1379633-21	1379633-23	1379633-25	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-16 / 0-15	19-16 / 30-60	19-7 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	2.91	6.70	2.26	0.01
SAR	Saturated Paste		12	14.8	6.5	
% Saturation		%	96	68	56	
Calcium	Saturated Paste	mg/kg	117	237	78.9	
Magnesium	Saturated Paste	mg/kg	34	137	14	
Sodium	Saturated Paste	mg/kg	554	953	178	
Potassium	Saturated Paste	mg/kg	11	18	<6	
Chloride	Saturated Paste	mg/L	22	33	587	2
Chloride	Saturated Paste	mg/kg	21	22	329	
Sulfate (SO4)	Saturated Paste	mg/kg	1370	2950	130	
TGR	Saturated Paste	T/ac	0.8	5.9	<0.1	

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Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-21	1379633-25	1379633-29	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-16 / 0-15	19-7 / 0-15	Duplicate 1	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Water Soluble Parameters					
Chromium (VI) Dry Weight	mg/kg	0.07	<0.05	<0.05	0.05

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7217 Roper Road NW
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F: +1 (780) 434-8586
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Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

		Reference Number	1379633-21	1379633-25	1379633-33	
		Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-16 / 0-15	19-7 / 0-15	Duplicate 5	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Physical and Aggregate Properties						
Texture			Clay Loam	Sandy Clay Loam	Clay Loam	
Sand	50 µm - 2 mm	% by weight	40	49	41	0.1
Silt	2 µm - 50 µm	% by weight	30	27	29	0.1
Clay	<2 µm	% by weight	30	24	30	0.1
Mono-Aromatic Hydrocarbons - Soil						
Benzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Toluene	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Ethylbenzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<0.03	<0.03	<0.03	0.03
Volatile Petroleum Hydrocarbons - Soil						
Methanol Field Preservation			Yes	Yes	Yes	
F1 C6-C10	Dry Weight	mg/kg	<10	<10	<10	10
F1 -BTEX	Dry Weight	mg/kg	<10	<10	<10	10
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date	Total Extractables		30-Sep-19	30-Sep-19	30-Sep-19	
F2c C10-C16	Dry Weight	mg/kg	<25	<25	<25	25
F3c C16-C34	Dry Weight	mg/kg	<50	<50	<50	50
F4c C34-C50	Dry Weight	mg/kg	<100	<100	<100	100
F4HTGCc C34-C50+	Dry Weight	mg/kg	<100	<100	<100	100
% C50+		%	14.9	<5	<5	
Silica Gel Cleanup						
Silica Gel Cleanup			Done	Done	Done	
Soil % Moisture						
Moisture	Soil % Moisture	% by weight	21.60	16.90	20.20	

Element
7217 Roper Road NW
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T6B 3J4, Canada

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F: +1 (780) 434-8586
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W: element.com

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-25
Sample Date	Sep 25, 2019
Sample Time	NA
Sample Location	
Sample Description	19-7 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Organochlorine Pesticides in Soil						
Aldrin	Dry Weight	mg/kg	<0.5			0.5
BHC (alpha isomer)	Dry Weight	mg/kg	<0.5			0.5
BHC (beta isomer)	Dry Weight	mg/kg	<0.5			0.5
BHC (delta isomer)	Dry Weight	mg/kg	<0.5			0.5
Captan	Dry Weight	mg/kg	<3.0			3.0
Chlorbenside	Dry Weight	mg/kg	<0.5			0.5
Chlordane-cis	Dry Weight	mg/kg	<0.5			0.5
Chlordane-trans	Dry Weight	mg/kg	<0.5			0.5
Chlorfenson	Dry Weight	mg/kg	<0.5			0.5
Chlorothalonil	Dry Weight	mg/kg	<0.5			0.5
Chlorthal-dimethyl	Dry Weight	mg/kg	<0.5			0.5
DDD-o,p'	Dry Weight	mg/kg	<0.5			0.5
DDD-p,p'	Dry Weight	mg/kg	<0.5			0.5
DDE-o,p'	Dry Weight	mg/kg	<0.5			0.5
DDE-p,p'	Dry Weight	mg/kg	<0.5			0.50
DDT-o,p'	Dry Weight	mg/kg	<0.5			0.5
DDT-p,p'	Dry Weight	mg/kg	<0.5			0.5
Dichlofluanid	Dry Weight	mg/kg	<0.5			0.5
Dieldrin	Dry Weight	mg/kg	<0.5			0.5
Endosulfan I	Dry Weight	mg/kg	<0.5			0.5
Endosulfan II	Dry Weight	mg/kg	<0.5			0.5
Endosulfan sulfate	Dry Weight	mg/kg	<0.5			0.5
Endrin	Dry Weight	mg/kg	<0.5			0.5
Folpet	Dry Weight	mg/kg	<3.0			3.0
Heptachlor	Dry Weight	mg/kg	<0.5			0.5
Heptachlor Epoxide	Dry Weight	mg/kg	<0.2			0.2
Hexachlorobenzene	Dry Weight	mg/kg	<0.5			0.5
Lindane	Dry Weight	mg/kg	<0.1			0.1
Methoxychlor	Dry Weight	mg/kg	<0.1			0.1
Mirex	Dry Weight	mg/kg	<0.5			0.5
Permethrin-cis	Dry Weight	mg/kg	<0.5			0.5
Permethrin-trans	Dry Weight	mg/kg	<0.5			0.5
Procymidone	Dry Weight	mg/kg	<0.5			0.5
Propachlor	Dry Weight	mg/kg	<0.5			0.5
Quintozene	Dry Weight	mg/kg	<0.5			0.5
Tecnazene	Dry Weight	mg/kg	<0.5			0.5
Tetradifon	Dry Weight	mg/kg	<0.5			0.5
Tolyfluanid	Dry Weight	mg/kg	<0.5			0.5

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Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

Reference Number	1379633-25
Sample Date	Sep 25, 2019
Sample Time	NA
Sample Location	
Sample Description	19-7 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Organochlorine Pesticides in Soil - Continued						
Triadimefon	Dry Weight	mg/kg	<0.5			0.5
Vinclozolin	Dry Weight	mg/kg	<0.5			0.5
Organochlorine Pesticides -Soil- Surrogate Rec.						
TPP	Surrogate	%	123			50-140
Neutral Herbicides in Soil						
Alachlor	Dry Weight	mg/kg	<0.5			0.5
Benfluralin	Dry Weight	mg/kg	<0.5			0.5
Butylate	Dry Weight	mg/kg	<0.5			0.5
Chlorpropham	Dry Weight	mg/kg	<0.5			0.5
Diallate	Dry Weight	mg/kg	<0.5			0.5
Dichlobenil	Dry Weight	mg/kg	<0.5			0.5
Diclofop-methyl	Dry Weight	mg/kg	<0.1			0.1
Diphenylamine	Dry Weight	mg/kg	<0.5			0.5
Eptam (EPTC)	Dry Weight	mg/kg	<0.5			0.5
Ethalfluralin	Dry Weight	mg/kg	<0.5			0.5
Fenoxaprop-ethyl	Dry Weight	mg/kg	<0.5			0.5
Fluazifop-p-butyl	Dry Weight	mg/kg	<0.5			0.5
Hexazinone	Dry Weight	mg/kg	<0.5			0.5
Metalaxyl	Dry Weight	mg/kg	<0.5			0.5
Metolachlor	Dry Weight	mg/kg	<0.1			0.1
Metribuzin	Dry Weight	mg/kg	<0.5			0.5
Pirimicarb	Dry Weight	mg/kg	<0.5			0.5
Profluralin	Dry Weight	mg/kg	<0.5			0.5
Prometryn	Dry Weight	mg/kg	<0.5			0.5
Propazine	Dry Weight	mg/kg	<0.5			0.5
Propyzamide	Dry Weight	mg/kg	<0.5			0.5
Quizalofop-ethyl	Dry Weight	mg/kg	<0.5			0.5
Simetryn	Dry Weight	mg/kg	<0.5			0.5
Terbuthylazine	Dry Weight	mg/kg	<0.5			0.5
Terbutryn	Dry Weight	mg/kg	<0.5			0.5
Triallate	Dry Weight	mg/kg	<0.1			0.1
Trifluralin	Dry Weight	mg/kg	<0.1			0.1
Neutral Herbicides - Soil - Surrogate Recovery						
TPP	Surrogate	%	123			50-140
Acid Herbicides in Soil						
2,4,5-T	Dry Weight	mg/kg	<0.02			0.02
2,4,5-TP	Dry Weight	mg/kg	<0.02			0.02
2,4-D	Dry Weight	mg/kg	<0.02			0.02

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Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

Reference Number	1379633-25
Sample Date	Sep 25, 2019
Sample Time	NA
Sample Location	
Sample Description	19-7 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Acid Herbicides in Soil - Continued						
2,4-DB	Dry Weight	mg/kg	<0.02			0.02
Bromoxynil	Dry Weight	mg/kg	<0.02			0.02
Clopyralid	Dry Weight	mg/kg	<0.02			0.02
Dicamba	Dry Weight	mg/kg	<0.02			0.02
Dichlorprop	Dry Weight	mg/kg	<0.02			0.02
Dinoseb	Dry Weight	mg/kg	<0.02			0.02
Imazamox	Dry Weight	mg/kg	<0.02			0.02
Imazapyr	Dry Weight	mg/kg	<0.02			0.02
Imazethapyr	Dry Weight	mg/kg	<0.02			0.02
MCPA	Dry Weight	mg/kg	<0.02			0.02
MCPB	Dry Weight	mg/kg	<0.02			0.02
Mecoprop	Dry Weight	mg/kg	<0.02			0.02
Picloram	Dry Weight	mg/kg	<0.02			0.02
Triclopyr	Dry Weight	mg/kg	<0.02			0.02
Acid Herbicides - Soil - Surrogate Recovery						
3,5-DCBA	Surrogate	%	93			50-140

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
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E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-25	1379633-26	1379633-27
Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	19-7 / 0-15	19-7 / 15-30	19-7 / 30-60
Matrix	Soil	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.8	7.1	7.6	

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

		Reference Number	1379633-25	1379633-29	1379633-33	
		Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-7 / 0-15	Duplicate 1	Duplicate 5	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Particle Size Analysis - Wet Sieve						
Texture			Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve	% Retained	% by weight	31.5	46.1	29.5	0.1
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	<0.01	<0.01	0.01	0.01
Anthracene	Dry Weight	mg/kg	<0.003	<0.003	<0.003	0.003
Fluoranthene	Dry Weight	mg/kg	<0.01	<0.01	0.018	0.010
Pyrene	Dry Weight	mg/kg	<0.01	<0.01	0.018	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	<0.01	0.01	0.01
Chrysene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	<0.001	<0.001	0.022	0.001
IACR_Coarse	Index of Additive Cancer Risk		<0.001	<0.001	0.003	0.001
IACR_Fine	Index of Additive Cancer Risk		<0.001	<0.001	0.005	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	105	109	102	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	79	95	90	50-140
p-Terphenyl-d14	PAH - Surrogate	%	107	108	104	50-140

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-26	1379633-27	1379633-28	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-7 / 15-30	19-7 / 30-60	19-7 / 60-100	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	1.43	1.80	7.01	0.01
SAR	Saturated Paste		4.7	6.3	13.1	
% Saturation		%	45	71	98	
Calcium	Saturated Paste	mg/kg	41.7	69.1	449	
Magnesium	Saturated Paste	mg/kg	7.8	18.2	222	
Sodium	Saturated Paste	mg/kg	84	192	1350	
Potassium	Saturated Paste	mg/kg	<1	3	14	
Chloride	Saturated Paste	mg/L	256	188	120	2
Chloride	Saturated Paste	mg/kg	116	133	118	
Sulfate (SO4)	Saturated Paste	mg/kg	87.1	378	4440	
TGR	Saturated Paste	T/ac	<0.1	<0.1	5.2	

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

	Reference Number	1379633-28	1379633-29	1379633-32	
	Sample Date	Sep 25, 2019	Sep 25, 2019	Sep 25, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-7 / 60-100	Duplicate 1	Duplicate 4	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.5	7.2	6.8	

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number			1379633-29	1379633-30	1379633-31
Sample Date			Sep 25, 2019	Sep 25, 2019	Sep 25, 2019
Sample Time			NA	NA	NA
Sample Location					
Sample Description			Duplicate 1	Duplicate 2	Duplicate 3
Matrix			Soil	Soil	Soil
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.14	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.3			0.2
Arsenic	Strong Acid Extractable	mg/kg	6.4			0.2
Barium	Strong Acid Extractable	mg/kg	131			1
Beryllium	Strong Acid Extractable	mg/kg	0.4			0.1
Cadmium	Strong Acid Extractable	mg/kg	0.25			0.01
Chromium	Strong Acid Extractable	mg/kg	13.7			0.5
Cobalt	Strong Acid Extractable	mg/kg	6.5			0.1
Copper	Strong Acid Extractable	mg/kg	13.9			1
Lead	Strong Acid Extractable	mg/kg	10.0			0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05			0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.6			1
Nickel	Strong Acid Extractable	mg/kg	15.9			0.5
Selenium	Strong Acid Extractable	mg/kg	0.5			0.3
Silver	Strong Acid Extractable	mg/kg	<0.10			0.1
Thallium	Strong Acid Extractable	mg/kg	0.12			0.05
Tin	Strong Acid Extractable	mg/kg	<1.0			1
Uranium	Strong Acid Extractable	mg/kg	0.9			0.5
Vanadium	Strong Acid Extractable	mg/kg	26.9			0.1
Zinc	Strong Acid Extractable	mg/kg	70			1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	1.95			0.01
SAR	Saturated Paste		11.9			
% Saturation		%	69	63	61	
Calcium	Saturated Paste	mg/kg	36.1			
Magnesium	Saturated Paste	mg/kg	13.0			
Sodium	Saturated Paste	mg/kg	273			
Potassium	Saturated Paste	mg/kg	3			
Chloride	Saturated Paste	mg/L	22			2
Chloride	Saturated Paste	mg/kg	15			
Sulfate (SO4)	Saturated Paste	mg/kg	476			
TGR	Saturated Paste	T/ac	0.4			

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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W: element.com

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T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-32	1379633-33	
Sample Date	Sep 25, 2019	Sep 25, 2019	
Sample Time	NA	NA	
Sample Location			
Sample Description	Duplicate 4	Duplicate 5	
Matrix	Soil	Soil	

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	2.21	4.60		0.01
SAR	Saturated Paste		7.9	11.1		
% Saturation		%	61	97		
Calcium	Saturated Paste	mg/kg	67.2	312		
Magnesium	Saturated Paste	mg/kg	27	80		
Sodium	Saturated Paste	mg/kg	238	839		
Potassium	Saturated Paste	mg/kg	<6	16		
Chloride	Saturated Paste	mg/L	7	21		2
Chloride	Saturated Paste	mg/kg	4	21		
Sulfate (SO4)	Saturated Paste	mg/kg	686	2610		
TGR	Saturated Paste	T/ac	0.1	1.7		

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Edmonton, Alberta
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14940 - 123 Avenue
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T5V 1B4
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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Reference Number	1379633-33
Sample Date	Sep 25, 2019
Sample Time	NA
Sample Location	
Sample Description	Duplicate 5
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5			0.05
Antimony	Strong Acid Extractable	mg/kg	0.4			0.2
Arsenic	Strong Acid Extractable	mg/kg	10.5			0.2
Barium	Strong Acid Extractable	mg/kg	171			1
Beryllium	Strong Acid Extractable	mg/kg	0.5			0.1
Cadmium	Strong Acid Extractable	mg/kg	0.23			0.01
Chromium	Strong Acid Extractable	mg/kg	15.3			0.5
Cobalt	Strong Acid Extractable	mg/kg	9.4			0.1
Copper	Strong Acid Extractable	mg/kg	18.1			1
Lead	Strong Acid Extractable	mg/kg	12.4			0.1
Mercury	Strong Acid Extractable	mg/kg	<0.05			0.05
Molybdenum	Strong Acid Extractable	mg/kg	2.3			1
Nickel	Strong Acid Extractable	mg/kg	25.2			0.5
Selenium	Strong Acid Extractable	mg/kg	0.6			0.3
Silver	Strong Acid Extractable	mg/kg	0.10			0.1
Thallium	Strong Acid Extractable	mg/kg	0.17			0.05
Tin	Strong Acid Extractable	mg/kg	<1.0			1
Uranium	Strong Acid Extractable	mg/kg	1.3			0.5
Vanadium	Strong Acid Extractable	mg/kg	25.4			0.1
Zinc	Strong Acid Extractable	mg/kg	86			1
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.7			
Sulfur	Elemental	µg/g	<10			10
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.06			0.05

Approved by:

Darlene Lintott, MSc
Consulting Scientist

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
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Element
7217 Roper Road NW
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F: +1 (780) 434-8586
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Proj. Acct. code:

Lot ID: **1379633**
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Acid Herbicides in Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
2,4,5-T	ng/mL	0	-0.08	0.08	yes
2,4,5-TP	ng/mL	0	-0.08	0.08	yes
2,4-D	ng/mL	0	-0.08	0.08	yes
2,4-DB	ng/mL	0	-0.08	0.08	yes
Bromoxynil	ng/mL	0	-0.08	0.08	yes
Clopyralid	ng/mL	0	-0.08	0.08	yes
Dicamba	ng/mL	0	-0.08	0.08	yes
Dichlorprop	ng/mL	0	-0.08	0.08	yes
Dinoseb	ng/mL	0	-0.08	0.08	yes
Imazamox	ng/mL	0	-0.08	0.08	yes
Imazapyr	ng/mL	0	-0.08	0.08	yes
Imazethapyr	ng/mL	0	-0.08	0.08	yes
MCPA	ng/mL	0	-0.08	0.08	yes
MCPB	ng/mL	0	-0.08	0.08	yes
Mecoprop	ng/mL	0	-0.08	0.08	yes
Picloram	ng/mL	0	-0.08	0.08	yes
Triclopyr	ng/mL	0	-0.08	0.08	yes
Date Acquired:	September 30, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
2,4,5-T	ng/mL	100.50	80	120	yes
2,4,5-TP	ng/mL	99.00	80	120	yes
2,4-D	ng/mL	99.00	80	120	yes
2,4-DB	ng/mL	100.50	80	120	yes
Bromoxynil	ng/mL	97.50	80	120	yes
Clopyralid	ng/mL	99.50	80	120	yes
Dicamba	ng/mL	101.50	80	120	yes
Dichlorprop	ng/mL	100.00	80	120	yes
Dinoseb	ng/mL	96.00	80	120	yes
Imazamox	ng/mL	102.50	80	120	yes
Imazapyr	ng/mL	104.50	80	120	yes
Imazethapyr	ng/mL	103.50	80	120	yes
MCPA	ng/mL	100.50	80	120	yes
MCPB	ng/mL	105.50	80	120	yes
Mecoprop	ng/mL	98.50	80	120	yes
Picloram	ng/mL	103.50	80	120	yes
Triclopyr	ng/mL	97.50	80	120	yes
Date Acquired:	September 30, 2019				

Extractable Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F2c C10-C16	µg/mL	0	-10	10	yes
F3c C16-C34	µg/mL	0	-30	30	yes
F4c C34-C50	µg/mL	0	-20	20	yes

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T6B 3J4, Canada

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Quality Control

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14940 - 123 Avenue
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T5V 1B4
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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
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Report Number: 2450080

Extractable Petroleum Hydrocarbons - Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F4HTGCc C34-C50+	µg/mL	0	-20	20	yes
Date Acquired: September 27, 2019					

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
F2c C10-C16	µg/mL	108.18	80	120	yes
F3c C16-C34	µg/mL	106.99	80	120	yes
F4c C34-C50	µg/mL	100.07	80	120	yes
F4HTGCc C34-C50+	µg/mL	98.14	80	120	yes
Date Acquired: September 27, 2019					

Metals Strong Acid Digestion

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Boron	mg/L	0.0014	-0.05	0.07	yes
Antimony	µg/L	0.0251105	-0.1	0.2	yes
Arsenic	µg/L	0.0444961	-0.2	0.2	yes
Barium	µg/L	-0.0164866	-1	1	yes
Beryllium	µg/L	0.00847258	-0.1	0.1	yes
Cadmium	µg/L	0.00057657	-0.01	0.01	yes
Chromium	µg/L	0.144824	-0.5	0.5	yes
Cobalt	µg/L	0.00698285	-0.1	0.1	yes
Copper	µg/L	0.261991	-0.6	1.2	yes
Lead	µg/L	0.0226196	-5.0	5.0	yes
Mercury	µg/L	0.00138968	-0.04	0.04	yes
Molybdenum	µg/L	0.246715	-1.0	1.0	yes
Nickel	µg/L	0.0630195	-0.4	0.7	yes
Selenium	µg/L	0.0142216	-0.3	0.3	yes
Silver	µg/L	0.00869023	-0.09	0.14	yes
Thallium	µg/L	0.00481018	-0.04	0.04	yes
Tin	µg/L	0.0347363	-0.4	0.4	yes
Uranium	µg/L	0.000207694	-0.5	0.5	yes
Vanadium	µg/L	0.0300447	-0.1	0.1	yes
Zinc	µg/L	0.0957937	-1	1	yes
Date Acquired: September 27, 2019					

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Antimony	mg/kg	1.3	1.2	20	0.4	yes
Arsenic	mg/kg	7.7	7.3	20	0.4	yes
Barium	mg/kg	189	183	20	2	yes
Beryllium	mg/kg	0.5	0.4	20	0.2	yes
Cadmium	mg/kg	1.62	1.66	20	0.02	yes
Chromium	mg/kg	44.0	40.0	20	1.1	yes
Cobalt	mg/kg	9.4	8.9	20	0.2	yes
Copper	mg/kg	46.9	46.0	20	2.2	yes
Lead	mg/kg	86.6	87.1	20	0.2	yes
Mercury	mg/kg	0.13	0.13	20	0.05	yes

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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Metals Strong Acid Digestion - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Molybdenum	mg/kg	10.0	9.2	20	2.2	yes
Nickel	mg/kg	55.0	52.8	20	1.1	yes
Selenium	mg/kg	0.8	0.7	20	0.7	yes
Silver	mg/kg	0.4	0.4	20	0.22	yes
Thallium	mg/kg	0.14	0.13	20	0.11	yes
Tin	mg/kg	2.8	3.4	20	2.2	yes
Uranium	mg/kg	0.9	0.9	20	1.1	yes
Vanadium	mg/kg	91.1	88.0	20	0.2	yes
Zinc	mg/kg	638	634	20	2	yes
Date Acquired:	September 27, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Antimony	mg/kg	40.3	36.1	43.9	yes
Arsenic	mg/kg	40.1	36.3	43.9	yes
Barium	mg/kg	202	183	225	yes
Beryllium	mg/kg	19.5	17.4	22.2	yes
Cadmium	mg/kg	2.09	1.88	2.28	yes
Chromium	mg/kg	100	93.6	105.6	yes
Cobalt	mg/kg	20.5	17.0	23.0	yes
Copper	mg/kg	195	183.1	212.7	yes
Lead	mg/kg	20.9	18.3	21.5	yes
Mercury	mg/kg	3.16	2.64	3.36	yes
Molybdenum	mg/kg	195	174.8	234.8	yes
Nickel	mg/kg	100	91.6	108.4	yes
Selenium	mg/kg	40.3	34.0	46.0	yes
Silver	mg/kg	21.5	18.20	22.40	yes
Thallium	mg/kg	10.4	8.76	10.74	yes
Tin	mg/kg	194	188.0	218.0	yes
Uranium	mg/kg	101	86.0	116.0	yes
Vanadium	mg/kg	20.1	18.0	21.6	yes
Zinc	mg/kg	200	170	230	yes
Date Acquired:	September 27, 2019				
Antimony	mg/kg	3.4	2.3	6.0	yes
Arsenic	mg/kg	3.9	2.6	6.8	yes
Barium	mg/kg	104	58	154	yes
Beryllium	mg/kg	0.3	0.2	0.5	yes
Cadmium	mg/kg	0.92	0.73	1.15	yes
Chromium	mg/kg	79.1	48.8	128.8	yes
Cobalt	mg/kg	6.8	3.9	10.4	yes
Copper	mg/kg	125	76.1	200.5	yes
Lead	mg/kg	232	198.7	305.5	yes
Mercury	mg/kg	0.06	0.05	0.07	yes
Molybdenum	mg/kg	1.1	0.6	1.5	yes
Nickel	mg/kg	26.1	15.8	41.5	yes
Selenium	mg/kg	<0.3	0.1	0.4	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Metals Strong Acid Digestion - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silver	mg/kg	3.9	2.28	6.00	yes
Thallium	mg/kg	0.07	0.04	0.11	yes
Tin	mg/kg	10.4	4.0	16.0	yes
Uranium	mg/kg	<0.5	0.3	0.7	yes
Vanadium	mg/kg	29.7	17.8	46.9	yes
Zinc	mg/kg	303	260	350	yes
Date Acquired:	September 27, 2019				

Mono-Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.005	0.005	yes
Toluene	ng	0	-0.06	0.06	yes
Ethylbenzene	ng	0	-0.030	0.030	yes
Total Xylenes (m,p,o)	ng	0	-0.09	0.09	yes
Styrene	ng	0	-0.030	0.030	yes
Date Acquired:	September 27, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	ng	117.40	80	120	yes
Toluene	ng	87.80	80	120	yes
Ethylbenzene	ng	93.60	80	120	yes
Total Xylenes (m,p,o)	ng	91.33	80	120	yes
Styrene	ng	84.40	80	120	yes
Date Acquired:	September 27, 2019				

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	mg/kg	91	70	130	yes
Toluene	mg/kg	88	70	130	yes
Ethylbenzene	mg/kg	87	70	130	yes
Total Xylenes (m,p,o)	mg/kg	86	70	130	yes
Date Acquired:	September 27, 2019				

Neutral Herbicides in Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Alachlor	ng/mL	0	-0.08	0.08	yes
Benfluralin	ng/mL	0	-0.08	0.08	yes
Butylate	ng/mL	0	-0.08	0.08	yes
Chlorpropham	ng/mL	0	-0.08	0.08	yes
Diallate	ng/mL	0	-0.08	0.08	yes
Dichlobenil	ng/mL	0	-0.08	0.08	yes
Diclofop-methyl	ng/mL	0	-0.08	0.08	yes
Diphenylamine	ng/mL	0	-0.08	0.08	yes
Eptam (EPTC)	ng/mL	0	-0.08	0.08	yes
Ethalfluralin	ng/mL	0	-0.08	0.08	yes
Fenoxaprop-ethyl	ng/mL	0	-0.08	0.08	yes
Fluazifop-p-butyl	ng/mL	0	-0.08	0.08	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Neutral Herbicides in Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Hexazinone	ng/mL	0	-0.08	0.08	yes
Metalaxyl	ng/mL	0	-0.08	0.08	yes
Metolachlor	ng/mL	0	-0.08	0.08	yes
Metribuzin	ng/mL	0	-0.08	0.08	yes
Pirimicarb	ng/mL	0	-0.08	0.08	yes
Profluralin	ng/mL	0	-0.08	0.08	yes
Prometryn	ng/mL	0	-0.08	0.08	yes
Propazine	ng/mL	0	-0.08	0.08	yes
Propyzamide	ng/mL	0	-0.08	0.08	yes
Quizalofop-ethyl	ng/mL	0	-0.08	0.08	yes
Simetryn	ng/mL	0	-0.08	0.08	yes
Terbuthylazine	ng/mL	0	-0.08	0.08	yes
Terbutryn	ng/mL	0	-0.08	0.08	yes
Triallate	ng/mL	0	-0.08	0.08	yes
Trifluralin	ng/mL	0	-0.08	0.08	yes

Date Acquired: September 30, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Alachlor	ng/mL	105.58	80	120	yes
Benfluralin	ng/mL	104.54	80	120	yes
Butylate	ng/mL	101.55	80	120	yes
Chlorpropham	ng/mL	90.84	80	120	yes
Diallate	ng/mL	107.13	80	120	yes
Dichlobenil	ng/mL	93.74	80	120	yes
Diclofop-methyl	ng/mL	105.23	80	120	yes
Diphenylamine	ng/mL	81.42	80	120	yes
Eptam (EPTC)	ng/mL	107.09	80	120	yes
Ethalfluralin	ng/mL	105.13	80	120	yes
Fenoxaprop-ethyl	ng/mL	91.28	80	120	yes
Fluazifop-p-butyl	ng/mL	107.59	80	120	yes
Hexazinone	ng/mL	95.63	80	120	yes
Metalaxyl	ng/mL	105.37	80	120	yes
Metolachlor	ng/mL	107.10	80	120	yes
Metribuzin	ng/mL	103.70	80	120	yes
Pirimicarb	ng/mL	107.52	80	120	yes
Profluralin	ng/mL	103.34	80	120	yes
Prometryn	ng/mL	108.14	80	120	yes
Propazine	ng/mL	108.02	80	120	yes
Propyzamide	ng/mL	105.04	80	120	yes
Quizalofop-ethyl	ng/mL	81.21	80	120	yes
Simetryn	ng/mL	98.82	80	120	yes
Terbuthylazine	ng/mL	107.86	80	120	yes
Terbutryn	ng/mL	105.92	80	120	yes
Triallate	ng/mL	110.74	80	120	yes
Trifluralin	ng/mL	103.30	80	120	yes

Date Acquired: September 30, 2019

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Neutral Herbicides in Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Alachlor	mg/kg	<0.5	<0.5	22	0.10	yes
Benfluralin	mg/kg	<0.5	<0.5	22	0.10	yes
Butylate	mg/kg	<0.5	<0.5	22	0.10	yes
Chlorpropham	mg/kg	<0.5	<0.5	22	0.10	yes
Diallate	mg/kg	<0.5	<0.5	22	0.10	yes
Dichlobenil	mg/kg	<0.5	<0.5	22	0.10	yes
Diclofop-methyl	mg/kg	<0.1	<0.1	22	0.10	yes
Diphenylamine	mg/kg	<0.5	<0.5	22	0.10	yes
Eptam (EPTC)	mg/kg	<0.5	<0.5	22	0.10	yes
Ethalfluralin	mg/kg	<0.5	<0.5	22	0.10	yes
Fenoxaprop-ethyl	mg/kg	<0.5	<0.5	22	0.10	yes
Fluazifop-p-butyl	mg/kg	<0.5	<0.5	22	0.10	yes
Hexazinone	mg/kg	<0.5	<0.5	22	0.10	yes
Metalaxyl	mg/kg	<0.5	<0.5	22	0.10	yes
Metolachlor	mg/kg	<0.1	<0.1	22	0.10	yes
Metribuzin	mg/kg	<0.5	<0.5	22	0.10	yes
Pirimicarb	mg/kg	<0.5	<0.5	22	0.10	yes
Profluralin	mg/kg	<0.5	<0.5	22	0.10	yes
Prometryn	mg/kg	<0.5	<0.5	22	0.10	yes
Propazine	mg/kg	<0.5	<0.5	22	0.10	yes
Propyzamide	mg/kg	<0.5	<0.5	22	0.10	yes
Quizalofop-ethyl	mg/kg	<0.5	<0.5	22	0.10	yes
Simetryn	mg/kg	<0.5	<0.5	22	0.10	yes
Terbuthylazine	mg/kg	<0.5	<0.5	22	0.10	yes
Terbutryn	mg/kg	<0.5	<0.5	22	0.10	yes
Triallate	mg/kg	<0.1	<0.1	22	0.10	yes
Trifluralin	mg/kg	<0.1	<0.1	22	0.10	yes

Date Acquired: September 30, 2019

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Alachlor	mg/kg	85	50	150	yes
Benfluralin	mg/kg	88	50	150	yes
Butylate	mg/kg	82	50	150	yes
Chlorpropham	mg/kg	79	50	150	yes
Diallate	mg/kg	91	50	150	yes
Dichlobenil	mg/kg	68	50	150	yes
Diclofop-methyl	mg/kg	82	50	150	yes
Diphenylamine	mg/kg	59	50	150	yes
Eptam (EPTC)	mg/kg	84	50	150	yes
Ethalfluralin	mg/kg	86	50	150	yes
Fenoxaprop-ethyl	mg/kg	81	50	150	yes
Fluazifop-p-butyl	mg/kg	101	50	150	yes
Hexazinone	mg/kg	50	50	150	yes
Metalaxyl	mg/kg	82	50	150	yes
Metolachlor	mg/kg	102	50	150	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Neutral Herbicides in Soil - Continued

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Metribuzin	mg/kg	95	50	150	yes
Pirimicarb	mg/kg	69	50	150	yes
Profluralin	mg/kg	85	50	150	yes
Prometryn	mg/kg	87	50	150	yes
Propazine	mg/kg	89	50	150	yes
Propyzamide	mg/kg	90	50	150	yes
Quizalofop-ethyl	mg/kg	74	50	150	yes
Simetryn	mg/kg	69	50	150	yes
Terbuthylazine	mg/kg	91	50	150	yes
Terbutryn	mg/kg	92	50	150	yes
Triallate	mg/kg	95	50	150	yes
Trifluralin	mg/kg	95	50	150	yes

Date Acquired: September 30, 2019

Organochlorine Pesticides in Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aldrin	ng/mL	0	-0.1	0.1	yes
BHC (alpha isomer)	ng/mL	0	-0.1	0.1	yes
BHC (beta isomer)	ng/mL	0	-0.1	0.1	yes
BHC (delta isomer)	ng/mL	0	-0.1	0.1	yes
Captan	ng/mL	0	-0.8	0.8	yes
Chlorbenside	ng/mL	0	-0.1	0.1	yes
Chlordane-cis	ng/mL	0	-0.1	0.1	yes
Chlordane-trans	ng/mL	0	-0.1	0.1	yes
Chlorfenson	ng/mL	0	-0.1	0.1	yes
Chlorothalonil	ng/mL	0	-0.8	0.8	yes
Chlorthal-dimethyl	ng/mL	0	-0.1	0.1	yes
DDD-o,p'	ng/mL	0	-0.1	0.1	yes
DDD-p,p'	ng/mL	0	-0.1	0.1	yes
DDE-o,p'	ng/mL	0	-0.1	0.1	yes
DDE-p,p'	ng/mL	0	-0.1	0.1	yes
DDT-o,p'	ng/mL	0	-0.1	0.1	yes
DDT-p,p'	ng/mL	0	-0.1	0.1	yes
Dichlofluanid	ng/mL	0	-0.1	0.1	yes
Dieldrin	ng/mL	0	-0.1	0.1	yes
Endosulfan I	ng/mL	0	-0.1	0.1	yes
Endosulfan II	ng/mL	0	-0.1	0.1	yes
Endosulfan sulfate	ng/mL	0	-0.1	0.1	yes
Endrin	ng/mL	0	-0.1	0.1	yes
Folpet	ng/mL	0	-0.8	0.8	yes
Heptachlor	ng/mL	0	-0.1	0.1	yes
Heptachlor Epoxide	ng/mL	0	-0.1	0.1	yes
Hexachlorobenzene	ng/mL	0	-0.1	0.1	yes
Lindane	ng/mL	0	-0.1	0.1	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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14940 - 123 Avenue
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Organochlorine Pesticides in Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Methoxychlor	ng/mL	0	-0.08	0.08	yes
Mirex	ng/mL	0	-0.1	0.1	yes
Permethrin-cis	ng/mL	0	-0.1	0.1	yes
Permethrin-trans	ng/mL	0	-0.1	0.1	yes
Procymidone	ng/mL	0	-0.1	0.1	yes
Propachlor	ng/mL	0	-0.1	0.1	yes
Quintozene	ng/mL	0	-0.1	0.1	yes
Tecnazene	ng/mL	0	-0.1	0.1	yes
Tetradifon	ng/mL	0	-0.1	0.1	yes
Tolyfluanid	ng/mL	0	-0.1	0.1	yes
Triadimefon	ng/mL	0	-0.1	0.1	yes
Vinclozolin	ng/mL	0	-0.1	0.1	yes

Date Acquired: October 01, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aldrin	ng/mL	113.79	80	120	yes
BHC (alpha isomer)	ng/mL	112.24	80	120	yes
BHC (beta isomer)	ng/mL	109.14	80	120	yes
BHC (delta isomer)	ng/mL	114.58	80	120	yes
Captan	ng/mL	112.17	80	120	yes
Chlorbenside	ng/mL	98.66	80	120	yes
Chlordane-cis	ng/mL	116.38	80	120	yes
Chlordane-trans	ng/mL	115.90	80	120	yes
Chlorfenson	ng/mL	101.92	80	120	yes
Chlorothalonil	ng/mL	102.06	80	120	yes
Chlorthal-dimethyl	ng/mL	111.43	80	120	yes
DDD-o,p'	ng/mL	111.22	80	120	yes
DDD-p,p'	ng/mL	110.62	80	120	yes
DDE-o,p'	ng/mL	117.57	80	120	yes
DDE-p,p'	ng/mL	111.13	80	120	yes
DDT-o,p'	ng/mL	112.56	80	120	yes
DDT-p,p'	ng/mL	103.86	80	120	yes
Dichlofluanid	ng/mL	109.90	80	120	yes
Dieldrin	ng/mL	106.84	80	120	yes
Endosulfan I	ng/mL	109.25	80	120	yes
Endosulfan II	ng/mL	112.35	80	120	yes
Endosulfan sulfate	ng/mL	109.38	80	120	yes
Endrin	ng/mL	109.72	80	120	yes
Folpet	ng/mL	107.87	80	120	yes
Heptachlor	ng/mL	111.28	80	120	yes
Heptachlor Epoxide	ng/mL	116.37	80	120	yes
Hexachlorobenzene	ng/mL	112.52	80	120	yes
Lindane	ng/mL	115.90	80	120	yes
Methoxychlor	ng/mL	109.42	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Organochlorine Pesticides in Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Mirex	ng/mL	113.78	80	120	yes
Permethrin-cis	ng/mL	101.60	80	120	yes
Permethrin-trans	ng/mL	105.70	80	120	yes
Procymidone	ng/mL	114.13	80	120	yes
Propachlor	ng/mL	107.13	80	120	yes
Quintozene	ng/mL	107.93	80	120	yes
Tecnazene	ng/mL	105.48	80	120	yes
Tetradifon	ng/mL	104.31	80	120	yes
Tolyfluanid	ng/mL	112.97	80	120	yes
Triadimefon	ng/mL	100.87	80	120	yes
Vinclozolin	ng/mL	113.11	80	120	yes

Date Acquired: October 01, 2019

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aldrin	mg/kg	<0.5	<0.5	22	0.2	yes
BHC (alpha isomer)	mg/kg	<0.5	<0.5	22	0.2	yes
BHC (beta isomer)	mg/kg	<0.5	<0.5	22	0.2	yes
BHC (delta isomer)	mg/kg	<0.5	<0.5	22	0.2	yes
Captan	mg/kg	<3.0	<3.0	22	1.0	yes
Chlorbenside	mg/kg	<0.5	<0.5	22	0.2	yes
Chlordane-cis	mg/kg	<0.5	<0.5	22	0.2	yes
Chlordane-trans	mg/kg	<0.5	<0.5	22	0.2	yes
Chlorfenson	mg/kg	<0.5	<0.5	22	0.2	yes
Chlorothalonil	mg/kg	<0.5	<0.5	22	1.0	yes
Chlorthal-dimethyl	mg/kg	<0.5	<0.5	22	0.2	yes
DDD-o,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDD-p,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDE-o,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDE-p,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDT-o,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDT-p,p'	mg/kg	<0.5	<0.5	22	0.2	yes
Dichlofluanid	mg/kg	<0.5	<0.5	22	0.2	yes
Dieldrin	mg/kg	<0.5	<0.5	22	0.2	yes
Endosulfan I	mg/kg	<0.5	<0.5	22	0.2	yes
Endosulfan II	mg/kg	<0.5	<0.5	22	0.2	yes
Endosulfan sulfate	mg/kg	<0.5	<0.5	22	0.2	yes
Endrin	mg/kg	<0.5	<0.5	22	0.2	yes
Folpet	mg/kg	<3.0	<3.0	22	1.0	yes
Heptachlor	mg/kg	<0.5	<0.5	22	0.2	yes
Heptachlor Epoxide	mg/kg	<0.2	<0.2	22	0.2	yes
Hexachlorobenzene	mg/kg	<0.5	<0.5	22	0.2	yes
Lindane	mg/kg	<0.1	<0.1	22	0.2	yes
Methoxychlor	mg/kg	<0.1	<0.1	22	0.08	yes
Mirex	mg/kg	<0.5	<0.5	22	0.2	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Organochlorine Pesticides in Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Permethrin-cis	mg/kg	<0.5	<0.5	22	0.2	yes
Permethrin-trans	mg/kg	<0.5	<0.5	22	0.2	yes
Procymidone	mg/kg	<0.5	<0.5	22	0.2	yes
Propachlor	mg/kg	<0.5	<0.5	22	0.2	yes
Quintozene	mg/kg	<0.5	<0.5	22	0.2	yes
Tecnazene	mg/kg	<0.5	<0.5	22	0.2	yes
Tetradifon	mg/kg	<0.5	<0.5	22	0.2	yes
Tolyfluanid	mg/kg	<0.5	<0.5	22	0.2	yes
Triadimefon	mg/kg	<0.5	<0.5	22	0.2	yes
Vinclozolin	mg/kg	<0.5	<0.5	22	0.2	yes

Date Acquired: October 01, 2019

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aldrin	mg/kg	109	55	145	yes
BHC (alpha isomer)	mg/kg	90	55	145	yes
BHC (beta isomer)	mg/kg	87	55	145	yes
BHC (delta isomer)	mg/kg	88	55	145	yes
Captan	mg/kg	97	55	145	yes
Chlorbenside	mg/kg	81	55	145	yes
Chlordane-cis	mg/kg	106	55	145	yes
Chlordane-trans	mg/kg	107	55	145	yes
Chlorfenson	mg/kg	89	55	145	yes
Chlorothalonil	mg/kg	85	55	145	yes
Chlorthal-dimethyl	mg/kg	108	55	145	yes
DDD-o,p'	mg/kg	105	55	145	yes
DDD-p,p'	mg/kg	99	55	145	yes
DDE-o,p'	mg/kg	106	55	145	yes
DDE-p,p'	mg/kg	97	55	145	yes
DDT-o,p'	mg/kg	102	55	145	yes
DDT-p,p'	mg/kg	95	55	145	yes
Dichlofluanid	mg/kg	102	55	145	yes
Dieldrin	mg/kg	111	55	145	yes
Endosulfan I	mg/kg	97	55	145	yes
Endosulfan II	mg/kg	98	55	145	yes
Endosulfan sulfate	mg/kg	109	55	145	yes
Endrin	mg/kg	103	55	145	yes
Folpet	mg/kg	91	55	145	yes
Heptachlor	mg/kg	91	55	145	yes
Heptachlor Epoxide	mg/kg	104	55	145	yes
Hexachlorobenzene	mg/kg	80	55	145	yes
Lindane	mg/kg	96	55	145	yes
Methoxychlor	mg/kg	101	55	145	yes
Mirex	mg/kg	109	55	145	yes
Permethrin-cis	mg/kg	92	55	145	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
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W: element.com

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Organochlorine Pesticides in Soil - Continued

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Permethrin-trans	mg/kg	95	55	145	yes
Procymidone	mg/kg	109	55	145	yes
Propachlor	mg/kg	94	55	145	yes
Quintozene	mg/kg	76	55	145	yes
Tecnazene	mg/kg	72	55	145	yes
Tetradifon	mg/kg	118	55	145	yes
Tolyfluanid	mg/kg	107	55	145	yes
Triadimefon	mg/kg	93	55	145	yes
Vinclozolin	mg/kg	90	55	145	yes
Date Acquired:	October 01, 2019				

PAH - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	76.3	50	140	yes
2-Fluorobiphenyl	%	84.06	50	140	yes
p-Terphenyl-d14	%	122.19	50	140	yes
Date Acquired:	September 27, 2019				

Particle Size Analysis - Wet Sieve

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
75 micron sieve	% by weight	18.1	12.2	26.0	yes
Date Acquired:	September 27, 2019				
75 micron sieve	% by weight	28.7	24.6	33.4	yes
Date Acquired:	September 27, 2019				

Physical and Aggregate Properties

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Sand	% by weight	41	41	10	0	yes
Silt	% by weight	32	32	10	0	yes
Clay	% by weight	27	27	10	0	yes
Date Acquired:	September 27, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sand	% by weight	30	24	34	yes
Clay	% by weight	30	26	36	yes
Date Acquired:	September 27, 2019				

Polychlorinated Biphenyls - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aroclor 1016	µg/mL	0	-0.3	0.3	yes
Aroclor 1221	µg/mL	0	-0.3	0.3	yes
Aroclor 1232	µg/mL	0	-0.3	0.3	yes
Aroclor 1242	µg/mL	0	-0.3	0.3	yes
Aroclor 1248	µg/mL	0	-0.3	0.3	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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Polychlorinated Biphenyls - Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aroclor 1254	µg/mL	0	-0.3	0.3	yes
Aroclor 1260	µg/mL	0	-0.3	0.3	yes
Aroclor 1262	µg/mL	0	-0.3	0.3	yes
Aroclor 1268	µg/mL	0	-0.3	0.3	yes
Date Acquired:	September 29, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aroclor 1260	µg/mL	110.00	80	120	yes
Date Acquired:	September 29, 2019				

Polychlorinated Biphenyls - Soil - Surrogate

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Decachlorobiphenyl	%	96.2216	50	140	yes
Date Acquired:	September 29, 2019				

Polycyclic Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.010	0.010	yes
Acenaphthylene	ng/mL	0	-0.05	0.05	yes
Acenaphthene	ng/mL	0	-0.05	0.05	yes
Fluorene	ng/mL	0	-0.05	0.05	yes
Phenanthrene	ng/mL	0	-0.01	0.01	yes
Anthracene	ng/mL	0	-0.003	0.003	yes
Fluoranthene	ng/mL	0	-0.010	0.010	yes
Pyrene	ng/mL	0	-0.010	0.010	yes
Benzo(a)anthracene	ng/mL	0	-0.01	0.01	yes
Chrysene	ng/mL	0	-0.05	0.05	yes
Benzo(b)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(b+j)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(k)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(a)pyrene	ng/mL	0	-0.05	0.05	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.05	0.05	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.05	0.05	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.05	0.05	yes
Date Acquired:	September 27, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	99.80	80	120	yes
Acenaphthylene	ng/mL	96.40	80	120	yes
Acenaphthene	ng/mL	98.20	80	120	yes
Fluorene	ng/mL	104.00	80	120	yes
Phenanthrene	ng/mL	89.20	80	120	yes
Anthracene	ng/mL	96.00	80	120	yes
Fluoranthene	ng/mL	96.20	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
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W: element.com

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T5V 1B4
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Lot ID: **1379633**
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Date Reported: Oct 17, 2019
Report Number: 2450080

Polycyclic Aromatic Hydrocarbons - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Pyrene	ng/mL	95.60	80	120	yes
Benzo(a)anthracene	ng/mL	96.80	80	120	yes
Chrysene	ng/mL	100.40	80	120	yes
Benzo(b)fluoranthene	ng/mL	84.60	80	120	yes
Benzo(k)fluoranthene	ng/mL	97.00	80	120	yes
Benzo(a)pyrene	ng/mL	90.40	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	89.00	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	82.80	80	120	yes
Benzo(g,h,i)perylene	ng/mL	88.20	80	120	yes

Date Acquired: September 27, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Naphthalene	mg/kg	<0.01	<0.01	50	0.020	yes
Acenaphthylene	mg/kg	<0.05	<0.05	50	0.10	yes
Acenaphthene	mg/kg	<0.05	<0.05	50	0.10	yes
Fluorene	mg/kg	<0.05	<0.05	50	0.10	yes
Phenanthrene	mg/kg	0.02	0.01	50	0.02	yes
Anthracene	mg/kg	0.005	<0.003	50	0.006	yes
Fluoranthene	mg/kg	0.033	0.015	50	0.020	yes
Pyrene	mg/kg	0.031	0.014	50	0.020	yes
Benzo(a)anthracene	mg/kg	0.02	<0.01	50	0.02	yes
Chrysene	mg/kg	<0.05	<0.05	50	0.10	yes
Benzo(b)fluoranthene	mg/kg	<0.05	<0.05	50	0.10	yes
Benzo(k)fluoranthene	mg/kg	<0.05	<0.05	50	0.10	yes
Benzo(a)pyrene	mg/kg	<0.05	<0.05	50	0.10	yes
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.05	<0.05	50	0.10	yes
Dibenzo(a,h)anthracene	mg/kg	<0.05	<0.05	50	0.10	yes
Benzo(g,h,i)perylene	mg/kg	<0.05	<0.05	50	0.10	yes

Date Acquired: October 09, 2019

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	mg/kg	91	50	140	yes
Acenaphthylene	mg/kg	78	50	140	yes
Acenaphthene	mg/kg	89	50	140	yes
Fluorene	mg/kg	87	50	140	yes
Phenanthrene	mg/kg	66	50	140	yes
Anthracene	mg/kg	89	50	140	yes
Fluoranthene	mg/kg	80	50	140	yes
Pyrene	mg/kg	82	50	140	yes
Benzo(a)anthracene	mg/kg	78	50	140	yes
Chrysene	mg/kg	107	50	140	yes
Benzo(b)fluoranthene	mg/kg	72	50	140	yes
Benzo(k)fluoranthene	mg/kg	100	50	140	yes
Benzo(a)pyrene	mg/kg	91	50	140	yes
Indeno(1,2,3-c,d)pyrene	mg/kg	70	50	140	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada Inc.

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
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Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Polycyclic Aromatic Hydrocarbons - Soil - Continued

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Dibenzo(a,h)anthracene	mg/kg	71	50	140	yes
Benzo(g,h,i)perylene	mg/kg	75	50	140	yes
Date Acquired:	September 27, 2019				

Salinity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	0.0309	-0.4	0.5	yes
Magnesium	mg/L	0.0134	-0.1	0.1	yes
Sodium	mg/L	0.1179	-0	2	yes
Potassium	mg/L	0.03	-0.5	0.7	yes
Chloride	mg/L	2.6076	0	5	yes
Sulfate-S	mg/L	0.0489	-0	1	yes
Date Acquired:	September 27, 2019				
Control Sample	**Units**	**Measured**	**Lower Limit**	**Upper Limit**	**Passed QC**
Electrical Conductivity	dS/m	0.96	0.60	1.50	yes
% Saturation	%	55	52	70	yes
Calcium	mg/L	138	87.8	195.8	yes
Magnesium	mg/L	31.7	20.5	44.5	yes
Sodium	mg/L	17	12	22	yes
Potassium	mg/L	15.0	9.5	18.5	yes
Chloride	mg/L	25	10	43	yes
Sulfate-S	mg/L	29	16	34	yes
Date Acquired:	September 27, 2019				
Electrical Conductivity	dS/m	2.00	-0.07	4.13	yes
% Saturation	%	52	46	57	yes
Calcium	mg/L	388	301.9	468.7	yes
Magnesium	mg/L	87	68.5	103.3	yes
Sodium	mg/L	45	32	53	yes
Potassium	mg/L	20	15.6	22.8	yes
Chloride	mg/L	39	32	45	yes
Sulfate-S	mg/L	248	178	294	yes
Date Acquired:	September 27, 2019				
Electrical Conductivity	dS/m	31.8	26.80	35.20	yes
Calcium	mg/L	246	230.2	261.4	yes
Magnesium	mg/L	98.1	92.1	104.1	yes
Sodium	mg/L	242	225	264	yes
Potassium	mg/L	242	222.6	270.6	yes
Chloride	mg/L	2100	1871	2231	yes
Sulfate-S	mg/L	147	138	156	yes
Date Acquired:	September 27, 2019				

Soil Acidity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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Soil Acidity

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Sulfur	mg/L	0.363587	-20.010	20.010		yes
Date Acquired:	October 01, 2019					
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
Sulfur	mg/L	95.60	91	110		yes
Date Acquired:	October 01, 2019					
Client Sample Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
pH	pH	7.9	8.0	0	0.3	yes
Date Acquired:	September 27, 2019					
Sulfur	µg/g	10	10	30	5.000	yes
Date Acquired:	October 01, 2019					
Control Sample	**Units**	**Measured**	**Lower Limit**	**Upper Limit**		**Passed QC**
pH	pH	6.7	6.2	7.7		yes
Date Acquired:	October 10, 2019					
Sulfur	µg/g	15000	14101.100	17360.900		yes
Date Acquired:	October 01, 2019					

Volatile Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
F1 C6-C10	ng	0	-10	10		yes
Date Acquired:	September 27, 2019					
Matrix Spike	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
F1 C6-C10	mg/kg	114	80	120		yes
Date Acquired:	September 27, 2019					

Water Soluble Parameters

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Chromium (VI)	mg/L	0.002	-0.10	0.10		yes
Date Acquired:	September 27, 2019					
Client Sample Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
Chromium (VI)	mg/kg	<0.05	<0.05	10	0.01	yes
Date Acquired:	September 27, 2019					

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T: +1 (780) 438-5522
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Methodology and Notes

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Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Sep 27, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Sep 30, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Oct 1, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Oct 10, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Sep 27, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Sep 30, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Oct 1, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Oct 10, 2019	Element Edmonton - Roper Road
Acid Herbicides - Soil	US EPA	*	Solvent Extractable Nonvolatile Compounds by HPLC/TS/MS or UV Detection, 8321 B	Sep 30, 2019	Element Calgary
BTEX-CCME - Soil	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Sep 27, 2019	Element Calgary
BTEX-CCME - Soil	US EPA	*	Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	Sep 27, 2019	Element Calgary
Landfill VOC - Soil (DV)	US EPA	*	Volatile Organic Compounds by GCMS / VOC in Various Sample matricies using Equilibrium Head Space Analysis, 8260B/5021A	Oct 2, 2019	Element Drayton Valley
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Sep 27, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Oct 10, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Sep 27, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Oct 10, 2019	Element Edmonton - Roper Road
Neutral Herbicides - Soil	US EPA	*	OC Pesticides by Gas Chromatography, 8081B	Sep 30, 2019	Element Calgary
Organochlorine Pesticides - Soil	US EPA	*	OC Pesticides by Gas Chromatography, 8081B	Oct 1, 2019	Element Calgary

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
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W: element.com

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14940 - 123 Avenue
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T5V 1B4
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LSD:
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Proj. Acct. code:

Lot ID: **1379633**
Control Number:
Date Received: Sep 26, 2019
Date Reported: Oct 17, 2019
Report Number: 2450080

Method Name	Reference		Method	Date Analysis Started	Location
PAH - Soil	AEP		Index of Additive Cancer Risk (IACR), IACR	Sep 27, 2019	Element Calgary
PAH - Soil	AEP		Index of Additive Cancer Risk (IACR), IACR	Oct 9, 2019	Element Calgary
PAH - Soil	US EPA	*	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Sep 27, 2019	Element Calgary
PAH - Soil	US EPA	*	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Oct 9, 2019	Element Calgary
Particle Size Analysis - GS	Carter	*	Hydrometer Method, 55.3	Sep 27, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	ASTM	*	Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing, C 117-17	Sep 27, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	Carter	*	Procedure for Particle Size Separation, 55.2.3	Sep 27, 2019	Element Edmonton - Roper Road
PCB - Soil	US EPA	*	Polychlorinated Biphenyls (PCBs) by Gas Chromatography, 8082A	Sep 29, 2019	Element Calgary
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Sep 27, 2019	Element Edmonton - Roper Road
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Oct 10, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Sep 27, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Oct 10, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Sep 27, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Oct 10, 2019	Element Edmonton - Roper Road
Sublet to SRC Geoanalytical	Ext. Lab		Analysis performed by external laboratory, .	Sep 27, 2019	Saskatchewan Research Council Geoanalyti
Sublet to SRC Geoanalytical	Ext. Lab		See attached test report,	Sep 27, 2019	Saskatchewan Research Council Geoanalyti
Sulfur (Elemental) - VAN	Element-in house		Elemental sulfur, TM SOIL 004-60	Oct 1, 2019	Element Vancouver
TEH-CCME-Soil (Shake)	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Sep 27, 2019	Element Calgary

** Reference Method Modified*

References

AEP	Alberta Tier 1 Soil and Groundwater Remediation Guidelines
APHA	Standard Methods for the Examination of Water and Wastewater
ASTM	Annual Book of ASTM Standards
Carter	Soil Sampling and Methods of Analysis.
CCME	Canadian Council of Ministers of the Environment
Element-in house	In house method

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To:	Tetra Tech EBA Inc 14940 - 123 Avenue Edmonton, AB, Canada T5V 1B4	Project ID:	704-SWM.SWOP04076-02	Lot ID:	**1379633**
Attn:	Mark Fawcett	Project Name:	Ryley 2019 SMP	Control Number:	
Sampled By:	BF/KM	Project Location:	Ryley, AB	Date Received:	Sep 26, 2019
Company:	Tetra Tech Canada Inc.	LSD:		Date Reported:	Oct 17, 2019
		P.O.:		Report Number:	2450080
		Proj. Acct. code:			

EPA	Environmental Protection Agency Test Methods - US
Ext. Lab	External Laboratory
McKeague	Manual on Soil Sampling and Methods of Analysis
US EPA	US Environmental Protection Agency Test Methods

Comments:

- Oct 16, 2019 - Report was issued to include addition of Metals analysis on samples 6,8,10-12 Salinity analysis on samples 26-28 and PAH analysis on samples 6,8,11 and 12 as requested by Brent Finnestad of Tetratech on Oct.16,2019. Previous report

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Report Transmission Cover Page

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Contact	Company	Address
Accounts Payable	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: EBA.accounts.Payable@tetratech.

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

Contact	Company	Address
Brent Finnestad	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: brent.finnestad@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Chemistry File	Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Sample File	Test Report

Contact	Company	Address
Data Management	**Tetra Tech EBA Inc**	100, 140 Quarry Park Blvd SE Calgary, AB T2C 3G3 Phone: (403) 203-3355 Fax: Email: EBA.labdata@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Multiple Reports By Lot	EBA ESDAT Sample File	Test Report
Email - Multiple Reports By Lot	Legacy Reverse Crosstab in CSV	Test Report
Email - Multiple Reports By Lot	PDF	COC / Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report

Contact	Company	Address
Mark Fawcett	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email: mark.fawcett@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	AB Tier 1 Custom Excel	Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report
Email - Single Report	EBA ESDAT Sample File	Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	Invoice

Notes To Clients:

- Oct 22, 2019 - Report was issued to include addition of Metals on samples 11 and 12 as well as salinity on samples 25, 27, 33, 35, 38, 40, 41, 43, 50 and 51 as requested by Brent Finnestad of Tetra Tech on Oct.22, 2019. Previous report 2447876.
- Dec 06, 2019 - Report was issued to correct for missing particle size by sieve analysis on sample#3. Previous report 2455363.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Company:	Tetra Tech Canada

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Project Name:	Ryley 2019 SMP
Project Location:	Ryley, AB
LSD:	
P.O.:	
Proj. Acct. code:	

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Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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14940 - 123 Avenue
Edmonton, AB, Canada
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Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

		Reference Number	1381283-1	1381283-2	1381283-3	
		Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-3 / 0-15	19-3 / 15-30	19-3 / 30-60	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.17	0.20	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.8	0.5	0.3	0.2
Arsenic	Strong Acid Extractable	mg/kg	5.9	5.6	6.2	0.2
Barium	Strong Acid Extractable	mg/kg	138	273	199	1
Beryllium	Strong Acid Extractable	mg/kg	0.3	0.4	0.6	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.38	0.21	0.19	0.01
Chromium	Strong Acid Extractable	mg/kg	25.6	26.2	15.8	0.5
Cobalt	Strong Acid Extractable	mg/kg	6.6	6.9	7.6	0.1
Copper	Strong Acid Extractable	mg/kg	17.0	14.3	15.0	1
Lead	Strong Acid Extractable	mg/kg	16.4	9.5	6.7	0.1
Mercury	Strong Acid Extractable	mg/kg	0.09	0.10	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	6.9	2.5	1.1	1
Nickel	Strong Acid Extractable	mg/kg	32.9	33.0	22.6	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	<0.3	0.3	0.3
Silver	Strong Acid Extractable	mg/kg	0.2	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.13	0.13	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.8	0.9	1.0	0.5
Vanadium	Strong Acid Extractable	mg/kg	33.6	21.1	22.7	0.1
Zinc	Strong Acid Extractable	mg/kg	116	61	48	1
Particle Size Analysis - Wet Sieve						
Texture			Coarse-Grained	Coarse-Grained	Fine-Grained	
75 micron sieve	% Retained	% by weight	70.7	57.3	39.8	0.1
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	0.64			0.01
SAR	Saturated Paste		4.1			
% Saturation		%	61	63	64	
Calcium	Saturated Paste	mg/kg	19.4			
Magnesium	Saturated Paste	mg/kg	5.1			
Sodium	Saturated Paste	mg/kg	62			
Potassium	Saturated Paste	mg/kg	4			
Chloride	Saturated Paste	mg/L	39			2
Chloride	Saturated Paste	mg/kg	24			
Sulfate (SO4)	Saturated Paste	mg/kg	52.3			
TGR	Saturated Paste	T/ac	<0.1			
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.05	<0.05	0.07	0.05

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-1	1381283-2	1381283-21	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3 / 0-15	19-3 / 15-30	19-4 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Phenanthrene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.01
Anthracene	Dry Weight	mg/kg	<0.003	<0.003	<0.003	0.003
Fluoranthene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Pyrene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.01
Chrysene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	<0.001	<0.001	<0.001	0.001
IACR_Coarse	Index of Additive Cancer Risk		<0.001	<0.001	<0.001	0.001
IACR_Fine	Index of Additive Cancer Risk		<0.001	<0.001	<0.001	0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	104	106	86	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	87	88	91	50-140
p-Terphenyl-d14	PAH - Surrogate	%	86	93	91	50-140

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Date Received: Oct 3, 2019
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	Reference Number	1381283-1	1381283-3	1381283-21	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3 / 0-15	19-3 / 30-60	19-4 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Soil					
Benzene Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Toluene Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Ethylbenzene Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Total Xylenes (m,p,o) Dry Weight	mg/kg	<0.03	<0.03	<0.03	0.03
Volatile Petroleum Hydrocarbons - Soil					
Methanol Field Preservation		Yes	Yes	Yes	
F1 C6-C10 Dry Weight	mg/kg	<10	<10	<10	10
F1 -BTEX Dry Weight	mg/kg	<10	<10	<10	10
Extractable Petroleum Hydrocarbons - Soil					
Extraction Date Total Extractables		4-Oct-19	4-Oct-19	4-Oct-19	
F2c C10-C16 Dry Weight	mg/kg	<25	<25	<25	25
F3c C16-C34 Dry Weight	mg/kg	<50	<50	<50	50
F4c C34-C50 Dry Weight	mg/kg	<100	<100	<100	100
F4HTGCc C34-C50+ Dry Weight	mg/kg	<100	<100	<100	100
% C50+	%	<5	<5	13.5	
Silica Gel Cleanup					
Silica Gel Cleanup		Done	Done	Done	
Soil % Moisture					
Moisture Soil % Moisture	% by weight	14.40	14.40	14.20	

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7217 Roper Road NW
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Date Received: Oct 3, 2019
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Report Number: 2473658

		Reference Number	1381283-1	1381283-4	1381283-21	
		Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-3 / 0-15	19-3 / 60-100	19-4 / 0-15	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.2	7.8	6.9	
Sulfur	Elemental	µg/g			<10	10

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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F: +1 (780) 434-8586
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W: element.com

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14940 - 123 Avenue
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Reference Number	1381283-1	1381283-21	
Sample Date	Oct 02, 2019	Oct 02, 2019	
Sample Time	NA	NA	
Sample Location			
Sample Description	19-3 / 0-15	19-4 / 0-15	
Matrix	Soil	Soil	

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polychlorinated Biphenyls - Soil						
Aroclor 1016	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1221	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1232	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1242	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1248	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1254	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1260	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1262	Dry Weight	mg/kg	<0.1	<0.1		0.1
Aroclor 1268	Dry Weight	mg/kg	<0.1	<0.1		0.1
Total PCBs	Dry Weight	mg/kg	<0.1	<0.1		0.1
Polychlorinated Biphenyls - Soil - Surrogate						
Decachlorobiphenyl	Surrogate	%	97	103		50-140

Element
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LSD:
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Lot ID: **1381283**
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Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-1	1381283-21	1381283-45	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3 / 0-15	19-4 / 0-15	19-5 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Physical and Aggregate Properties						
Texture			Sandy Clay Loam	Loam	Loam	
Sand	50 µm - 2 mm	% by weight	52	45	35	0.1
Silt	2 µm - 50 µm	% by weight	22	33	40	0.1
Clay	<2 µm	% by weight	25	22	25	0.1

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	Reference Number	1381283-1	1381283-45	1381283-49	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3 / 0-15	19-5 / 0-15	Duplicate 6	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Organochlorine Pesticides in Soil						
Aldrin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
BHC (alpha isomer)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
BHC (beta isomer)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
BHC (delta isomer)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Captan	Dry Weight	mg/kg	<3.0	<3.0	<3.0	3.0
Chlorbenside	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlordane-cis	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlordane-trans	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorfenson	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorothalonil	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorthal-dimethyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDD-o,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDD-p,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDE-o,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDE-p,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.50
DDT-o,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
DDT-p,p'	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Dichlofluanid	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Dieldrin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endosulfan I	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endosulfan II	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endosulfan sulfate	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Endrin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Folpet	Dry Weight	mg/kg	<3.0	<3.0	<3.0	3.0
Heptachlor	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Heptachlor Epoxide	Dry Weight	mg/kg	<0.2	<0.2	<0.2	0.2
Hexachlorobenzene	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Lindane	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Methoxychlor	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Mirex	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Permethrin-cis	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Permethrin-trans	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Procymidone	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Propachlor	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Quintozene	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Tecnazene	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Tetradifon	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Tolyfluanid	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-1	1381283-45	1381283-49	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3 / 0-15	19-5 / 0-15	Duplicate 6	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Organochlorine Pesticides in Soil - Continued						
Triadimefon	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Vinclozolin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Organochlorine Pesticides -Soil- Surrogate Rec.						
TPP	Surrogate	%	108	114	108	50-140
Neutral Herbicides in Soil						
Alachlor	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Benfluralin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Butylate	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Chlorpropham	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Diallate	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Dichlobenil	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Diclofop-methyl	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Diphenylamine	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Eptam (EPTC)	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Ethalfluralin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Fenoxaprop-ethyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Fluazifop-p-butyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Hexazinone	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Metalaxyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Metolachlor	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Metribuzin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Pirimicarb	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Profluralin	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Prometryn	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Propazine	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Propyzamide	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Quizalofop-ethyl	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Simetryn	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Terbuthylazine	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Terbutryn	Dry Weight	mg/kg	<0.5	<0.5	<0.5	0.5
Triallate	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Trifluralin	Dry Weight	mg/kg	<0.1	<0.1	<0.1	0.1
Neutral Herbicides - Soil - Surrogate Recovery						
TPP	Surrogate	%	108	114	108	50-140
Acid Herbicides in Soil						
2,4,5-T	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
2,4,5-TP	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
2,4-D	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-1	1381283-45	1381283-49	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3 / 0-15	19-5 / 0-15	Duplicate 6	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Acid Herbicides in Soil - Continued					
2,4-DB Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Bromoxynil Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Clopyralid Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Dicamba Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Dichlorprop Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Dinoseb Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Imazamox Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Imazapyr Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Imazethapyr Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
MCPA Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
MCPB Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Mecoprop Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Picloram Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Triclopyr Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Acid Herbicides - Soil - Surrogate Recovery					
3,5-DCBA Surrogate	%	92	118	83	50-140

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Control Number:
Date Received: Oct 3, 2019
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Report Number: 2473658

Reference Number	1381283-1	1381283-49	
Sample Date	Oct 02, 2019	Oct 02, 2019	
Sample Time	NA	NA	
Sample Location			
Sample Description	19-3 / 0-15	Duplicate 6	
Matrix	Soil	Soil	

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Available Nutrients						
Nitrate - N	Available	µg/g	<2	<2		2

Element
7217 Roper Road NW
Edmonton, Alberta
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Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

		Reference Number	1381283-4	1381283-5	1381283-6	
		Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-3 / 60-100	19-3A / 0-15	19-3A / 15-30	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	2.27			0.01
SAR	Saturated Paste		23			
% Saturation		%	74	86	58	
Calcium	Saturated Paste	mg/kg	16			
Magnesium	Saturated Paste	mg/kg	8.2			
Sodium	Saturated Paste	mg/kg	392			
Potassium	Saturated Paste	mg/kg	<7			
Chloride	Saturated Paste	mg/L	100			2
Chloride	Saturated Paste	mg/kg	74			
Sulfate (SO4)	Saturated Paste	mg/kg	669			
TGR	Saturated Paste	T/ac	1.0			

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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W: element.com

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
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Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
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	Reference Number	1381283-5	1381283-6	1381283-9	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3A / 0-15	19-3A / 15-30	19-3B / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.37	<0.5	0.23	0.05
Antimony	Strong Acid Extractable	mg/kg	3.2	0.5	5.6	0.2
Arsenic	Strong Acid Extractable	mg/kg	9.0	6.0	13.7	0.2
Barium	Strong Acid Extractable	mg/kg	179	197	131	1
Beryllium	Strong Acid Extractable	mg/kg	0.4	0.4	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	1.73	0.18	2.14	0.01
Chromium	Strong Acid Extractable	mg/kg	75.4	21.0	79.9	0.5
Cobalt	Strong Acid Extractable	mg/kg	13.8	7.4	25.9	0.1
Copper	Strong Acid Extractable	mg/kg	53.0	15.3	77.2	1
Lead	Strong Acid Extractable	mg/kg	108	10.1	176	0.1
Mercury	Strong Acid Extractable	mg/kg	0.45	0.09	0.85	0.05
Molybdenum	Strong Acid Extractable	mg/kg	25.4	1.7	22.0	1
Nickel	Strong Acid Extractable	mg/kg	92.1	28.9	89.5	0.5
Selenium	Strong Acid Extractable	mg/kg	0.5	0.5	0.7	0.3
Silver	Strong Acid Extractable	mg/kg	1.1	0.1	2.9	0.1
Thallium	Strong Acid Extractable	mg/kg	0.14	0.14	0.19	0.05
Tin	Strong Acid Extractable	mg/kg	4.4	<1.0	8.7	1
Uranium	Strong Acid Extractable	mg/kg	0.9	0.8	0.8	0.5
Vanadium	Strong Acid Extractable	mg/kg	54.7	24.1	129	0.1
Zinc	Strong Acid Extractable	mg/kg	593	61	716	1
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.07	<0.05	0.05	0.05

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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14940 - 123 Avenue
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T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-9	1381283-10	1381283-11	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3B / 0-15	19-3B / 15-30	19-3B / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity					
% Saturation	%	109	49	54	

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
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W: element.com

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
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Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
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	Reference Number	1381283-10	1381283-11	1381283-12	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3B / 15-30	19-3B / 30-60	19-3B / 60-100	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.18	0.19	0.14	0.05
Antimony	Strong Acid Extractable	mg/kg	1.3	0.5	0.4	0.2
Arsenic	Strong Acid Extractable	mg/kg	7.3	7.7	6.4	0.2
Barium	Strong Acid Extractable	mg/kg	117	157	135	1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.4	0.4	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.31	0.15	0.20	0.01
Chromium	Strong Acid Extractable	mg/kg	21.1	27.8	15.7	0.5
Cobalt	Strong Acid Extractable	mg/kg	7.6	8.6	7.3	0.1
Copper	Strong Acid Extractable	mg/kg	16.0	19.7	15.3	1
Lead	Strong Acid Extractable	mg/kg	10.3	8.1	6.2	0.1
Mercury	Strong Acid Extractable	mg/kg	0.16	0.07	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	13.9	1.1	1.2	1
Nickel	Strong Acid Extractable	mg/kg	31.0	29.6	23.1	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	0.4	<0.3	0.3
Silver	Strong Acid Extractable	mg/kg	0.2	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.13	0.15	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.6	0.6	0.8	0.5
Vanadium	Strong Acid Extractable	mg/kg	24.3	23.8	21.5	0.1
Zinc	Strong Acid Extractable	mg/kg	66	55	47	1
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.05	0.08	<0.05	0.05

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-12	1381283-13	1381283-14	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3B / 60-100	19-3C / 0-15	19-3C / 15-30	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity					
% Saturation	%	46	60	55	

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	Reference Number	1381283-13	1381283-14	1381283-17	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3C / 0-15	19-3C / 15-30	19-3D / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	0.23	0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	0.3	4.1	0.2
Arsenic	Strong Acid Extractable	mg/kg	8.7	5.7	9.0	0.2
Barium	Strong Acid Extractable	mg/kg	151	133	190	1
Beryllium	Strong Acid Extractable	mg/kg	0.6	0.4	0.4	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.15	0.15	3.40	0.01
Chromium	Strong Acid Extractable	mg/kg	15.3	24.9	94.2	0.5
Cobalt	Strong Acid Extractable	mg/kg	7.5	6.6	11.7	0.1
Copper	Strong Acid Extractable	mg/kg	12.7	12.5	101	1
Lead	Strong Acid Extractable	mg/kg	8.1	6.0	237	0.1
Mercury	Strong Acid Extractable	mg/kg	0.06	0.06	0.63	0.05
Molybdenum	Strong Acid Extractable	mg/kg	2.6	1.1	17.1	1
Nickel	Strong Acid Extractable	mg/kg	22.9	27.3	113	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	<0.3	1.0	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	2.9	0.1
Thallium	Strong Acid Extractable	mg/kg	0.09	0.12	0.15	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	8.1	1
Uranium	Strong Acid Extractable	mg/kg	1.4	1.1	1.0	0.5
Vanadium	Strong Acid Extractable	mg/kg	22.4	18.8	259	0.1
Zinc	Strong Acid Extractable	mg/kg	59	44	1530	1
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	0.08	0.05

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-17	1381283-18	1381283-21	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-3D / 0-15	19-3D / 15-30	19-4 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m			5.70	0.01
SAR	Saturated Paste				9.0	
% Saturation		%	107	50	61	
Calcium	Saturated Paste	mg/kg			338	
Magnesium	Saturated Paste	mg/kg			118	
Sodium	Saturated Paste	mg/kg			591	
Potassium	Saturated Paste	mg/kg			<6	
Chloride	Saturated Paste	mg/L			423	2
Chloride	Saturated Paste	mg/kg			259	
Sulfate (SO4)	Saturated Paste	mg/kg			1810	
TGR	Saturated Paste	T/ac			1.4	

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Reference Number		1381283-18	1381283-21	1381283-22	
Sample Date		Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
Sample Time		NA	NA	NA	
Sample Location					
Sample Description		19-3D / 15-30	19-4 / 0-15	19-4 / 15-30	
Matrix		Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	<0.5	<0.5	<0.5	0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	0.3	0.2	0.2
Arsenic	Strong Acid Extractable	mg/kg	5.9	5.2	5.2	0.2
Barium	Strong Acid Extractable	mg/kg	141	143	147	1
Beryllium	Strong Acid Extractable	mg/kg	0.4	0.5	0.4	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.19	0.20	0.20	0.01
Chromium	Strong Acid Extractable	mg/kg	14.9	15.7	13.8	0.5
Cobalt	Strong Acid Extractable	mg/kg	7.5	6.1	6.5	0.1
Copper	Strong Acid Extractable	mg/kg	14.8	12.7	12.4	1
Lead	Strong Acid Extractable	mg/kg	8.0	7.2	7.4	0.1
Mercury	Strong Acid Extractable	mg/kg	0.06	<0.05	<0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.1	<1.0	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	23.7	18.2	15.4	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	0.5	0.5	0.3
Silver	Strong Acid Extractable	mg/kg	<0.10	<0.10	<0.10	0.1
Thallium	Strong Acid Extractable	mg/kg	0.13	0.12	0.11	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.8	1.0	1.0	0.5
Vanadium	Strong Acid Extractable	mg/kg	21.2	23.1	23.0	0.1
Zinc	Strong Acid Extractable	mg/kg	52	55	60	1
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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14940 - 123 Avenue
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T5V 1B4
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Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
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Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
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Reference Number	1381283-21
Sample Date	Oct 02, 2019
Sample Time	NA
Sample Location	
Sample Description	19-4 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Subcontracted Analysis						
Total Sulfur	SRC	%	0.12			
Subcontractor Report Id	SRC		G-2019-1925			

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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F: +1 (780) 434-8586
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Project Name: Ryley 2019 SMP
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Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-21	1381283-23	1381283-45	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-4 / 0-15	19-4 / 30-60	19-5 / 0-15	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Particle Size Analysis - Wet Sieve					
Texture		Fine-Grained	Fine-Grained	Fine-Grained	
75 micron sieve % Retained	% by weight	38.0	40.2	26.8	0.1

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Project Location: Ryley, AB
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Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

		Reference Number	1381283-22	1381283-23	1381283-24	
		Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-4 / 15-30	19-4 / 30-60	19-4 / 60-100	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	5.43	4.72	6.05	0.01
SAR	Saturated Paste		11.8	8.7	10.8	
% Saturation		%	61	62	55	
Calcium	Saturated Paste	mg/kg	214	273	277	
Magnesium	Saturated Paste	mg/kg	90.2	86.8	114	
Sodium	Saturated Paste	mg/kg	636	509	632	
Potassium	Saturated Paste	mg/kg	<6	9	9	
Chloride	Saturated Paste	mg/L	442	91	120	2
Chloride	Saturated Paste	mg/kg	269	57	67	
Sulfate (SO4)	Saturated Paste	mg/kg	1650	1900	2240	
TGR	Saturated Paste	T/ac	2.7	0.9	2.9	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	6.5	7.4	7.8	

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	Reference Number	1381283-23	1381283-45	1381283-49	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-4 / 30-60	19-5 / 0-15	Duplicate 6	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Soil						
Benzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Toluene	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Ethylbenzene	Dry Weight	mg/kg	<0.005	<0.005	<0.005	0.005
Total Xylenes (m,p,o)	Dry Weight	mg/kg	<0.03	<0.03	<0.03	0.03
Volatile Petroleum Hydrocarbons - Soil						
Methanol Field Preservation			Yes	Yes	No	
F1 C6-C10	Dry Weight	mg/kg	<10	<10	<10	10
F1 -BTEX	Dry Weight	mg/kg	<10	<10	<10	10
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date	Total Extractables		4-Oct-19	4-Oct-19	4-Oct-19	
F2c C10-C16	Dry Weight	mg/kg	<25	<25	<25	25
F3c C16-C34	Dry Weight	mg/kg	<50	140	<50	50
F4c C34-C50	Dry Weight	mg/kg	<100	128	<100	100
F4HTGCc C34-C50+	Dry Weight	mg/kg	<100	164	<100	100
% C50+		%	<5	8.2	<5	
Silica Gel Cleanup						
Silica Gel Cleanup			Done	Done	Done	
Soil % Moisture						
Moisture	Soil % Moisture	% by weight	15.10	26.00	11.50	

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Lot ID: **1381283**
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	Reference Number	1381283-25	1381283-26	1381283-27	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-4A / 0-15	19-4A / 15-30	19-4A / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	5.14	6.44	5.52	0.01
SAR	Saturated Paste		14.6	17.4	8.5	
% Saturation		%	89	74	71	
Calcium	Saturated Paste	mg/kg	215	234	387	
Magnesium	Saturated Paste	mg/kg	79	92.1	117	
Sodium	Saturated Paste	mg/kg	934	1070	627	
Potassium	Saturated Paste	mg/kg	14	18	<7	
Chloride	Saturated Paste	mg/L	164	235	260	2
Chloride	Saturated Paste	mg/kg	147	173	184	
Sulfate (SO4)	Saturated Paste	mg/kg	2450	2760	2280	
TGR	Saturated Paste	T/ac	3.2	6.8	1.0	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.4	7.6	7.3	

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Lot ID: **1381283**
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Date Received: Oct 3, 2019
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	Reference Number	1381283-28	1381283-29	1381283-31	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-4A / 60-100	19-4B / 0-15	19-4B / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	5.78	3.92	6.66	0.01
SAR	Saturated Paste		10.2	10.9	13.9	
% Saturation		%	58	62	60	
Calcium	Saturated Paste	mg/kg	309	147	273	
Magnesium	Saturated Paste	mg/kg	112	63.5	111	
Sodium	Saturated Paste	mg/kg	625	495	841	
Potassium	Saturated Paste	mg/kg	10	8	11	
Chloride	Saturated Paste	mg/L	58	106	44	2
Chloride	Saturated Paste	mg/kg	34	65	27	
Sulfate (SO4)	Saturated Paste	mg/kg	2150	1410	2720	
TGR	Saturated Paste	T/ac	2.4	1.5	5.6	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.7	6.7	7.4	

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Lot ID: **1381283**
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	Reference Number	1381283-33	1381283-34	1381283-35	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-4C / 0-15	19-4C / 15-30	19-4C / 30-60	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	3.25	2.69	5.99	0.01
SAR	Saturated Paste		8.3	15	9.8	
% Saturation		%	69	59	69	
Calcium	Saturated Paste	mg/kg	169	48	368	
Magnesium	Saturated Paste	mg/kg	48	18	125	
Sodium	Saturated Paste	mg/kg	394	364	710	
Potassium	Saturated Paste	mg/kg	9	<6	8	
Chloride	Saturated Paste	mg/L	145	206	167	2
Chloride	Saturated Paste	mg/kg	100	121	116	
Sulfate (SO4)	Saturated Paste	mg/kg	1140	671	2460	
TGR	Saturated Paste	T/ac	0.4	1.1	2.0	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.3	7.4	7.6	

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Lot ID: **1381283**
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Date Received: Oct 3, 2019
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	Reference Number	1381283-36	1381283-37	1381283-38	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-4C / 60-100	19-4D / 0-15	19-4D / 15-30	
	Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	7.06	1.63	1.66	0.01
SAR	Saturated Paste		14.0	4.9	4.9	
% Saturation		%	65	58	57	
Calcium	Saturated Paste	mg/kg	316	66.4	62.3	
Magnesium	Saturated Paste	mg/kg	142	20.2	20.3	
Sodium	Saturated Paste	mg/kg	961	135	131	
Potassium	Saturated Paste	mg/kg	10	6	3	
Chloride	Saturated Paste	mg/L	204	126	125	2
Chloride	Saturated Paste	mg/kg	133	73	71	
Sulfate (SO4)	Saturated Paste	mg/kg	2950	354	286	
TGR	Saturated Paste	T/ac	6.3	<0.1	<0.1	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.9	7.4	7.5	

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Lot ID: **1381283**
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		Reference Number	1381283-39	1381283-40	1381283-41	
		Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	19-4D / 30-60	19-4D / 60-100	19-4E / 0-15	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	5.75	8.69	7.81	0.01
SAR	Saturated Paste		13.7	19.5	15.2	
% Saturation		%	54	74	61	
Calcium	Saturated Paste	mg/kg	199	345	307	
Magnesium	Saturated Paste	mg/kg	66.3	163	128	
Sodium	Saturated Paste	mg/kg	643	1510	985	
Potassium	Saturated Paste	mg/kg	<5	9	7	
Chloride	Saturated Paste	mg/L	197	119	334	2
Chloride	Saturated Paste	mg/kg	106	88	205	
Sulfate (SO4)	Saturated Paste	mg/kg	1850	4310	2830	
TGR	Saturated Paste	T/ac	4.1	14.1	7.8	
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.2	7.4	7.5	

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Report Number: 2473658

			Reference Number	1381283-42	1381283-43	1381283-44	
			Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
			Sample Time	NA	NA	NA	
			Sample Location				
			Sample Description	19-4E / 15-30	19-4E / 30-60	19-4E / 60-100	
			Matrix	Soil	Soil	Soil	
Analyte		**Units**		**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity							
Electrical Conductivity	Saturated Paste	dS/m		6.27	7.46	5.83	0.01
SAR	Saturated Paste			12.5	16.8	10.9	
% Saturation		%		60	74	58	
Calcium	Saturated Paste	mg/kg		299	277	274	
Magnesium	Saturated Paste	mg/kg		104	144	105	
Sodium	Saturated Paste	mg/kg		764	1190	640	
Potassium	Saturated Paste	mg/kg		8	11	9	
Chloride	Saturated Paste	mg/L		233	57	142	2
Chloride	Saturated Paste	mg/kg		140	42	83	
Sulfate (SO4)	Saturated Paste	mg/kg		2380	3470	2180	
TGR	Saturated Paste	T/ac		4.3	8.3	2.7	
Soil Acidity							
pH	1:2 Soil:CaCl2 sol.	pH		7.4	7.8	7.7	

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Reference Number	1381283-45
Sample Date	Oct 02, 2019
Sample Time	NA
Sample Location	
Sample Description	19-5 / 0-15
Matrix	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01			0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05			0.05
Acenaphthene	Dry Weight	mg/kg	<0.05			0.05
Fluorene	Dry Weight	mg/kg	<0.05			0.05
Phenanthrene	Dry Weight	mg/kg	0.01			0.01
Anthracene	Dry Weight	mg/kg	<0.003			0.003
Fluoranthene	Dry Weight	mg/kg	0.026			0.010
Pyrene	Dry Weight	mg/kg	0.026			0.010
Benzo(a)anthracene	Dry Weight	mg/kg	0.02			0.01
Chrysene	Dry Weight	mg/kg	<0.05			0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05			0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05			0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05			0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05			0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05			0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05			0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	0.016			0.001
IACR_Coarse	Index of Additive Cancer Risk		0.003			0.001
IACR_Fine	Index of Additive Cancer Risk		0.005			0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	113			50-140
2-Fluorobiphenyl	PAH - Surrogate	%	95			50-140
p-Terphenyl-d14	PAH - Surrogate	%	98			50-140

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

	Reference Number	1381283-45	1381283-47	1381283-49	
	Sample Date	Oct 02, 2019	Oct 02, 2019	Oct 02, 2019	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	19-5 / 0-15	19-5 / 30-60	Duplicate 6	
	Matrix	Soil	Soil	Soil	
Analyte	**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity					
Electrical Conductivity Saturated Paste	dS/m	1.20	7.92	1.21	0.01
SAR Saturated Paste		8.0	19.1	6.6	
% Saturation	%	76	110	54	
Calcium Saturated Paste	mg/kg	31.9	499	27.6	
Magnesium Saturated Paste	mg/kg	10.0	180	8.1	
Sodium Saturated Paste	mg/kg	177	2060	112	
Potassium Saturated Paste	mg/kg	3	<11	5	
Chloride Saturated Paste	mg/L	24	52	46	2
Chloride Saturated Paste	mg/kg	18	57	25	
Sulfate (SO4) Saturated Paste	mg/kg	290	5940	219	
TGR Saturated Paste	T/ac	<0.1	11.7	<0.1	
Soil Acidity					
pH 1:2 Soil:CaCl2 sol.	pH	7.6	7.8	7.9	

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7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Reference Number	1381283-45	1381283-49	
Sample Date	Oct 02, 2019	Oct 02, 2019	
Sample Time	NA	NA	
Sample Location			
Sample Description	19-5 / 0-15	Duplicate 6	
Matrix	Soil	Soil	

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Digestion						
Boron	Saturated Paste	mg/L	0.15	0.20		0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	0.5		0.2
Arsenic	Strong Acid Extractable	mg/kg	6.6	7.2		0.2
Barium	Strong Acid Extractable	mg/kg	174	165		1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.6		0.1
Cadmium	Strong Acid Extractable	mg/kg	0.45	0.18		0.01
Chromium	Strong Acid Extractable	mg/kg	15.8	19.3		0.5
Cobalt	Strong Acid Extractable	mg/kg	7.1	8.3		0.1
Copper	Strong Acid Extractable	mg/kg	37.1	14.7		1
Lead	Strong Acid Extractable	mg/kg	15.3	8.3		0.1
Mercury	Strong Acid Extractable	mg/kg	0.10	0.10		0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.9	3.6		1
Nickel	Strong Acid Extractable	mg/kg	20.0	36.2		0.5
Selenium	Strong Acid Extractable	mg/kg	0.6	<0.3		0.3
Silver	Strong Acid Extractable	mg/kg	0.3	<0.10		0.1
Thallium	Strong Acid Extractable	mg/kg	0.12	0.12		0.05
Tin	Strong Acid Extractable	mg/kg	3.6	<1.0		1
Uranium	Strong Acid Extractable	mg/kg	1.3	0.9		0.5
Vanadium	Strong Acid Extractable	mg/kg	32.4	21.0		0.1
Zinc	Strong Acid Extractable	mg/kg	110	60		1
Water Soluble Parameters						
Chromium (VI)	Dry Weight	mg/kg	0.1	<0.05		0.05

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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W: element.com

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Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

		Reference Number	1381283-50	1381283-51		
		Sample Date	Oct 02, 2019	Oct 02, 2019		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	Duplicate 7	Duplicate 8		
		Matrix	Soil	Soil		
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	7.17	5.86		0.01
SAR	Saturated Paste		15.3	10.9		
% Saturation		%	69	62		
Calcium	Saturated Paste	mg/kg	316	279		
Magnesium	Saturated Paste	mg/kg	109	105		
Sodium	Saturated Paste	mg/kg	1030	665		
Potassium	Saturated Paste	mg/kg	19	7		
Chloride	Saturated Paste	mg/L	246	133		2
Chloride	Saturated Paste	mg/kg	171	82		
Sulfate (SO4)	Saturated Paste	mg/kg	2960	2180		
TGR	Saturated Paste	T/ac	6.8	2.6		
Soil Acidity						
pH	1:2 Soil:CaCl2 sol.	pH	7.6	7.7		

Approved by:

Jimmy Tran
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
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Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

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Lot ID: **1381283**
Control Number:
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Report Number: 2473658

Acid Herbicides in Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
2,4,5-T	ng/mL	0	-0.08	0.08	yes
2,4,5-TP	ng/mL	0	-0.08	0.08	yes
2,4-D	ng/mL	0	-0.08	0.08	yes
2,4-DB	ng/mL	0	-0.08	0.08	yes
Bromoxynil	ng/mL	0	-0.08	0.08	yes
Clopyralid	ng/mL	0	-0.08	0.08	yes
Dicamba	ng/mL	0	-0.08	0.08	yes
Dichlorprop	ng/mL	0	-0.08	0.08	yes
Dinoseb	ng/mL	0	-0.08	0.08	yes
Imazamox	ng/mL	0	-0.08	0.08	yes
Imazapyr	ng/mL	0	-0.08	0.08	yes
Imazethapyr	ng/mL	0	-0.08	0.08	yes
MCPA	ng/mL	0	-0.08	0.08	yes
MCPB	ng/mL	0	-0.08	0.08	yes
Mecoprop	ng/mL	0	-0.08	0.08	yes
Picloram	ng/mL	0	-0.08	0.08	yes
Triclopyr	ng/mL	0	-0.08	0.08	yes
Date Acquired:	October 07, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
2,4,5-T	ng/mL	98.50	80	120	yes
2,4,5-TP	ng/mL	98.00	80	120	yes
2,4-D	ng/mL	99.00	80	120	yes
2,4-DB	ng/mL	100.00	80	120	yes
Bromoxynil	ng/mL	100.00	80	120	yes
Clopyralid	ng/mL	98.50	80	120	yes
Dicamba	ng/mL	98.00	80	120	yes
Dichlorprop	ng/mL	97.50	80	120	yes
Dinoseb	ng/mL	99.50	80	120	yes
Imazamox	ng/mL	101.00	80	120	yes
Imazapyr	ng/mL	102.00	80	120	yes
Imazethapyr	ng/mL	101.00	80	120	yes
MCPA	ng/mL	100.50	80	120	yes
MCPB	ng/mL	104.00	80	120	yes
Mecoprop	ng/mL	100.00	80	120	yes
Picloram	ng/mL	100.50	80	120	yes
Triclopyr	ng/mL	97.50	80	120	yes
Date Acquired:	October 07, 2019				

Available Nutrients

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrate - N	mg/L	-0.019	-1	1	yes
Date Acquired:	October 04, 2019				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Nitrate - N	µg/g	<2	<2	10	2	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
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Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Available Nutrients - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Date Acquired: October 04, 2019						
Control Sample	**Units**	**Measured**	**Lower Limit**	**Upper Limit**		**Passed QC**
Nitrate - N	µg/g	39	32	45		yes
Date Acquired: October 04, 2019						
Nitrate - N	µg/g	4	4	4		yes
Date Acquired: October 04, 2019						

Extractable Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
F2c C10-C16	µg/mL	0	-10	10		yes
F3c C16-C34	µg/mL	0	-30	30		yes
F4c C34-C50	µg/mL	0	-20	20		yes
F4HTGCc C34-C50+	µg/mL	0	-20	20		yes
Date Acquired: October 04, 2019						
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
F2c C10-C16	µg/mL	102.81	80	120		yes
F3c C16-C34	µg/mL	105.22	80	120		yes
F4c C34-C50	µg/mL	102.39	80	120		yes
F4HTGCc C34-C50+	µg/mL	99.78	80	120		yes
Date Acquired: October 04, 2019						
Client Sample Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
F2c C10-C16	mg/kg	<25	<25	50	10	yes
F3c C16-C34	mg/kg	<50	<50	50	10	yes
F4c C34-C50	mg/kg	<100	<100	50	10	yes
F4HTGCc C34-C50+	mg/kg	<100	<100	50	10	yes
Date Acquired: October 04, 2019						
Matrix Spike	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
F2c C10-C16	mg/kg	107	70	130		yes
F3c C16-C34	mg/kg	117	70	130		yes
F4c C34-C50	mg/kg	112	70	130		yes
F4HTGCc C34-C50+	mg/kg	110	70	130		yes
Date Acquired: October 04, 2019						

Metals Strong Acid Digestion

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Boron	mg/L	-0.00059848	-0.05	0.07		yes
Antimony	µg/L	0.00116486	-0.1	0.2		yes
Arsenic	µg/L	0.0106479	-0.2	0.2		yes
Barium	µg/L	0.0253838	-1	1		yes
Beryllium	µg/L	-0.000224857	-0.1	0.1		yes
Cadmium	µg/L	0.0014722	-0.01	0.01		yes
Chromium	µg/L	0.00695245	-0.5	0.5		yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

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14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
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Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Metals Strong Acid Digestion - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Cobalt	µg/L	0.00063605	-0.1	0.1	yes
Copper	µg/L	0.0294789	-0.6	1.2	yes
Lead	µg/L	0.00310919	-5.0	5.0	yes
Mercury	µg/L	0.00114614	-0.04	0.04	yes
Molybdenum	µg/L	0.0523606	-1.0	1.0	yes
Nickel	µg/L	0.0355779	-0.4	0.7	yes
Selenium	µg/L	0.00421157	-0.3	0.3	yes
Silver	µg/L	0.00050325	-0.09	0.14	yes
Thallium	µg/L	-0.000432467	-0.04	0.04	yes
Tin	µg/L	0.00969205	-0.4	0.4	yes
Uranium	µg/L	0.000999951	-0.5	0.5	yes
Vanadium	µg/L	0.063115	-0.1	0.1	yes
Zinc	µg/L	0.198821	-1	1	yes

Date Acquired: October 04, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Antimony	mg/kg	0.5	0.5	20	0.4	yes
Arsenic	mg/kg	7.6	7.9	20	0.4	yes
Barium	mg/kg	216	212	20	2	yes
Beryllium	mg/kg	0.8	0.9	20	0.2	yes
Cadmium	mg/kg	0.12	0.10	20	0.02	yes
Chromium	mg/kg	22.8	22.4	20	1.1	yes
Cobalt	mg/kg	10.1	10.0	20	0.2	yes
Copper	mg/kg	24.1	24.5	20	2.2	yes
Lead	mg/kg	9.6	9.8	20	0.2	yes
Mercury	mg/kg	<0.05	<0.05	20	0.05	yes
Molybdenum	mg/kg	<1.0	<1.0	20	2.2	yes
Nickel	mg/kg	36.2	34.3	20	1.1	yes
Selenium	mg/kg	<0.3	<0.3	20	0.7	yes
Silver	mg/kg	<0.10	<0.10	20	0.22	yes
Thallium	mg/kg	0.16	0.16	20	0.11	yes
Tin	mg/kg	<1.0	<1.0	20	2.2	yes
Uranium	mg/kg	0.7	0.7	20	1.1	yes
Vanadium	mg/kg	34.0	35.0	20	0.2	yes
Zinc	mg/kg	62	63	20	2	yes

Date Acquired: October 04, 2019

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Antimony	mg/kg	38.6	36.1	43.9	yes
Arsenic	mg/kg	40.3	36.3	43.9	yes
Barium	mg/kg	198	183	225	yes
Beryllium	mg/kg	19.9	17.4	22.2	yes
Cadmium	mg/kg	2.02	1.88	2.28	yes
Chromium	mg/kg	103	93.6	105.6	yes
Cobalt	mg/kg	20.5	17.0	23.0	yes
Copper	mg/kg	202	183.1	212.7	yes

Element
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Edmonton, Alberta
T6B 3J4, Canada

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F: +1 (780) 434-8586
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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Metals Strong Acid Digestion - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Lead	mg/kg	19.4	18.3	21.5	yes
Mercury	mg/kg	3.00	2.64	3.36	yes
Molybdenum	mg/kg	195	174.8	234.8	yes
Nickel	mg/kg	102	91.6	108.4	yes
Selenium	mg/kg	43.0	34.0	46.0	yes
Silver	mg/kg	19.4	18.20	22.40	yes
Thallium	mg/kg	9.66	8.76	10.74	yes
Tin	mg/kg	197	188.0	218.0	yes
Uranium	mg/kg	96.8	86.0	116.0	yes
Vanadium	mg/kg	20.6	18.0	21.6	yes
Zinc	mg/kg	200	170	230	yes
Date Acquired:	October 04, 2019				
Antimony	mg/kg	3.8	2.3	6.0	yes
Arsenic	mg/kg	3.9	2.6	6.8	yes
Barium	mg/kg	108	58	154	yes
Beryllium	mg/kg	0.3	0.2	0.5	yes
Cadmium	mg/kg	0.92	0.73	1.15	yes
Chromium	mg/kg	86.7	48.8	128.8	yes
Cobalt	mg/kg	7.1	3.9	10.4	yes
Copper	mg/kg	130	76.1	200.5	yes
Lead	mg/kg	248	198.7	305.5	yes
Mercury	mg/kg	0.06	0.05	0.07	yes
Molybdenum	mg/kg	1.2	0.6	1.5	yes
Nickel	mg/kg	27.8	15.8	41.5	yes
Selenium	mg/kg	<0.3	0.1	0.4	yes
Silver	mg/kg	3.4	2.28	6.00	yes
Thallium	mg/kg	0.07	0.04	0.11	yes
Tin	mg/kg	11.1	4.0	16.0	yes
Uranium	mg/kg	<0.5	0.3	0.7	yes
Vanadium	mg/kg	31.3	17.8	46.9	yes
Zinc	mg/kg	320	260	350	yes
Date Acquired:	October 04, 2019				

Mono-Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.005	0.005	yes
Toluene	ng	0	-0.06	0.06	yes
Ethylbenzene	ng	0	-0.030	0.030	yes
Total Xylenes (m,p,o)	ng	0	-0.09	0.09	yes
Styrene	ng	0	-0.030	0.030	yes
Date Acquired:	October 04, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	ng	92.20	80	120	yes
Toluene	ng	88.60	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

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F: +1 (780) 434-8586
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Quality Control

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Mono-Aromatic Hydrocarbons - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Ethylbenzene	ng	98.00	80	120	yes
Total Xylenes (m,p,o)	ng	103.33	80	120	yes
Styrene	ng	94.80	80	120	yes

Date Acquired: October 04, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Benzene	mg/kg	<0.005	<0.005	50	0.010	yes
Toluene	mg/kg	<0.02	<0.02	50	0.04	yes
Ethylbenzene	mg/kg	<0.005	<0.005	50	0.020	yes
m,p-Xylene	mg/kg	<0.02	<0.02	50	0.04	yes
o-Xylene	mg/kg	<0.02	<0.02	50	0.04	yes
Total Xylenes (m,p,o)	mg/kg	<0.03	<0.03	50	0.06	yes
Styrene	mg/kg	<0.01	<0.01	50	0.020	yes

Date Acquired: October 04, 2019

Neutral Herbicides in Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Alachlor	ng/mL	0	-0.08	0.08	yes
Benfluralin	ng/mL	0	-0.08	0.08	yes
Butylate	ng/mL	0	-0.08	0.08	yes
Chlorpropham	ng/mL	0	-0.08	0.08	yes
Diallate	ng/mL	0	-0.08	0.08	yes
Dichlobenil	ng/mL	0	-0.08	0.08	yes
Diclofop-methyl	ng/mL	0	-0.08	0.08	yes
Diphenylamine	ng/mL	0	-0.08	0.08	yes
Eptam (EPTC)	ng/mL	0	-0.08	0.08	yes
Ethalfluralin	ng/mL	0	-0.08	0.08	yes
Fenoxaprop-ethyl	ng/mL	0	-0.08	0.08	yes
Fluazifop-p-butyl	ng/mL	0	-0.08	0.08	yes
Hexazinone	ng/mL	0	-0.08	0.08	yes
Metalaxyl	ng/mL	0	-0.08	0.08	yes
Metolachlor	ng/mL	0	-0.08	0.08	yes
Metribuzin	ng/mL	0	-0.08	0.08	yes
Pirimicarb	ng/mL	0	-0.08	0.08	yes
Profluralin	ng/mL	0	-0.08	0.08	yes
Prometryn	ng/mL	0	-0.08	0.08	yes
Propazine	ng/mL	0	-0.08	0.08	yes
Propyzamide	ng/mL	0	-0.08	0.08	yes
Quizalofop-ethyl	ng/mL	0	-0.08	0.08	yes
Simetryn	ng/mL	0	-0.08	0.08	yes
Terbuthylazine	ng/mL	0	-0.08	0.08	yes
Terbutryn	ng/mL	0	-0.08	0.08	yes
Triallate	ng/mL	0	-0.08	0.08	yes
Trifluralin	ng/mL	0	-0.08	0.08	yes

Date Acquired: October 09, 2019

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Neutral Herbicides in Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Alachlor	ng/mL	104.94	80	120	yes
Benfluralin	ng/mL	103.96	80	120	yes
Butylate	ng/mL	101.45	80	120	yes
Chlorpropham	ng/mL	91.43	80	120	yes
Diallate	ng/mL	107.28	80	120	yes
Dichlobenil	ng/mL	103.81	80	120	yes
Diclofop-methyl	ng/mL	103.11	80	120	yes
Diphenylamine	ng/mL	87.31	80	120	yes
Eptam (EPTC)	ng/mL	104.14	80	120	yes
Ethalfluralin	ng/mL	99.48	80	120	yes
Fenoxaprop-ethyl	ng/mL	92.92	80	120	yes
Fluazifop-p-butyl	ng/mL	104.99	80	120	yes
Hexazinone	ng/mL	93.91	80	120	yes
Metalaxyl	ng/mL	99.11	80	120	yes
Metolachlor	ng/mL	103.11	80	120	yes
Metribuzin	ng/mL	101.78	80	120	yes
Pirimicarb	ng/mL	101.95	80	120	yes
Profluralin	ng/mL	110.98	80	120	yes
Prometryn	ng/mL	102.80	80	120	yes
Propazine	ng/mL	102.81	80	120	yes
Propyzamide	ng/mL	99.20	80	120	yes
Quizalofop-ethyl	ng/mL	90.31	80	120	yes
Simetryn	ng/mL	91.94	80	120	yes
Terbuthylazine	ng/mL	102.84	80	120	yes
Terbutryn	ng/mL	100.59	80	120	yes
Triallate	ng/mL	107.44	80	120	yes
Trifluralin	ng/mL	102.47	80	120	yes

Date Acquired: October 09, 2019

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Alachlor	mg/kg	<0.5	<0.5	22	0.10	yes
Benfluralin	mg/kg	<0.5	<0.5	22	0.10	yes
Butylate	mg/kg	<0.5	<0.5	22	0.10	yes
Chlorpropham	mg/kg	<0.5	<0.5	22	0.10	yes
Diallate	mg/kg	<0.5	<0.5	22	0.10	yes
Dichlobenil	mg/kg	<0.5	<0.5	22	0.10	yes
Diclofop-methyl	mg/kg	<0.1	<0.1	22	0.10	yes
Diphenylamine	mg/kg	<0.5	<0.5	22	0.10	yes
Eptam (EPTC)	mg/kg	<0.5	<0.5	22	0.10	yes
Ethalfluralin	mg/kg	<0.5	<0.5	22	0.10	yes
Fenoxaprop-ethyl	mg/kg	<0.5	<0.5	22	0.10	yes
Fluazifop-p-butyl	mg/kg	<0.5	<0.5	22	0.10	yes
Hexazinone	mg/kg	<0.5	<0.5	22	0.10	yes
Metalaxyl	mg/kg	<0.5	<0.5	22	0.10	yes
Metolachlor	mg/kg	<0.1	<0.1	22	0.10	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Neutral Herbicides in Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Metribuzin	mg/kg	<0.5	<0.5	22	0.10	yes
Pirimicarb	mg/kg	<0.5	<0.5	22	0.10	yes
Profluralin	mg/kg	<0.5	<0.5	22	0.10	yes
Prometryn	mg/kg	<0.5	<0.5	22	0.10	yes
Propazine	mg/kg	<0.5	<0.5	22	0.10	yes
Propyzamide	mg/kg	<0.5	<0.5	22	0.10	yes
Quizalofop-ethyl	mg/kg	<0.5	<0.5	22	0.10	yes
Simetryn	mg/kg	<0.5	<0.5	22	0.10	yes
Terbuthylazine	mg/kg	<0.5	<0.5	22	0.10	yes
Terbutryn	mg/kg	<0.5	<0.5	22	0.10	yes
Triallate	mg/kg	<0.1	<0.1	22	0.10	yes
Trifluralin	mg/kg	<0.1	<0.1	22	0.10	yes
Date Acquired:	October 09, 2019					

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Alachlor	mg/kg	90	50	150	yes
Benfluralin	mg/kg	96	50	150	yes
Butylate	mg/kg	82	50	150	yes
Chlorpropham	mg/kg	82	50	150	yes
Diallate	mg/kg	98	50	150	yes
Dichlobenil	mg/kg	71	50	150	yes
Diclofop-methyl	mg/kg	80	50	150	yes
Diphenylamine	mg/kg	73	50	150	yes
Eptam (EPTC)	mg/kg	88	50	150	yes
Ethalfluralin	mg/kg	89	50	150	yes
Fenoxaprop-ethyl	mg/kg	93	50	150	yes
Fluazifop-p-butyl	mg/kg	98	50	150	yes
Hexazinone	mg/kg	53	50	150	yes
Metalaxyl	mg/kg	77	50	150	yes
Metolachlor	mg/kg	96	50	150	yes
Metribuzin	mg/kg	90	50	150	yes
Pirimicarb	mg/kg	81	50	150	yes
Profluralin	mg/kg	110	50	150	yes
Prometryn	mg/kg	82	50	150	yes
Propazine	mg/kg	91	50	150	yes
Propyzamide	mg/kg	79	50	150	yes
Quizalofop-ethyl	mg/kg	88	50	150	yes
Simetryn	mg/kg	71	50	150	yes
Terbuthylazine	mg/kg	92	50	150	yes
Terbutryn	mg/kg	86	50	150	yes
Triallate	mg/kg	101	50	150	yes
Trifluralin	mg/kg	101	50	150	yes
Date Acquired:	October 09, 2019				

Organochlorine Pesticides in Soil

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Organochlorine Pesticides in Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aldrin	ng/mL	0	-0.1	0.1	yes
BHC (alpha isomer)	ng/mL	0	-0.1	0.1	yes
BHC (beta isomer)	ng/mL	0	-0.1	0.1	yes
BHC (delta isomer)	ng/mL	0	-0.1	0.1	yes
Captan	ng/mL	0	-0.8	0.8	yes
Chlorbenside	ng/mL	0	-0.1	0.1	yes
Chlordane-cis	ng/mL	0	-0.1	0.1	yes
Chlordane-trans	ng/mL	0	-0.1	0.1	yes
Chlorfenson	ng/mL	0	-0.1	0.1	yes
Chlorothalonil	ng/mL	0	-0.8	0.8	yes
Chlorthal-dimethyl	ng/mL	0	-0.1	0.1	yes
DDD-o,p'	ng/mL	0	-0.1	0.1	yes
DDD-p,p'	ng/mL	0	-0.1	0.1	yes
DDE-o,p'	ng/mL	0	-0.1	0.1	yes
DDE-p,p'	ng/mL	0	-0.1	0.1	yes
DDT-o,p'	ng/mL	0	-0.1	0.1	yes
DDT-p,p'	ng/mL	0	-0.1	0.1	yes
Dichlofluanid	ng/mL	0	-0.1	0.1	yes
Dieldrin	ng/mL	0	-0.1	0.1	yes
Endosulfan I	ng/mL	0	-0.1	0.1	yes
Endosulfan II	ng/mL	0	-0.1	0.1	yes
Endosulfan sulfate	ng/mL	0	-0.1	0.1	yes
Endrin	ng/mL	0	-0.1	0.1	yes
Folpet	ng/mL	0	-0.8	0.8	yes
Heptachlor	ng/mL	0	-0.1	0.1	yes
Heptachlor Epoxide	ng/mL	0	-0.1	0.1	yes
Hexachlorobenzene	ng/mL	0	-0.1	0.1	yes
Lindane	ng/mL	0	-0.1	0.1	yes
Methoxychlor	ng/mL	0	-0.08	0.08	yes
Mirex	ng/mL	0	-0.1	0.1	yes
Permethrin-cis	ng/mL	0	-0.1	0.1	yes
Permethrin-trans	ng/mL	0	-0.1	0.1	yes
Procymidone	ng/mL	0	-0.1	0.1	yes
Propachlor	ng/mL	0	-0.1	0.1	yes
Quintozene	ng/mL	0	-0.1	0.1	yes
Tecnazene	ng/mL	0	-0.1	0.1	yes
Tetradifon	ng/mL	0	-0.1	0.1	yes
Tolyfluanid	ng/mL	0	-0.1	0.1	yes
Triadimefon	ng/mL	0	-0.1	0.1	yes
Vinclozolin	ng/mL	0	-0.1	0.1	yes
Date Acquired:	October 09, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aldrin	ng/mL	110.89	80	120	yes
BHC (alpha isomer)	ng/mL	106.11	80	120	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
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Project ID: 704-SWM.SWOP04076-02
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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Organochlorine Pesticides in Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
BHC (beta isomer)	ng/mL	94.82	80	120	yes
BHC (delta isomer)	ng/mL	97.16	80	120	yes
Captan	ng/mL	108.57	80	120	yes
Chlorbenside	ng/mL	98.79	80	120	yes
Chlordane-cis	ng/mL	110.36	80	120	yes
Chlordane-trans	ng/mL	108.93	80	120	yes
Chlorfenson	ng/mL	99.14	80	120	yes
Chlorothalonil	ng/mL	95.14	80	120	yes
Chlorthal-dimethyl	ng/mL	109.68	80	120	yes
DDD-o,p'	ng/mL	102.93	80	120	yes
DDD-p,p'	ng/mL	106.22	80	120	yes
DDE-o,p'	ng/mL	109.16	80	120	yes
DDE-p,p'	ng/mL	105.92	80	120	yes
DDT-o,p'	ng/mL	107.20	80	120	yes
DDT-p,p'	ng/mL	104.51	80	120	yes
Dichlofluanid	ng/mL	103.29	80	120	yes
Dieldrin	ng/mL	107.98	80	120	yes
Endosulfan I	ng/mL	91.24	80	120	yes
Endosulfan II	ng/mL	95.96	80	120	yes
Endosulfan sulfate	ng/mL	106.33	80	120	yes
Endrin	ng/mL	109.44	80	120	yes
Folpet	ng/mL	104.23	80	120	yes
Heptachlor	ng/mL	101.62	80	120	yes
Heptachlor Epoxide	ng/mL	111.07	80	120	yes
Hexachlorobenzene	ng/mL	107.01	80	120	yes
Lindane	ng/mL	115.75	80	120	yes
Methoxychlor	ng/mL	108.74	80	120	yes
Mirex	ng/mL	110.71	80	120	yes
Permethrin-cis	ng/mL	97.41	80	120	yes
Permethrin-trans	ng/mL	105.10	80	120	yes
Procymidone	ng/mL	110.96	80	120	yes
Propachlor	ng/mL	104.32	80	120	yes
Quintozene	ng/mL	107.12	80	120	yes
Tecnazene	ng/mL	99.97	80	120	yes
Tetradifon	ng/mL	104.30	80	120	yes
Tolyfluanid	ng/mL	111.39	80	120	yes
Triadimefon	ng/mL	96.37	80	120	yes
Vinclozolin	ng/mL	102.28	80	120	yes

Date Acquired: October 09, 2019

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aldrin	mg/kg	<0.5	<0.5	22	0.2	yes
BHC (alpha isomer)	mg/kg	<0.5	<0.5	22	0.2	yes
BHC (beta isomer)	mg/kg	<0.5	<0.5	22	0.2	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Organochlorine Pesticides in Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
BHC (delta isomer)	mg/kg	<0.5	<0.5	22	0.2	yes
Captan	mg/kg	<3.0	<3.0	22	1.0	yes
Chlorbenside	mg/kg	<0.5	<0.5	22	0.2	yes
Chlordane-cis	mg/kg	<0.5	<0.5	22	0.2	yes
Chlordane-trans	mg/kg	<0.5	<0.5	22	0.2	yes
Chlorfenson	mg/kg	<0.5	<0.5	22	0.2	yes
Chlorothalonil	mg/kg	<0.5	<0.5	22	1.0	yes
Chlorthal-dimethyl	mg/kg	<0.5	<0.5	22	0.2	yes
DDD-o,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDD-p,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDE-o,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDE-p,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDT-o,p'	mg/kg	<0.5	<0.5	22	0.2	yes
DDT-p,p'	mg/kg	<0.5	<0.5	22	0.2	yes
Dichlofluanid	mg/kg	<0.5	<0.5	22	0.2	yes
Dieldrin	mg/kg	<0.5	<0.5	22	0.2	yes
Endosulfan I	mg/kg	<0.5	<0.5	22	0.2	yes
Endosulfan II	mg/kg	<0.5	<0.5	22	0.2	yes
Endosulfan sulfate	mg/kg	<0.5	<0.5	22	0.2	yes
Endrin	mg/kg	<0.5	<0.5	22	0.2	yes
Folpet	mg/kg	<3.0	<3.0	22	1.0	yes
Heptachlor	mg/kg	<0.5	<0.5	22	0.2	yes
Heptachlor Epoxide	mg/kg	<0.2	<0.2	22	0.2	yes
Hexachlorobenzene	mg/kg	<0.5	<0.5	22	0.2	yes
Lindane	mg/kg	<0.1	<0.1	22	0.2	yes
Methoxychlor	mg/kg	<0.1	<0.1	22	0.08	yes
Mirex	mg/kg	<0.5	<0.5	22	0.2	yes
Permethrin-cis	mg/kg	<0.5	<0.5	22	0.2	yes
Permethrin-trans	mg/kg	<0.5	<0.5	22	0.2	yes
Procymidone	mg/kg	<0.5	<0.5	22	0.2	yes
Propachlor	mg/kg	<0.5	<0.5	22	0.2	yes
Quintozene	mg/kg	<0.5	<0.5	22	0.2	yes
Tecnazene	mg/kg	<0.5	<0.5	22	0.2	yes
Tetradifon	mg/kg	<0.5	<0.5	22	0.2	yes
Tolyfluanid	mg/kg	<0.5	<0.5	22	0.2	yes
Triadimefon	mg/kg	<0.5	<0.5	22	0.2	yes
Vinclozolin	mg/kg	<0.5	<0.5	22	0.2	yes

Date Acquired: October 09, 2019

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aldrin	mg/kg	109	55	145	yes
BHC (alpha isomer)	mg/kg	91	55	145	yes
BHC (beta isomer)	mg/kg	88	55	145	yes
BHC (delta isomer)	mg/kg	87	55	145	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
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Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Organochlorine Pesticides in Soil - Continued

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Captan	mg/kg	100	55	145	yes
Chlorbenside	mg/kg	78	55	145	yes
Chlordane-cis	mg/kg	103	55	145	yes
Chlordane-trans	mg/kg	103	55	145	yes
Chlorfenson	mg/kg	85	55	145	yes
Chlorothalonil	mg/kg	82	55	145	yes
Chlorthal-dimethyl	mg/kg	96	55	145	yes
DDD-o,p'	mg/kg	89	55	145	yes
DDD-p,p'	mg/kg	82	55	145	yes
DDE-o,p'	mg/kg	99	55	145	yes
DDE-p,p'	mg/kg	93	55	145	yes
DDT-o,p'	mg/kg	101	55	145	yes
DDT-p,p'	mg/kg	95	55	145	yes
Dichlofluanid	mg/kg	95	55	145	yes
Dieldrin	mg/kg	103	55	145	yes
Endosulfan I	mg/kg	107	55	145	yes
Endosulfan II	mg/kg	78	55	145	yes
Endosulfan sulfate	mg/kg	84	55	145	yes
Endrin	mg/kg	89	55	145	yes
Folpet	mg/kg	90	55	145	yes
Heptachlor	mg/kg	95	55	145	yes
Heptachlor Epoxide	mg/kg	100	55	145	yes
Hexachlorobenzene	mg/kg	88	55	145	yes
Lindane	mg/kg	104	55	145	yes
Methoxychlor	mg/kg	106	55	145	yes
Mirex	mg/kg	105	55	145	yes
Permethrin-cis	mg/kg	80	55	145	yes
Permethrin-trans	mg/kg	105	55	145	yes
Procymidone	mg/kg	93	55	145	yes
Propachlor	mg/kg	92	55	145	yes
Quintozene	mg/kg	90	55	145	yes
Tecnazene	mg/kg	80	55	145	yes
Tetradifon	mg/kg	99	55	145	yes
Tolyfluanid	mg/kg	105	55	145	yes
Triadimefon	mg/kg	87	55	145	yes
Vinclozolin	mg/kg	84	55	145	yes

Date Acquired: October 09, 2019

PAH - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	115.05	50	140	yes
2-Fluorobiphenyl	%	83.74	50	140	yes
p-Terphenyl-d14	%	109.42	50	140	yes

Date Acquired: October 04, 2019

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

PAH - Soil - Surrogate Recovery - Continued

Particle Size Analysis - Wet Sieve

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
75 micron sieve	% by weight	18.0	12.2	26.0	yes
Date Acquired:	October 04, 2019				
75 micron sieve	% by weight	26.8	24.6	33.4	yes
Date Acquired:	October 04, 2019				

Physical and Aggregate Properties

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sand	% by weight	37	30	43	yes
Clay	% by weight	24	20	32	yes
Date Acquired:	October 04, 2019				

Polychlorinated Biphenyls - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aroclor 1016	µg/mL	0	-0.3	0.3	yes
Aroclor 1221	µg/mL	0	-0.3	0.3	yes
Aroclor 1232	µg/mL	0	-0.3	0.3	yes
Aroclor 1242	µg/mL	0	-0.3	0.3	yes
Aroclor 1248	µg/mL	0	-0.3	0.3	yes
Aroclor 1254	µg/mL	0	-0.3	0.3	yes
Aroclor 1260	µg/mL	0	-0.3	0.3	yes
Aroclor 1262	µg/mL	0	-0.3	0.3	yes
Aroclor 1268	µg/mL	0	-0.3	0.3	yes
Date Acquired:	October 04, 2019				
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**	**Passed QC**
Aroclor 1260	µg/mL	110.00	80	120	yes
Date Acquired:	October 04, 2019				

Polychlorinated Biphenyls - Soil - Surrogate

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Decachlorobiphenyl	%	72.9017	50	140	yes
Date Acquired:	October 04, 2019				

Polycyclic Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.010	0.010	yes
Acenaphthylene	ng/mL	0	-0.05	0.05	yes
Acenaphthene	ng/mL	0	-0.05	0.05	yes
Fluorene	ng/mL	0	-0.05	0.05	yes
Phenanthrene	ng/mL	0	-0.01	0.01	yes
Anthracene	ng/mL	0	-0.003	0.003	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
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Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Polycyclic Aromatic Hydrocarbons - Soil - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Fluoranthene	ng/mL	0	-0.010	0.010	yes
Pyrene	ng/mL	0	-0.010	0.010	yes
Benzo(a)anthracene	ng/mL	0	-0.01	0.01	yes
Chrysene	ng/mL	0	-0.05	0.05	yes
Benzo(b)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(b+j)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(k)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(a)pyrene	ng/mL	0	-0.05	0.05	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.05	0.05	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.05	0.05	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.05	0.05	yes

Date Acquired: October 04, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	98.60	80	120	yes
Acenaphthylene	ng/mL	90.00	80	120	yes
Acenaphthene	ng/mL	96.60	80	120	yes
Fluorene	ng/mL	100.00	80	120	yes
Phenanthrene	ng/mL	87.00	80	120	yes
Anthracene	ng/mL	90.80	80	120	yes
Fluoranthene	ng/mL	92.00	80	120	yes
Pyrene	ng/mL	93.80	80	120	yes
Benzo(a)anthracene	ng/mL	92.40	80	120	yes
Chrysene	ng/mL	105.80	80	120	yes
Benzo(b)fluoranthene	ng/mL	86.00	80	120	yes
Benzo(k)fluoranthene	ng/mL	83.40	80	120	yes
Benzo(a)pyrene	ng/mL	88.40	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	99.40	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	101.20	80	120	yes
Benzo(g,h,i)perylene	ng/mL	101.20	80	120	yes

Date Acquired: October 04, 2019

Salinity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	-0.0791166	-0.4	0.5	yes
Magnesium	mg/L	-0.000709143	-0.1	0.1	yes
Sodium	mg/L	0.018668	-0	2	yes
Potassium	mg/L	0.0133016	-0.5	0.7	yes
Chloride	mg/L	1.3992	0	5	yes
Sulfate-S	mg/L	0.0455316	-0	1	yes

Date Acquired: October 04, 2019

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Electrical Conductivity	dS/m	0.63	0.59	20	0.01	yes
Calcium	mg/kg	41.7	38.0	20	0.6	yes

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
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Report Number: 2473658

Salinity - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Magnesium	mg/kg	6.6	6.0	20	0.6	yes
Sodium	mg/kg	4	4	20	1	yes
Potassium	mg/kg	5	5	20	1	yes
Chloride	mg/kg	5	4	15	3	yes
Sulfate-S	mg/kg	4.8	4.7	20	1.2	yes
Date Acquired:	October 07, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Electrical Conductivity	dS/m	2.00	1.73	2.33	yes
% Saturation	%	50	39	65	yes
Calcium	mg/L	403	289.0	481.6	yes
Magnesium	mg/L	86.6	64.6	107.2	yes
Sodium	mg/L	45	32	53	yes
Potassium	mg/L	19.7	14.4	24.0	yes
Chloride	mg/L	38	29	48	yes
Sulfate-S	mg/L	241	178	294	yes
Date Acquired:	October 04, 2019				
Electrical Conductivity	dS/m	31.7	26.80	35.20	yes
Calcium	mg/L	251	230.2	261.4	yes
Magnesium	mg/L	97.9	92.1	104.1	yes
Sodium	mg/L	248	225	264	yes
Potassium	mg/L	248	222.6	270.6	yes
Chloride	mg/L	2100	1871	2231	yes
Sulfate-S	mg/L	149	138	156	yes
Date Acquired:	October 04, 2019				

Soil Acidity

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	0.433232	-20.010	20.010	yes
Date Acquired:	October 09, 2019				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	100.29	91	110	yes
Date Acquired:	October 09, 2019				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH	pH	6.9	6.8	0	0.3	yes
Date Acquired:	October 04, 2019					
Sulfur	µg/g	<10	<10	30	5.000	yes
Date Acquired:	October 09, 2019					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
pH	pH	6.6	6.2	7.7	yes
Date Acquired:	October 04, 2019				
Sulfur	µg/g	16000	14101.100	17360.900	yes
Date Acquired:	October 09, 2019				

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1381283**
Control Number:
Date Received: Oct 3, 2019
Date Reported: Dec 7, 2019
Report Number: 2473658

Volatile Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
F1 C6-C10	ng	0	-10	10		yes
Date Acquired:	October 04, 2019					

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
F1 C6-C10	mg/kg	<10	<10	50	0	yes
F1 -BTEX	mg/kg	<10	<10	50	0	yes
Date Acquired:	October 04, 2019					

Water Soluble Parameters

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Chromium (VI)	mg/L	0	-0.10	0.10		yes
Date Acquired:	October 04, 2019					

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Chromium (VI)	mg/kg	0.10	0.10	10	0.01	yes
Date Acquired:	October 04, 2019					

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
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Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Oct 4, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Oct 8, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	APHA	*	Colorimetric Method, 3500-Cr B	Oct 23, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Oct 4, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Oct 8, 2019	Element Edmonton - Roper Road
1:5 Water Soluble Extraction	McKeague	*	Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23	Oct 23, 2019	Element Edmonton - Roper Road
Acid Herbicides - Soil	US EPA	*	Solvent Extractable Nonvolatile Compounds by HPLC/TS/MS or UV Detection, 8321 B	Oct 7, 2019	Element Calgary
BTEX-CCME - Soil	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Oct 4, 2019	Element Calgary
BTEX-CCME - Soil	US EPA	*	Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	Oct 4, 2019	Element Calgary
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Oct 4, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Oct 8, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	EPA	*	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	Oct 23, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Oct 4, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Oct 8, 2019	Element Edmonton - Roper Road
Metals ICP (Hot Block) in soil	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Oct 23, 2019	Element Edmonton - Roper Road
Neutral Herbicides - Soil	US EPA	*	OC Pesticides by Gas Chromatography, 8081B	Oct 9, 2019	Element Calgary
Nutrients in General Soil	Comm. Soil Sci. Pl. Anal.	*	Modified Kelowna Soil Test, Vol 26, 1995	Oct 4, 2019	Element Edmonton - Roper Road
Organochlorine Pesticides - Soil	US EPA	*	OC Pesticides by Gas Chromatography, 8081B	Oct 9, 2019	Element Calgary

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By: BF/KM
Company: Tetra Tech Canada

Project ID: 704-SWM.SWOP04076-02
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Method Name	Reference		Method	Date Analysis Started	Location
PAH - Soil	AEP		Index of Additive Cancer Risk (IACR), IACR	Oct 4, 2019	Element Calgary
PAH - Soil	US EPA	*	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Oct 4, 2019	Element Calgary
Particle Size Analysis - GS	Carter	*	Hydrometer Method, 55.3	Oct 4, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	ASTM	*	Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing, C 117-17	Oct 4, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	ASTM	*	Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing, C 117-17	Dec 7, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	Carter	*	Procedure for Particle Size Separation, 55.2.3	Oct 4, 2019	Element Edmonton - Roper Road
Particle Size by Wet Sieve	Carter	*	Procedure for Particle Size Separation, 55.2.3	Dec 7, 2019	Element Edmonton - Roper Road
PCB - Soil	US EPA	*	Polychlorinated Biphenyls (PCBs) by Gas Chromatography, 8082A	Oct 4, 2019	Element Calgary
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Oct 4, 2019	Element Edmonton - Roper Road
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Oct 7, 2019	Element Edmonton - Roper Road
pH by CaCl2 (1:2 ratio) in soil	McKeague	*	pH in 0.01M Calcium Chloride, 3.11	Oct 23, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Oct 4, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Oct 7, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	APHA	*	Automated Ferricyanide Method, 4500-Cl-E	Oct 23, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Oct 4, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Oct 7, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Oct 9, 2019	Element Edmonton - Roper Road
Saturated Paste in General Soil	Carter	*	Electrical Conductivity and Soluble Ions, Chapter 15	Oct 23, 2019	Element Edmonton - Roper Road
Sublet to SRC Geoanalytical	Ext. Lab		Analysis performed by external laboratory, .	Oct 4, 2019	Saskatchewan Research Council Geoanalyti
Sublet to SRC Geoanalytical	Ext. Lab		See attached test report,	Oct 4, 2019	Saskatchewan Research Council Geoanalyti
Sulfur (Elemental) - VAN	Element-in house		Elemental sulfur, TM SOIL 004-60	Oct 9, 2019	Element Vancouver
TEH-CCME-Soil (Shake)	CCME	*	Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	Oct 4, 2019	Element Calgary

** Reference Method Modified*

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To:	Tetra Tech EBA Inc 14940 - 123 Avenue Edmonton, AB, Canada T5V 1B4	Project ID:	704-SWM.SWOP04076-02	Lot ID:	**1381283**
Attn:	Mark Fawcett	Project Name:	Ryley 2019 SMP	Control Number:	
Sampled By:	BF/KM	Project Location:	Ryley, AB	Date Received:	Oct 3, 2019
Company:	Tetra Tech Canada	LSD:		Date Reported:	Dec 7, 2019
		P.O.:		Report Number:	2473658
		Proj. Acct. code:			

References

AEP	Alberta Tier 1 Soil and Groundwater Remediation Guidelines
APHA	Standard Methods for the Examination of Water and Wastewater
ASTM	Annual Book of ASTM Standards
Carter	Soil Sampling and Methods of Analysis.
CCME	Canadian Council of Ministers of the Environment
Comm. Soil Sci. Pl.	Communications in Soil Science and Plant Analysis
Element-in house	In house method
EPA	Environmental Protection Agency Test Methods - US
Ext. Lab	External Laboratory
McKeague	Manual on Soil Sampling and Methods of Analysis
US EPA	US Environmental Protection Agency Test Methods

Comments:

- Oct 22, 2019 - Report was issued to include addition of Metals on samples 11 and 12 as well as salinity on samples 25, 27, 33, 35, 38, 40, 41, 43, 50 and 51 as requested by Brent Finnestad of Tetra Tech on Oct.22, 2019. Previous report 2447876.
- Dec 06, 2019 - Report was issued to correct for missing particle size by sieve analysis on sample#3. Previous report 2455363.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Report Transmission Cover Page

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By:
Company:

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Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
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P.O.:
Proj. Acct. code:

Lot ID: **1396314**
Control Number:
Date Received: Dec 6, 2019
Date Reported: Dec 7, 2019
Report Number: 2473697

Contact	Company	Address
Accounts Payable	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: EBA.accounts.Payable@tetratech.

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

Contact	Company	Address
Brent Finnestad	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2121 Fax: (780) 454-5688 Email: brent.finnestad@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Chemistry File	Test Report
Email - Multiple Reports By Agreement	EBA ESDAT Sample File	Test Report

Contact	Company	Address
Data Management	**Tetra Tech EBA Inc**	100, 140 Quarry Park Blvd SE Calgary, AB T2C 3G3 Phone: (403) 203-3355 Fax: Email: EBA.labdata@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Multiple Reports By Lot	EBA ESDAT Sample File	Test Report
Email - Multiple Reports By Lot	Legacy Reverse Crosstab in CSV	Test Report
Email - Multiple Reports By Lot	PDF	COC / Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report

Contact	Company	Address
Mark Fawcett	**Tetra Tech EBA Inc**	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email: mark.fawcett@tetratech.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	AB Tier 1 Custom Excel	Test Report
Email - Single Report	EBA ESDAT Chemistry File	Test Report
Email - Single Report	EBA ESDAT Sample File	Test Report
Email - Single Report	PDF	Invoice

Notes To Clients:

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Analytical Report

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By:
Company:

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1396314**
Control Number:
Date Received: Dec 6, 2019
Date Reported: Dec 7, 2019
Report Number: 2473697

Reference Number	1396314-1	1396314-2
Sample Date	Dec 06, 2019	Dec 06, 2019
Sample Time	NA	NA
Sample Location		
Sample Description	19-1 0-13	19-2 0-15
Matrix	Soil	Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydrocarbons - Soil						
Naphthalene	Dry Weight	mg/kg	<0.01	<0.01		0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Fluorene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Phenanthrene	Dry Weight	mg/kg	<0.01	0.01		0.01
Anthracene	Dry Weight	mg/kg	<0.003	<0.003		0.003
Fluoranthene	Dry Weight	mg/kg	<0.01	<0.01		0.010
Pyrene	Dry Weight	mg/kg	<0.01	<0.01		0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	<0.01		0.01
Chrysene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	<0.05		0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	<0.05		0.05
CB(a)P	B(a)P Total Potency Equivalents	mg/kg	<0.001	0.006		0.001
IACR_Coarse	Index of Additive Cancer Risk		<0.001	<0.001		0.001
IACR_Fine	Index of Additive Cancer Risk		<0.001	<0.001		0.001
PAH - Soil - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	88	97		50-140
2-Fluorobiphenyl	PAH - Surrogate	%	89	87		50-140
p-Terphenyl-d14	PAH - Surrogate	%	99	90		50-140

Approved by:

Jimmy Tran
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Quality Control

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By:
Company:

Project ID: 704-SWM.SWOP04076-02
Project Name: Ryley 2019 SMP
Project Location: Ryley, AB
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1396314**
Control Number:
Date Received: Dec 6, 2019
Date Reported: Dec 7, 2019
Report Number: 2473697

PAH - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	77.52	50	140	yes
2-Fluorobiphenyl	%	74.85	50	140	yes
p-Terphenyl-d14	%	85.93	50	140	yes

Date Acquired: December 07, 2019

Polycyclic Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.010	0.010	yes
Acenaphthylene	ng/mL	0	-0.05	0.05	yes
Acenaphthene	ng/mL	0	-0.05	0.05	yes
Fluorene	ng/mL	0	-0.05	0.05	yes
Phenanthrene	ng/mL	0	-0.01	0.01	yes
Anthracene	ng/mL	0	-0.003	0.003	yes
Fluoranthene	ng/mL	0	-0.010	0.010	yes
Pyrene	ng/mL	0	-0.010	0.010	yes
Benzo(a)anthracene	ng/mL	0	-0.01	0.01	yes
Chrysene	ng/mL	0	-0.05	0.05	yes
Benzo(b)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(b+j)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(k)fluoranthene	ng/mL	0	-0.05	0.05	yes
Benzo(a)pyrene	ng/mL	0	-0.05	0.05	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.05	0.05	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.05	0.05	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.05	0.05	yes

Date Acquired: December 07, 2019

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	103.00	80	120	yes
Acenaphthylene	ng/mL	97.40	80	120	yes
Acenaphthene	ng/mL	95.60	80	120	yes
Fluorene	ng/mL	99.00	80	120	yes
Phenanthrene	ng/mL	97.40	80	120	yes
Anthracene	ng/mL	105.60	80	120	yes
Fluoranthene	ng/mL	98.00	80	120	yes
Pyrene	ng/mL	98.20	80	120	yes
Benzo(a)anthracene	ng/mL	107.80	80	120	yes
Chrysene	ng/mL	95.00	80	120	yes
Benzo(b)fluoranthene	ng/mL	108.60	80	120	yes
Benzo(k)fluoranthene	ng/mL	112.20	80	120	yes
Benzo(a)pyrene	ng/mL	105.60	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	99.00	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	91.00	80	120	yes
Benzo(g,h,i)perylene	ng/mL	100.00	80	120	yes

Date Acquired: December 07, 2019

Element
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: info.Edmonton@element.com
W: element.com

Methodology and Notes

Bill To: Tetra Tech EBA Inc
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Mark Fawcett
Sampled By:
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Project ID: 704-SWM.SWOP04076-02
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P.O.:
Proj. Acct. code:

Lot ID: **1396314**
Control Number:
Date Received: Dec 6, 2019
Date Reported: Dec 7, 2019
Report Number: 2473697

Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
PAH - Soil	AEP		Index of Additive Cancer Risk (IACR), IACR	Dec 7, 2019	Element Calgary
PAH - Soil	US EPA	*	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Dec 7, 2019	Element Calgary

** Reference Method Modified*

References

AEP	Alberta Tier 1 Soil and Groundwater Remediation Guidelines
US EPA	US Environmental Protection Agency Test Methods

APPENDIX F

RECORD OF SITE CONDITION FORM

Record of Site Condition

1 REPORT AND FORM INFORMATION

Title of report	2019 Soil Monitoring Program, Clean Harbors Ryley Industrial Waste Management Facility		
Report date (*dd-mon-yyyy*)	January 2020	Record of Site Condition (RSC) ID No.[Ψ]	

2 SITE IDENTIFICATION AND PHYSICAL LOCATION

2.1 Site name	Clean Harbors Ryley Industrial Waste Management Facility		
2.2 Address of site	Box 390		
	Municipality	Ryley	**Alberta**

2.3 Legal land description of site *(if multiple, list all.)*

Plan, Block, Lot (PBL)			Alberta Township System (ATS)					
Plan	Block	Lot	LSD	Quarter	Section	Township	Range	Meridian
				SE	09	050	17	4

3 STAKEHOLDERS

3.1 Operator

Company	Clean Harbors Canada, Inc.	Contact person	Stan Yuha
Mailing address	P.O. Box 390 Ryley, AB T0B 4A0	Position held	Facility Manager
		Business phone No.	780-663-2509
		Business fax No.	780-663-3539
		Business e-mail	yuha.stan@cleanharbors.com

3.2 Consultant ☐ Not applicable

Company	Tetra Tech Canada Inc.	Contact person	Mark Fawcett
Mailing address	**14940 - 123 Avenue** **Edmonton, AB T5V 1B4**	Position held	Senior Soil Scientist
		Business phone No.	587-460-3505
		Business fax No.	780-454-5688
		Business e-mail	mark.fawcett@tetratech.com

3.3 Landowner(s)

Land type	☒ Private ☐ Special Areas ☐ Parks and protected area ☐ Public (*if not private, provide Disposition No.: _____)*
Landowner(s)	☒ Same as operator ☐ Other

[Ψ]: Do not fill in. Reserved for internal administrative purposes only.

3.4 Occupant(s)			
Are there occupants at the site?	☐ Yes	☒ No	☐ To be determined (TBD)
Occupant(s)	☐ Same as operator	☐ Same as landowner	☐ Other
What is the type of occupancy?	☐ Apartment building	☐ Town house	☐ Single detached house
	☐ Agricultural	☐ Industrial	☐ Commercial
	☐ Other (*specify*) _____		

4 OPERATING STATUS

☒ Operating ☐ Suspended ☐ Abandoned ☐ Decommissioning in progress ☐ Closed
☐ Reclaimed (*provide Reclamation Certificate No.(s):* _____) ☐ Not applicable

5 TYPE OF ACTIVITY AND SITE

5.1 Petroleum Storage Tank Site ☒ Yes

5.1.1 ESRD file No.(s)		PTMAA site No.	6021

5.1.2 Types of activity

☐	Retail gas station	☐	Aviation fuelling station	☒	Bulk fuel	☐	Other *(specify)*: _____

5.2 Upstream Oil and Gas Facility ☐ Yes

5.2.1 ESRD file No.(s)		AER approval No.(s)	

5.2.2 AER authorization type ☐ Approval ☐ License ☐ Permit ☐ Order ☐ Other (*specify*)_____

5.2.3 Types of activity

☐	Wellsite and associated facility	☐	Satellite	☐	Battery	☐	Pipeline
☐	Compressor and pumping station	☐	Other (*specify*): _____				

5.3 Approved Facility Under Environmental Protection and Enhancement Act (EPEA) ☒ Yes

5.3.1 ESRD approval No.(s)	10348-03-00	AER approval No.(s)	

5.3.2 Types of approved activity

☐	Chemical manufacturing plant	☐	Enhanced recovery in-situ oil sands or heavy oil processing plant	☐	Fertilizer manufacturing plant	☒	Landfill
☐	Metal manufacturing plant	☐	Oil refinery	☐	Oilsands processing plant	☐	Oil production site
☐	Pesticide manufacturing plant	☐	Petrochemical manufacturing plant	☐	Pipeline	☐	Power plant
☐	Pulp and paper processing plant	☐	Sour gas processing plant	☐	Sulphur manufacturing or processing plant	☒	Waste management facility
☐	Wood treatment plant	☐	Other *(specify):* _____				

5.4 Facility Under EPEA Code of Practice	☒ Yes		
5.4.1 ESRD registration No.(s)	10348-03-00	**AER registration No.(s)**	

5.4.2 Type of Code of Practice

☐	Asphalt paving plant	☐	Compressor and pumping station	☐	Concrete producing plant	☒	Landfill
☐	Pesticides	☐	Pipeline	☐	Land treatment of soils containing hydrocarbons	☐	Sand and gravel pit
☐	Small incinerator	☐	Sweet gas processing plant	☐	Other *(specify)*: _____		

5.5 Other Activity ☐ Yes

5.5.1 ESRD file No.(s)		Other site ID No.(s)		Authorized by	

5.5.2 Types of activity

☐	Dry cleaning operation	☐	Highway maintenance yard	☐	Transportation
☐	Other *(specify)*: _____				

6 SITE CHARACTERIZATION

6.1 What Environmental Site Assessments (ESA) Have Been Conducted and Completed to Date?

☐ Phase I ESA
☒ Phase II ESA (*check all that apply.*)
☒ Initial intrusive sampling ☒ delineation completed ☐ post-remediation monitoring ☐ final confirmatory sampling

6.2 Contaminants of Potential Concern (COPC)

6.2.1 Does the site have any of the conditions that require the mandatory use of *Alberta Tier 2 Soil and Groundwater Remediation Guidelines* (ESRD, 2007 and updates)? *(check all that apply in Section 6.2.1.1.)*

☐ Yes ☒ No *(➔proceed to Section 6.2.2.)*

6.2.1.1 Identify any conditions that require the approaches of the Alberta Tier 2 guidelines. *(see Alberta Tier I Soil and Groundwater Remediation Guidelines (ESRD, 2007 and updates), for details.)*

☐	Contamination within 30 cm of building foundation	☐	Unusual building feature (*eg. earthen floor*)	☐	Contamination within 10 m distance of surface water body
☐	Fractured bedrock	☐	Potentially high hydraulic conductivity *(> 10^{-5} m/sec.)*	☐	Other (*see Alberta Tier 1 guidelines and specify):* _____

6.2.1.2 Did the Alberta Tier 2 approach lead to a soil or groundwater guideline that was lower than the corresponding Tier 1 guideline for the same contaminant(s)?

☐ Yes ☐ TBD ☐ No *(➔proceed to Section 6.2.2.)*

6.2.1.3 If you answered 'yes' or 'TBD' to Section 6.2.1.2, identify the group of contaminants for each COPC with a mandatory Tier 2 guideline that is lower than the corresponding Tier 1 guideline (*check all that apply*, *see Alberta Tier 1 guidelines, Tables 1-4 for detailed listing).*

☐	General and inorganic parameters	☐	Metals
☐	Hydrocarbons	☐	Halogenated aliphatics
☐	Chlorinated aromatics	☐	Pesticides
☐	Other organics	☐	Radionuclides
☐	Salt	☐	Other (*specify*): _____

6.2.1.4 Did any past or current ESA relevant to this investigation identify an exceedance of the mandatory Tier 2 guidelines referred to in Section 6.2.1.3 (e.g. Tier 2 guidelines that are lower than the corresponding Tier 1 guidelines)? ☐ Yes ☐ No ☐ TBD

6.2.1.5 If you answered 'yes' in Section 6.2.1.4, have all relevant COPC been remediated to meet the mandatory Tier 2 guidelines? ☐ Yes ☐ No

6.2.2. Did any past or current ESA relevant to this investigation identify a drilling waste disposal area?

☐ Yes ☒ No *(➔proceed to Section 6.2.3.)*

6.2.2.1 If a drilling waste disposal area was identified, did any past or current ESA identify non-compliance with the compliance options outlined in *Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification* (AER, 2014), as amended?

☐ Yes ☐ No

6.2.2.2 If you answered 'yes' in Section 6.2.2.1, have all COPC been remediated to meet the compliance options outlined in *Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification* (AER, 2014), as amended?

☐ Yes ☐ No

6.2.2.3 For any COPC that did not meet the compliance options in Assessing Drilling Waste Disposal Areas, identify the group of contaminants (*check of all that apply*, *see the Alberta Tier 1 guidelines, Tables 1-4 for detailed listing).*

☐	General and inorganic parameters	☐	Metals
☐	Hydrocarbons	☐	Halogenated aliphatics
☐	Chlorinated aromatics	☐	Pesticides
☐	Other organics	☐	Radionuclides
☐	Salt	☐	Other (*specify*): _____

6.2.3 For all areas and COPCs not assessed under Sections 6.2.1 or 6.2.2, did any ESA relevant to this investigation identify an exceedance over the Alberta Tier 1 guidelines?

☒ Yes ☐ No *(➔proceed to Section 6.3.)*

6.2.3.1 If you answered 'yes' in Section 6.2.3, have all COPC been remediated to meet the Alberta Tier 1 guidelines?

☐ Yes ☒ No ☐ TBD

6.2.3.2 For any COPC that exceeded Alberta Tier 1 guidelines in Section 6.2.3.1, identify the group of contaminants. (*check all that apply*, *see the Alberta Tier 1 guidelines, Tables 1-4 for detailed listing.)*

☒	General and inorganic parameters	☒	Metals
☒	Hydrocarbons	☐	Halogenated aliphatics
☐	Chlorinated aromatics	☐	Pesticides
☐	Other organics	☐	Radionuclides
☐	Salt	☐	Other (*specify*): _____

6.3 Status of Investigation

6.3.1 Identify soil and groundwater guidelines used to assess the COPCs that are the subject of this investigation *(check all that apply).*

- ☒ *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* – 2007 and updates,
  - ☐ Coarse grained ☒ Fine grained
- ☐ *Alberta Tier 2 Soil and Groundwater Remediation Guidelines* – 2007 and updates,
  - ☐ Pathway exclusion ☐ Guideline adjustment ☐ Site specific remediation objectives
- ☐ *Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification* (AER, 2014), as amended
- ☒ Other (*specify*): Typical background concentrations, published soil data, and professional judgement

6.3.2 What land use classification(s) is used?

☐ Natural ☒ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☐ Other (*specify:*_____)

6.3.3 What is the outcome of the investigation? *(check one only.)*

- ☐ For all COPCs on-site and off-site, no exceedance has been found above any applicable soil and groundwater guidelines in any prior and current assessments.
- ☐ All contamination on-site and off-site has been completely remediated and meets the applicable soil and groundwater guidelines.
- ☒ One or more COPC still exceeds the applicable soil or groundwater guidelines.

6.3.4 How many contaminated areas are there currently at the site?

4 ☐ None ☐ TBD

6.3.5 Are all contaminated areas and potential contaminated areas assessed during this investigation?

☒ Yes ☐ No

6.3.6 For all areas of potential environmental concern, list the dates when the contamination was discovered *(specify dd-mon-yyyy)***: 06-Oct-2014; 08-Oct-2014; 10-Oct-2014; 21-Nov-2017; 09-Aug-2018; 24-Sep-2019; 25-Sep-2019; 02-Oct-2019**

6.3.7 For all areas that have been identified in Section 6.3.4, have all substance releases been reported to ESRD?

☐ Yes ☒ No ☐ Not applicable

6.3.8 If the answer to Section 6.3.7 is 'yes', list all Incident No.(s) (*attach separate sheet if necessary*):

_____; _____ ☐ Not assigned

6.3.9 What is the approximate, cumulative amount of land area remaining exceeding applicable remediation guidelines? _____ (m^2) ☐ None ☒ TBD

6.3.10 Is there non-aqueous phase liquid (NAPL) product remaining on site? ☐ Yes ☒ No ☐ TBD

6.3.11 Is there non-aqueous phase liquid (NAPL) product remaining off site? ☐ Yes ☒ No ☐ TBD

6.3.12 What is the remediation status of the contaminated areas at site?

☐	No remediation required	☐	Site has exceedance but no remediation plan
☒	Remediation plan developed	☐	Active remediation
☐	Remediation completed	☐	Post remediation assessment completed
☒	Ongoing risk management plan – on-site	☐	Ongoing risk management plan – off-site
☐	Remediation Certificate issued for some area(s) *(provide Remediation Certificate No.(s):_____)*		
☐	Remediation Certificate cancelled for some area(s) *(provide Remediation Certificate No.(s):_____)*		

Direction for Completing the Remainder of the Form

Attach the analytical summary tables of the COPCs that are the subject of this investigation and still present at this site. A detailed listing of COPCs can be found with Tables 1-4 in *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (ESRD, 2007 and updates), as amended. Refer to the *RSC User's Guide* for detailed information on format and other requirements regarding the summary table.

For the remainder of the form, follow the directions below:

- If the COPCs on-site and off-site have never exceeded any applicable soil and groundwater guidelines in any prior and current assessments, ➔proceed to Section 8, or
- If the COPCs on-site and off-site have been completely remediated and meet the applicable soil and groundwater guidelines, ➔proceed to Section 8, or
- For all other circumstances, continue with Section 6.4.

6.4 Key Transport Factors for Existing COPCs

6.4.1 What is the horizontal distance to the nearest water well from the edge of the nearest contaminated area?

☐ 0-50 m ☐ 50-100 m ☐ 100-300 m ☒ 300-1000 m ☐ > 1000 m

6.4.2 What is the horizontal distance to the nearest surface water body from the edge of the contaminated area?

☐ ≤10 m ☐ 10-50 m ☐ 50-100 m ☒ 100-300 m ☐ 300-1000 m ☐ > 1000 m

6.4.3 Does delineation achieve closure above the groundwater water table that is nearest to the ground surface?

☐ Yes *(➔ go to Section 6.5.)* ☐ No ☒ TBD

6.4.4 Is the groundwater that is nearest the ground surface a domestic use aquifer (DUA) as defined in Alberta Tier 2 guidelines?

☒ Yes ☐ No ☐ TBD ☐ Not required (NR)

6.4.5 Is there a hydraulic barrier, as defined in Alberta Tier 2 guidelines, between the base of the contaminated area and the DUA?

☐ Yes ☐ No ☒ TBD ☐ NR

6.4.6 If you answered 'yes' to Section 6.4.5, provide the measured largest value of the hydraulic conductivity (as value ×10^{-7} m/sec.) for the 5.0 m vertical layer from the bottom of the contaminated zone.

_____(×10^{-7} m/sec.) ☐ TBD ☐ NR

6.5 On-site Characterization

6.5.1 What is the dominant soil texture that governs substance transport at the site?

☐ Coarse grained ☒ Fine grained ☐ TBD ☐ Not applicable (*must identify reason in Section 6.2.1.1.)*

6.5.2 What are the shallowest and deepest measured depths (meters below ground surface) of the water table at site?

Shallowest: **0.31** (m) Deepest: 6.70 (m) ☐ TBD ☐ NR (*specify max. depth assessed*: _____(m))

6.5.3 What is the dominant horizontal direction of groundwater flow for the near surface water table?

(*N, NW, etc.:* NE) ☐ TBD ☐ NR

6.5.4 What is the existing land use classification?

☐ Natural ☒ Agricultural ☐ Residential ☐ Commercial ☒ Industrial ☐ Other (*specify*) _____

6.5.5 What is the end land use classification?

☐ Natural ☒ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☐ Other (*specify*) _____

6.5.6 Identify exposure pathways for which the applicable guidelines are exceeded on-site *(check all that apply).*			
☐	Vapour inhalation	☐	Soil ingestion
☐	Ingestion of potable water	☒	Soil dermal (skin) contact
☒	Fresh water aquatic life	☒	Soil contact for plants and invertebrates
☐	TBD	☐	Other *(specify)*: _____

6.6 Off-site Characterization

6.6.1 Are there COPCs off-site exceeding applicable soil or groundwater guidelines?

☒ No *(➔if on-site contamination was reported, proceed to Section 7, otherwise, proceed to Section 8.)*
☐ Yes ☐ TBD

6.6.2 What is the current land use classification for any off-site area(s) identified in Section 6.6.1?

☐ Natural ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☐ Other (*specify*) _____

6.6.3 What is the end land use classification for any off-site area(s) identified in Section 6.6.1?

☐ Natural ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☐ Other (*specify*) _____

6.6.4 Is there any substance concentration under a road allowance exceeding the applicable soil or groundwater guidelines?

☐ Yes ☐ No (➔*proceed to Section 6.6.6.)* ☐ TBD

6.6.5 What is the most sensitive land use classification adjacent to the road allowance?

☐ Natural ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☐ Other (*specify*) _____

6.6.6 Identify exposure pathways for which the applicable guidelines are exceeded off-site *(check all that apply).*			
☐	Vapour inhalation	☐	Soil ingestion
☐	Ingestion of potable water	☐	Soil dermal (skin) contact
☐	Fresh water aquatic life	☐	Soil contact for plants and invertebrates
☐	TBD	☐	Other *(specify):* _____

7 RISK MANAGEMENT PLAN (RMP)

7.1 What is the Plan for Contaminated Areas Still Remaining on and off the Site? *(check one only.)*

- ☐ Complete remediation *(➔proceed to Section 8).*
- ☒ Partial remediation with risk management for some residual contamination.
- ☐ Risk management for all remaining contamination.

7.2 Key Progress of RMP

7.2.1 If the site needs an on-going RMP, answer all the following questions that apply to the RMP.

☐ Yes	☒ No	Are contaminated areas completely delineated horizontally and vertically in soil?
☒ Yes	☐ No	Are contaminated areas completely delineated horizontally and vertically in groundwater?
☐ Yes	☒ No	Is source identified and completely delineated?
☐ Yes	☒ No	Is source migrating or has migrated off-site?
☒ Yes	☐ No	Is source left as is?
☐ Yes	☒ No	Is source partially removed and residual source being managed?
☒ Yes	☐ No	Is source controlled with physical or administrative methods?
☒ Yes	☐ No	Are all pathways of concern identified?
☒ Yes	☐ No	Have all relevant receptors been identified and protected?
☐ Yes	☒ No	Is there a monitoring program in place to verify RMP success?
☐ Yes	☒ No	Are there third parties related to this RMP? (*if the answer is 'no', skip the next question.*)
☐ Yes	☐ No	If there are third parties, have all of them accepted the RMP?
☒ Yes	☐ No	Is there a commitment from person(s) responsible to implement and monitor the RMP until final remediation guidelines are achieved?
☐ Yes	☒ No	Is there a contingency plan in place should the RMP fail?
☐ Yes	☒ No	Is the RMP implemented for the site?

Public Disclosure and Privacy Notification

The *Record of Site Condition* form is a public record that is disclosed in accordance with section 35 of the *Environmental Protection and Enhancement Act, Disclosure of Information Regulation*, and *Ministerial Order 23/2004*. Reasonable efforts have been made to minimize collection of personal information where possible. Personal information on the form is collected under the authority of section 12(c) and other provisions of the *Environmental Protection and Enhancement Act* and is in compliance with section 33(a) and 33(c) of the *Freedom of Information and Protection of Privacy Act* (FOIP). Personal information collected on this form will be used by Alberta Environment and Sustainable Resource Development (ESRD) or the Alberta Energy Regulator (AER), as the case may be, for the purposes of administering its programs.

Accuracy of Information

The information in this document has been submitted by persons other than ESRD or the AER. The Department, the Government of Alberta, and the AER cannot and do not warrant that the information in this document is current, accurate, complete, or free of errors. Persons accessing the information provided should not rely on it, and any reliance on the information provided is taken at the sole risk of the user. Users of this information are advised to conduct their own due diligence to satisfy themselves of the environmental condition of the property of interest.

8 DECLARATION

This *Record of Site Condition* form was prepared for the purpose of reporting on the state of environmental site conditions and, where applicable, for the purpose of remediation or reclamation, for:

Clean Harbors Ryley Industrial Waste Management Facility (site name) (the "Site").

I, as the licensed operator or authorized representative, have reviewed all information that was used in preparation of this form and I am satisfied that it was prepared in a manner consistent with the Applicable Standard[‡] together with any relevant additional guidance that is available from Alberta Environment and Sustainable Resource Development as of this date for conducting environmental site assessments.

Having conducted reasonable inquiries to obtain all relevant information, to my knowledge, the statements made in this form are true as of this date. I have disclosed all pertinent information of which I am aware concerning the historical and current environmental condition of the Site to the Director.

Any use which a third party, other than the Crown in right of Alberta or the AER, makes of this form, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. The undersigned accepts no responsibility for damages, if any, suffered by any third party, other than the Crown in right of Alberta and the AER, as a result of decisions made or actions based on this form. Any exclusions or disclaimers to the contrary contained in any attachment to this form are of no force or effect as against the Crown in right of Alberta and the AER.

Footnote ‡:

"Applicable Standard" means

a) for the purposes of upstream oil and gas sites,

i) *2010 Reclamation Criteria for Wellsites and Associated Facilities Application Guidelines* (ESRD 2011),

ii) CSA Standard Z769, *Phase II Environmental Site Assessment,* as amended, for any Phase II site assessment information used in preparation of this form on all upstream oil and gas sites not included in a) i);

b) for the purposes of all other sites, CSA Standard Z768, *Phase I Environmental Site Assessment,* as amended, for any Phase I site assessment information and with CSA Standard Z769, *Phase II Environmental Site Assessment,* as amended, for any Phase II site assessment information used in preparation of this form.

By signing below, I as the licensed operator or authorized representative, confirm the information provided herein is correct and complete, to the best of my knowledge and belief.

Clean Harbors Canada, Inc.	Stan Yuha	Facility Manager	Stan Yuha	29/Jan/2020
Name of operator	Name of authorized representative	Title of authorized representative (*e.g. officer, director*)	Signature	Date (*dd-mon-yyyy*)