Phase II Environmental Site Assessment
Historic Waste Disposal Site
Riverside Heavy Dry Waste
The City of Red Deer

Prepared For: **The City of Red Deer**
Prepared By: **Tiamat Environmental Consultants Ltd.**
Date: **February 26, 2014**
File: **12-435**

Unit 107, 2719 - 7 Avenue NE, Calgary, Alberta T2A 2L9
T. 403-640-9009 F. 403-640-9006

EXECUTIVE SUMMARY

On behalf of the City of Red Deer, Tiamat Environmental Consultants Ltd. (Tiamat) has conducted a Phase II Environmental Site Assessment on a parcel of land utilized for the disposal of dry waste. The waste site lies within the Waskasoo Park System and is bounded on the east by the Riverside Heavy Industrial Park.

The objective of this Phase II ESA is to assess the environmental quality of the subsurface soil and groundwater underlying the site. This report presents the scope of work, a summary of the results and our professional opinion respecting the environmental quality of the site.

This report is intended to complement the Phase I ESA dated September 24, 2013, prepared by Tiamat.

The key results of this Phase II ESA are as follow:

- Waste materials were encountered in a series of testholes advanced at various points along the hill slope through the fill material.

- Laboratory results of groundwater samples show elevated concentrations of routine water parameters and metals exceeding the Alberta Tier 1 Guidelines.

- Laboratory results of soil vapour show trace amounts of volatile organic compounds (VOCs) and siloxanes.

This Phase II ESA confirmed the presence of MSW in the upper central section of the hill slope. The thickness of the MSW deposit is about 6 m, more or less. The soil cover is a relatively permeable mix of sand and silt with a discontinuous unit of clay fill. The initial test results indicate the local groundwater has been mildly impacted as characterised by the presence of leachate constituents and comparative quality of the groundwater between the top of the hill and the toe of the hill slope. The results indicate the leachate constituents to be principally composed of nutrient type compounds of a mild strength.

TABLE OF CONTENTS

TABLE OF CONTENTS
Continued…

1.0 INTRODUCTION

On behalf of The City of Red Deer, Tiamat Environmental Consultants Ltd. (Tiamat) presents this Phase II Environmental Site Assessment (ESA) report for a potential historic waste disposal site designated as the Riverside Heavy Dry Waste Site.

The objectives of this Phase II ESA are to better understand the areal extent and the composition of the waste material. This report presents the scope of work, a summary of the results and our professional opinion respecting the subsurface environmental conditions associated with the historic waste materials. This report is intended to complement the Phase I ESA dated September 24, 2013.

1.1 Scope of Work

A summary of the key tasks for this Phase II ESA are outlined below:

Fieldwork

- Identify and locate underground utilities within the work areas on the site;
- Supervise the drilling of testholes (THs) located within the legal property lines of the site;
- Collect the soil samples for laboratory analyses of benzene, toluene, ethylbenzene, xylenes (BTEX), petroleum hydrocarbon fractions F1 (C_6-C_{10}), F2 (>C_{10}-C_{16}), F3 (>C_{16}-C_{34}), F4 (>C_{34}), EPA 8260 list of volatile organic compounds (VOCs), metals, chlorides (Cl^-) and nitrates/nitrites (NO_3^-/NO_2^-);
- Screen the soil cuttings to determine the feasibility to dispose of drill cuttings at a Class II landfill facility. Acceptance parameters for disposal include laboratory analyses of pH, soil flash point, paint filter, total organic carbon (TOC) and TCLP assay for BTEX compounds and metals;
- Each TH is completed with either a groundwater (MW) or vapour (VW) monitoring well or backfilled and abandoned;
- Collect groundwater samples for laboratory analyses of BTEX, hydrocarbon fractions F1, F2, VOCs, total and dissolved metals, Cl^-, sulfate (SO_4), ammonium (NH_4-N), phosphorus (P), TOC, chemical oxygen demand (COD), biochemical oxygen demand (BOD), NO_3^-/NO_2^-, total nitrogen (N), pH, electrical conductivity (EC), adsorbable organic halides (AOXs) and volatile fatty acids;
- Collect vapour samples for laboratory analyses of VOCs, oxygen (O_2), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), nitrogen (N), volatile hydrocarbons and siloxanes or volatile organic silicon compounds (VOSCs);

- Survey each test location for horizontal and vertical control relative to established ASCM (Alberta Survey Control Marker) datums within The City of Red Deer.

Report

- Prepare a report summarising the results including figures, tabulated data and our interpretation of the subsurface environmental conditions resulting from the historic waste disposal site.

2.0 SITE DESCRIPTION & ENVIRONMENTAL SETTING

This section provides general information of the site including a brief description of the location, surrounding land use(s), regional geology, hydrogeology and notable environmental conditions specific to the site.

2.1 Site Description and Environmental Setting

The potential historic waste material has been suspected to lie within two legal land descriptions. The larger portion to the north is situated within the NE 33-38-27 W4M and the smaller portion to the south lies within the SE 33-38-27 W4M. These two areas are contiguous and define the Riverside Heavy Dry Waste Site. The site is currently designated A2 – Environmental Preservation (Land Use Bylaw #3357/2006) and the municipal address is 4240 Northland Drive.

The site is situated on a hill slope in the northwest quadrant of the Riverside Heavy Industrial Park. The waste material lies within the east face slope that is landscaped by a mix of prairie fescue grasses, prairie wildflowers and weeds. It overlooks the river valley of the Red Deer River. Vehicular access onto the site is via a secured gate within the Red Deer Fire Training Centre. A mountain bike trail from the north side of 77 Street traverses the hill top along the entire westerly margin of the site. The east and north boundary of the site is bounded by a rail spur line operated by Canadian National Railway. On the north side of the site across the rail spur line is Northland Drive followed by the Red Deer Waste Water Treatment Plant. A permanent slough is situated at the base of the hill on the south. Various commercial/industrial businesses and the Fire Training Centre are in the vicinity of the site to the west and east. The nearest residential development is located west of Gaetz (50) Avenue, approximately 1,200 m from the site. A site plan showing the site and the surrounding land uses is presented as Figure 1.

A review of historical information indicates the historical waste disposal activity was conducted with agreement between the regulatory authorities and The City of Red Deer, refer to the September 24, 2013 Phase I ESA. Historical information suggests disposal activities of dry waste occurred on the site from 1994 to approximately 2007.

2.2 Notable Environmental Conditions for Special Consideration

In the early 1990s to about 2007, The City of Red Deer undertook corrective measures to stabilize the east slope by placing inert construction material (dry waste) onto the slope and seeding the reclaimed slope.

The reclaimed hill slope is completed as a natural area with limited access to the public. The slope across the hill side varies somewhat between the north and the south sections. The south side exhibits a steeper slope relative to the north side. The east slope mimics the south slope. The slough is utilized by wildlife.

The area is mapped outside of the 100-year flood fringe (Environment Canada and Alberta Environmental Protection, Edition 1, 1995). Following the recent severe June 2013 flood event, it is recognized the flood fringe may be updated following a review by the provincial authority.

There are no underground municipal utilities identified in the area of the historic waste site. The relative locations of nearby underground municipal utilities are shown on Figure 2.

Generally, potential environmental concerns arising from this historic waste site are grouped into three broad categories:

- Ground stability issue where the historic waste lies;
- Continual generation of soil vapour from the decomposing waste materials; and
- Lateral transport of groundwater, which passes through the waste material and ultimately migrates down to the Riverside Heavy Industrial Park in the Red Deer River Valley.

Several geochemical processes and physical settlement occurs as the buried historic waste materials decompose. At this site, there is some minor visual indicator for the ground cover on the hill slope to settle in a non-uniform or irregular manner. The testhole observations indicate the vegetation and underlying the loam appears to be variable across the site.

Landfill gas is a by-product of a geochemical process associated with the decomposing waste materials. The soil vapours comprising of constituents from landfill gas can migrate in the subsurface. The geochemical process also yields soluble hydrocarbons to the groundwater system with some volatile components capable of degassing into the soil vapour regime.

As surface infiltration percolates through the historic waste materials and contacts the groundwater table, leachate is formed. This leachate is a potentially polluting liquid that can adversely affect the local groundwater system.

Elements of testing in this Phase II ESA is an initial assessment of the subsurface conditions for soil vapour and leachate near the perimeter of the historic waste site relative to existing and potential future land developments.

2.3 Regional Geology and Hydrogeology

A summary of the published geological and hydrogeological information is presented in the September 24, 2013 Phase I ESA report.

Within the immediate area of the historic waste, the Red Deer River is located approximately 800 m east of the site. The slough, at its closest position, lies within 15 m, more or less south of the site. The CN spur line includes a drainage ditch along the west side of the track. The drainage ditch appears to channel surface run-off in two directions; the south portion to the slough and the north section to the north, towards Northland Drive.

Previous mitigative actions to stabilize the hill slope include the installation of a gravity drainage system to collect and direct surface infiltration from the hill slope to a drainage swale that is situated along the toe of the slope. The swale appears to divert the surface run-off to a drainage channel along the south side of Northland Drive. This gravity drainage system was installed, circa September 2000. There are no obvious environmental concerns for surface water run-on at the site.

Based on a local topographic map for this area, regional groundwater flow is expected to be east-northeast towards the Red Deer River. There may also be some local flow to the slough located south of the site.

It should be noted that local topography, geology, land development and soil disturbances might influence the local movement and pattern of groundwater. Furthermore, groundwater may also fluctuate from seasonal and climatic conditions.

2.4 Previous Investigations and Historic Perspective

Information obtained from The City of Red Deer indicates several past environmental investigations for the site. The past investigations were performed by various consultants to address the slope stability and proposal for dry waste disposal at the site.

The specific assessments that have been obtained as a part of the environmental assessment:

- Summary Report Former City Landfill Riverside Dry Waste, Part of 33-38-27-W4M, Red Deer, Alberta, April 2007. Prepared by Stantec Inc. and Parkland Geotechnical Consulting Ltd.

- Geotechnical Investigation – Slope Failure Investigation, Red Deer Riverside Industrial Park, Red Deer, Alberta, December 1993. Prepared by HBT AGRA Ltd.

- Geotechnical Investigation – Proposed Dry Waste Disposal Facility, Section 33-38-27-W4M, Red Deer, Alberta, January 1994. Prepared by HBT AGRA Ltd.

The above noted documents, as provided by The City of Red Deer were perused and discussed in the Phase I ESA report (Tiamat, 2013).

The potential historic waste disposal activity was suspected to have occurred over a period of about fourteen years, between 1994 and 2007. Documentation available to Tiamat indicates the Red Deer Regional Health Unit, Red Deer City Council and the Red Deer Planning Commission granted approval to place concrete and asphalt debris at the site. The reader should note, limited documentation and records during this period was made available to Tiamat.

The key results of the 2013 Phase I ESA are as follows:

- Historical records indicate the present configuration of the site has been largely unchanged. Currently, the site is zoned as environmental preservation and no municipal infrastructure lies on the site.

- Historic information suggests this landfill site has been used for the disposal of inert materials such as concrete, asphalt and soil since 1994 with disposal activities ending on or about the fall of 2007.

- Anecdotal information provided by The City of Red Deer suggests contaminated soils due to clean up of a gas station, drums of oil and contaminated soil from a city storm detention pond may have been placed at this waste disposal site.

- Records from regulatory agencies do not indicate any outstanding environmental concern on the site.

- The site is surrounded by the Northland Industrial Park, the Riverside Heavy Industrial Park and the Waskasoo Park. Utility right-of-ways border the west and east side of the site, respectively. There are presently no obvious activities on the adjacent lands that are interpreted as an environmental concern relative to the site.

- Adjacent and nearby developments include public parks, municipal reserves, residential homes and light commercial businesses. There are presently no obvious activities on the adjacent lands that are interpreted as an environmental concern relative to the site.

- At this time, there is no data to suggest an adverse impact has occurred to the water quality in the slough or to the wildlife within the Waskasoo Park. There is a potential for leachate to flow in a radial pattern from the site to the slough and river valley.

The findings of the 2013 Phase I ESA identify several uncertainties associated with this historic waste disposal site. In consultation with the Management of The City of Red Deer, a Phase II ESA should include an attempt to determine whether waste material is present in the hill and its composition. It is understood this information would assist the City to identify whether further efforts are necessary to manage environmental risks associated with historic waste material at this site relative to existing and future land uses in the vicinity of this site.

3.0 FIELD WORK

This section describes the fieldwork for this Phase II ESA. A description of the field methods and data quality assurance implemented by Tiamat for this Phase II ESA is provided in Appendix A. Testhole logs describing the subsurface stratigraphy and monitoring instrumentation are provided in Appendix B. Select photographs of testholes and groundwater monitoring wells are presented in Appendix C.

3.1 Underground Line Locates and Testhole Drilling

Prior to drilling, public and private underground utilities within the work area were confirmed to not be present within the site. The steepness of the hill slope required a track-mounted drill to navigate the hill side. The subsurface investigation commenced in the afternoon of Thursday, July 11 and was completed on Saturday, July 13, 2013.

A representative of Tiamat supervised an auger drill mounted on a track rig from Earth Drilling Co. of Calgary, Alberta to advance 152 mm diameter test holes at various locations across the site.

The testhole locations were selected with consideration of access for the drill rig. The drilling program is intended to determine whether subsurface waste material is present, its composition and areal footprint. Information concerning the potential locations of the historic waste from previous investigations (by others) was reviewed in the context to assist with drilling program.

Each testhole was drilled vertically to depths ranging between 3.7 m to 19.5 m below the ground surface. On completion of drilling either a groundwater monitoring well or soil vapour well was installed, or the testhole was backfilled and abandoned.

Each monitoring well consists of a 51 mm diameter PVC machine slotted screen section and a solid section of pipe. The annulus of the borehole was backfilled with Sil-9 sand to approximately 0.3 m above the screen section followed by granular bentonite to about 0.3 m from the surface. An above ground lockable protective steel well protector was installed at each well location.

Subsequent to establishing the depth of the testhole for a soil vapour well, a dedicated soil vapour well was assembled. Typically the soil vapour well consists of a 30 cm 0.020 machine slotted PVC screen and a 25 mm diameter PVC solid stand pipe. The screen section and brass valve assembly are mechanically threaded with stainless steel locking set screws.

A summary of the well completion details is presented in Table 1 and shown on the testhole logs in Appendix B. Each test location and monitoring well was surveyed for horizontal and vertical control by MRAC Surveys Ltd. of Red Deer, Alberta. Multiple ASCM points within The City of Red Deer were utilized to reduce survey errors. The specific ASCM points applied are listed in Table 1 and a copy of the specified ASCM information sheets are provided in Appendix A. The relative locations of each testhole are shown in Figure 2.

The soil profile was visually classified during drilling and bulk grab samples were retrieved at approximately 0.6 m intervals for field screening. In the event significant MSW (municipal solid waste) material is encountered an RKI Eagle 2 capable of simultaneously measuring the combustible and volatile vapour in the testhole at the surface was used. This was to assess whether potential methane and other VOCs were emanating from the testhole at concentrations deemed potentially hazardous for drilling operations. For example, should combustible vapours exceed the lower explosive limit or elevated VOCs greater than 35 ppm is encountered, drilling would temporarily cease until the level of vapours have subsided. Each on-site worker had a dedicated half-mask respirator with organic vapour filter as part of their respective personal protective equipment during drilling.

The drilling protocol for testhole(s) encountering MSW was to advance the drill such that contact is made with the underlying native soil. At locations where MSW was not found, the testhole was advanced to an appropriate depth to install either a soil vapour well or a groundwater well. Drill cuttings were stored in 1 cubic meter capacity tote bags for off-site disposal.

3.2 Site Monitoring and Groundwater Sampling

On Saturday, August 17, 2013, monitoring wells were field tested. Field measurements consisted of measurement of headspace vapours and the depth to liquid in each well. Groundwater samples were collected from the three newly installed monitoring wells, one located (MW-01) in an interpreted up-gradient position and two located (MW-02 and MW-03) on the down gradient margin relative to the site.

4.0 RESULTS

The area of the past backfilling activity for slope stabilization was referenced as the east facing slope.

Accordingly, the commercial/industrial criteria have been referenced to assess the environmental quality of the subsurface soil and groundwater beneath the site. It should be noted the assessment is to illustrate the relative environmental quality and is not intended to infer remedial objectives.

This section summarizes the field observations during drilling and field testing for this Phase II ESA. For clarity, the analytical results for soil, groundwater and soil vapours are discussed in Section 5.

4.1 Soil Profile

Testholes which did not encounter buried waste material generally exhibited a variable soil texture of sand, clay and minor amount of gravel. Following surficial fill material (prairie vegetation over loamy soil), the soil encountered was either a clay or sand material to a depth of 4.6 m to 7 m. Native clay underlies the fill material. At MW-02, a siltstone unit was identified to be bedrock.

Where found, the thickness of the soil cover (predominantly organic silt and sand) ranged from approximately 15 cm to 45 cm. In general, relatively inert construction debris (brick, concrete, asphalt, timber and minor amounts of glass and metal) was encountered across the majority of the site. The debris is combined with a mix of sand, silt and clay. MSW was encountered at some testholes in the central portion of the site. The MSW was a mixture of silty sand combined with typical dry construction waste (heavy wire, plastic, brick and concrete fragments, glass and wood).

Auger refusal was encountered at two testholes (TH-03 and TH-07), at an approximate depth of 3.4 m to 3.7 m, respectively. The refusal was suspected to be hard concrete. TH-03 and TH-07 were relocated north and re-drilled; MSW was encountered with clay fill to a depth of 7.6 m. Native clay was encountered at a depth of about 18 m below the ground surface.

Select cross sections of the site depicting the interpreted soil stratigraphy are presented as Figures 3A and 3B. A copy of the testhole logs is presented in Appendix B. Select photographs of the drilling are presented in Appendix C.

To verify the environmental quality of the drill cuttings, soil samples from each soil bag were submitted for laboratory testing. The soil tests performed were to ensure the soil can be disposed at The City Waste Management Facility. The analytical results are discussed in Section 5.1.

4.2 Groundwater Conditions

Static depth to groundwater was measured at each accessible monitoring well. The relative groundwater elevations are presented on Table 2. The groundwater elevations are plotted and the interpreted contours are illustrated as Figure 4. The depth to the groundwater at MW-01, near the crest of the hill was about 10.4 m below the ground surface while at MW-03, near the base of the slope, the groundwater was at a depth of about 2.6 m. Please note, MW-01 is about 24 m above MW-03. The measured groundwater elevations suggest a local groundwater flow pattern to the northeast, towards the Red Deer River.

The purged water was clear to mildly murky with no obvious hydrocarbon sheen. A trace humic-type odour was noted from the purged water at MW-03. General water quality indices were measured during purging and at the time of sampling. A summary of the field measured indices is presented as Table 4A.

Water samples were preserved and submitted to the laboratory for analysis. The results of groundwater tests are discussed in Section 5.2.

4.3 Headspace Vapours

A summary of the concentration of soil vapours as interpreted from headspace measurements from the existing monitoring wells is tabulated in Table 2. The headspace vapours were measured in the groundwater monitoring wells and the soil vapour well.

Combustible vapours from the headspace of the groundwater monitoring wells ranged between 20 ppm (MW-02) to 1,100 ppm (MW-01). Volatile vapours from the headspace ranged from non-detect, less than 0.1 ppm (MW-03) to 30 ppm (MW-01).

At soil vapour well VW-01, combustible and volatile vapours were 185 ppm and 1 ppm respectively. Laboratory results for the soil vapour sample are discussed in Section 5.3.

5.0 SUMMARY OF ASSESSMENT

This section further discusses our observations during the fieldwork along with an interpretation of the laboratory results in respect to potentials for an adverse environmental impact.

Buried waste materials were encountered in six of the nine testholes advanced across the site. The waste material is present within the hill slope and is predominantly construction type waste materials. MSW was encountered in the central section of the site. The relative location of the noted MSW during drilling along with observations from aerial photographs between 1993 and 1997 showing the observed ground disturbance in this area appears to explain the presence of MSW. The presence of MSW is considered contrary to previous information for this site. The interpreted plan area with the MSW is estimated to be 5,135 m^2 or about 16% of the total area of the historic waste site.

5.1 Quality of Subsurface Soil

The drill cuttings for this Phase II ESA were stored into three soil bags. A soil sample from each soil bag was submitted for laboratory testing. Analytical results indicate the drill cuttings satisfy the acceptance guidelines for disposal at The City of Red Deer Class II Waste Management Facility, refer to Table 3A.

For this Phase II ESA, samples were analyzed following the laboratory package using the US EPA 8260 list of VOCs. This list includes a greater number of VOCs relative to the VOC list published in the referenced Tier 1 Guideline.

A summary of the soil test results are presented in Tables 3B to 3C. A copy of the laboratory reports for soil are provided in Appendix A.

5.2 Quality of Local Groundwater

For this initial Phase II ESA, three test locations were sampled for groundwater, namely MW-01 to MW-03. MW-01 was located in the interpreted upgradient location and MW-02 and MW-03 are located in down gradient locations. Calculated elevations of the groundwater is presented as Figure 4. On Saturday, August 17, 2013, the depth to the groundwater ranges from about 10.4 m at MW-01 to 2.6 m at MW-03. The interpreted pattern of the local groundwater inferred from the three groundwater monitoring wells suggests an east-northeast direction of flow towards the Red Deer River. The horizontal gradient varies from approximately 7 cm/m (easterly component) to 10 cm/m (northeast component).

Field measured water quality indices were recorded during purging and at the time of sampling (August 17, 2013, sunny, no precipitation prior to or during). The acidity of the

local groundwater varied from an alkaline condition at MW-01 (pH 7.91) to a near neutral or slightly acidic condition at MW-03 (pH 6.99). Relative to the other well locations, the greatest negative redox potential (-106.7 mV) was measured at MW-03. Similarly, the dissolved oxygen measured at the three well locations exhibit a consistent pattern, with the lowest value at MW-03.

General Water Quality parameters are tabulated in Table 4B, with the exceptions of cadmium and ammonia (as nitrogen) exceeding the referenced Tier 1 Guideline. The relative concentration of ammonia at MW-03 was between 6 to 7 times the concentration at MW-01 and MW-02.

The reported alkalinity ranges from 570 mg/L to 860 mg/L while the field measured pH was less than 8. Typical groundwater has an alkalinity not more than 100 mg/L and seldom exceeds 300 mg/L in a natural setting. Similarly, the concentration of bicarbonates in the groundwater samples may also infer a higher concentration of carbon dioxide in the subsurface.

Table 4C is a tabulation of total and dissolved metals from each groundwater sample. The concentrations of specific metals exceed the referenced Alberta Tier 1 Guideline. The companion dissolved concentration of heavy metals shown in Table 4C were low or not detected, suggesting the reported total concentration as likely naturally occurring in the soil and not in soluble forms. The exceptions are boron and some common cations where the relative concentrations between total and dissolved are of relative magnitude.

VOCs in groundwater were not detected in the monitoring wells. The results are tabulated in Table 4D and the laboratory reports are presented in Appendix A, attached.

5.3 Interpretation of Soil Vapours

Previous procedures and methods to assess soil vapours (constituents of landfill gas) at this site as described in the referenced reports by others, illustrate several data quality issues and the resulting uncertainties of previous results.

For this Phase II ESA, an initial evaluation of the soil vapour was performed at locations analogous to the groundwater tests. This approach was undertaken to develop a “snap-shot assessment” of the local groundwater and soil vapour relationship, specifically at the interpreted down gradient margin of the historic area of the waste materials.

To reduce uncertainties concerning the assessment of soil vapour, the construction of soil vapour wells, sample collection and laboratory testing of soil vapour was performed in accordance with a standardized practice. Specifically, ASTM D5314-92(2006) Standard Guide for Soil Gas Monitoring in the vadose zone.

Field headspace vapour measurements were performed by a RKI Eagle 2 equipped with dual sensors to concurrently measure combustible and volatile vapours. The combustible vapours from the groundwater monitoring wells (MW-01 to MW-03) ranged between 20 to 1,100 ppm and at the soil vapour well (VW-01) the combustible vapour was 185 ppm. Volatile vapours were detected at MW-01 (30 ppm), MW-02 (1 ppm) and VW-01 (3 ppm).

The soil vapour pressure (15.05 psig) measured at VW-01 relative to the ambient barometric pressure (15.03 psig) was within the margin of error of the digital pressure gauge (+/- 0.25% full scale at greater than 0.04 psig). There was no notable pressure gradient in the vapour well relative to atmospheric pressure on the day of testing (Saturday, August 17, 2013). Thus, the soil vapour is interpreted to be in a steady-state level relative to the ambient atmospheric pressure. A summary of the field measurements are presented in Table 5A.

The soil vapour sample collected by the Summa Canister® was analysed for general air indices (oxygen, carbon dioxide, carbon monoxide, nitrogen and methane) and a suite of VOCs in accordance with US EPA TO14A for toxic organic compounds in air. The sample collected in the Tedlar Bag® was analysed for volatile organic silicon compounds (VOSCs) or commonly referred as siloxanes. Table 5B summarises the general indices for soil vapour from the sample collected by Summa Canister®. The results indicate nitrogen to be the predominant component in the soil vapour with proportional concentrations of oxygen and carbon dioxide. The volume fraction of subsurface methane was less than the limit of method detection (0.3% v/v).

The composition of other volatiles measured from the soil vapour sample from VW-01 is presented in Table 5C. Small amounts of aliphatic hydrocarbons having a carbon range between C_5 to C_{16}, aromatic hydrocarbons with a carbon range between C_8 and C_{12} and an assortment of trace VOCs were detected.

Table 5D presents the results of analyses of the soil vapour sample for siloxanes. The laboratory results indicate negligible organosilicon compounds. The reported aggregate mass was 0.2722 mg/m^3 and the calculated volume fraction was 0.0288 ppmv. Presently, there is no regulatory guideline for exposure to organosilicon compounds. However, ongoing toxicity studies have implicated exposure to siloxanes by inhalation to be linked to adverse effects to humans. It is anticipated, regulatory guidelines will be developed in the future as further research and toxicity information becomes available.

Overall, the field measured headspace vapours and the results of laboratory testing of a soil vapour sample exhibit no notable concern for the environmental quality of the subsurface soil vapour.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this Phase II ESA confirmed the presence of MSW in the upper central section of the hill slope. The thickness of the MSW deposit is about 6 m, more or less. The soil cover is a relatively permeable mix of sand and silt with a discontinuous unit of clay fill. The initial test results indicate the local groundwater has been mildly impacted as characterised by the presence of leachate constituents and comparative quality of the groundwater between the MW-01 near the top of the hill and MW-02 and MW-03 at the toe of the hill slope. The results indicate the leachate constituents to be principally composed of weak nutrient type compounds. Various VOCs and hydrocarbons were not detected in the local groundwater during this sampling event.

The results for soil vapour indicate trace or low concentration of petroleum hydrocarbon vapours with total BTEX at 6.26 ppbv and 124.9 ppbv aliphatic hydrocarbons. It must be acknowledged, this summer sampling event likely reflects muted concentrations which may increase when the lack of natural venting from the soil occurs under frozen ground conditions.

In order to better understand the off-site environmental risks associated with this historic waste disposal site, several aspects of the data presented in this Phase II ESA deserve some further attention. It is recommended Management at The City of Red Deer consider the following actions:

- Collect groundwater elevations and soil vapour data at quarterly intervals for at least one standard hydrogeological cycle. This information is to better understand the local flow pattern and what risks may be present for areas hydraulically down gradient of the site.

- There is no obvious evidence the local groundwater is affecting the slough that is south of the site. Should conditions of the groundwater change, the water quality at the slough should be reviewed.

- Collect a second data set consisting of soil vapour and groundwater chemistry, groundwater levels and headspace measurements during the winter period. The information obtained from this second event would attempt to illustrate the best/worst case for seasonal variability of the soil vapours.

- Develop a site specific risk management plan (RMP) addressing the identified environmental concerns with consideration of the potential future land development opportunities with an emphasis on lands which are deemed down gradient and on lands in proximity to the historic waste disposal area.

- Review all additional data to develop and (when necessary) update/amend the site specific RMP in light of new information.

7.0 STATEMENT OF LIMITATIONS

This Phase II Environmental Site Assessment was conducted on the dates presented within this report. The conditions prevalent and noted at this time must be recognized as having a limited life. Should activities be introduced or practices change, either of which may not be deemed to comply with generally accepted environmental practices, the site conditions would be altered sufficiently for this report to be invalid. This report has been prepared for the use of The City of Red Deer and the approved designates for the specific application described in Section 1.0.

The report has been based in part with information obtained by others. Verification of the results presented by others has not been done. This report has been prepared in accordance with generally accepted environmental engineering practice and no other warranty is made, either expressed or implied. The opinions, conclusions and recommendations presented herein reflect the best judgment of Tiamat As such, Tiamat reserves the right to re-evaluate our conclusions and recommendations presented in this report should new information become available.

Any use by a third party of this report or any reliance by a third party upon the information, records or documents in this report is undertaken solely at the risk and responsibility of such third party. Tiamat shall not in any way be responsible for any damages suffered by a third party due to decisions or actions taken by a third party on the basis of this report.

This report was issued electronically in an encrypted PDF format. Notwithstanding, the file encryption, Tiamat cannot guarantee the contents of this report has not been altered. Should an authenticated copy be required, the reader should contact The City of Red Deer and our office.

8.0 CLOSURE

We trust the information presented herein satisfies your present requirements. Should you have any questions, we invite the reader to contact our office at (403) 640-9009.

Respectfully submitted,
Tiamat Environmental Consultants Ltd.

Per: Jessica A.C. Lee, E.I.T.
Environmental Engineer

Per: Kristen E. Sanger, G.I.T.
Environmental Geoscientist

Per: Leon T. Mah, P.Eng.
Senior Project Engineer

/kjs

The Association of Professional Engineers and Geoscientists of Alberta
Permit To Practice No.: P 7109

References

1. Standard Guide for Soil Gas Monitoring in the Vadose Zone, ASTM D5314-92(2006).

2. Summary Report Former City Landfill Riverside Dry Waste, Part of 33-38-27-W4M, Red Deer, Alberta, April 2007, Stantec Inc. and Parkland Geotechnical Consulting Ltd.

3. Geotechnical Investigation – Slope Failure Investigation, Red Deer Riverside Industrial Park, Red Deer, Alberta, December 1993, HBT AGRA Ltd.

4. Geotechnical Investigation – Proposed Dry Waste Disposal Facility, Section 33-38-27-W4M, Red Deer, Alberta, January 1994, HBT AGRA Ltd.

5. Phase I Environmental Site Assessment, Historic Waste Disposal Sites, Riverside Dry Waste, The City of Red Deer, September 24 2013.

TABLES

Table 1
Soil Vapour and Groundwater Monitoring Well Elevations

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval		
				From	To	
MW-01	14.9	871.813	872.559	856.913	859.913	3.0
MW-02	6.1	848.556	849.294	842.456	845.456	3.0
MW-03	6.1	847.734	848.466	841.634	846.234	4.6
VW-01	7.3	871.261	NA	863.961	864.261	0.3
TH-03	NA	868.951	NA	NA	NA	NA
TH-04	NA	868.686	NA	NA	NA	NA
TH-05	NA	869.951	NA	NA	NA	NA
TH-06	NA	866.315	NA	NA	NA	NA
TH-07	NA	863.026	NA	NA	NA	NA

Notes:

1) Geodetic elevations are determined from multiple datums, ASCM Nos. 36574, 170910 and 124339.
2) MW - Monitoring Well.
3) VW - Soil Vapour Well.
4) TH- Testhole.
5) NA - Not Applicable.

Table 2
Site Monitoring Results

Test Location	Elevation		Groundwater Elevation (m)		Headspace Vapour			
					08/17/2013			
	Ground (m)	Top of Pipe (m)	08/17/2013		Combustible	Volatile	Combustile	Volatile
MW-01	871.813	872.559	862.180		1,100	30		
MW-02	848.556	849.294	844.568		20	1		
MW-03	847.734	848.466	845.831		230	ND		
VW-01	871.261	NA	- -	- -	185	3		

Notes:

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

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

Parameter	Detection Limit	Soil Bag			Class II Landfill Acceptance Criteria
		1 of 3	2 of 3	3 of 3	
pH	0.10	8.42	7.90	7.74	2-12.5
Flash Point (°C)	30.0	>75	>75	>75	>61
Paint Filter Test	-	PASS	PASS	PASS	PASS
Total Carbon by Combustion	0.1	3.5	2.8	1.8	- -
Total Organic Carbon	0.10	0.86	1.99	0.84	- -
TCLP Hydrocarbons					
Benzene	0.0050	ND	ND	ND	0.5
Toluene	0.0050	ND	ND	ND	0.5
Ethylbenzene	0.0050	ND	ND	ND	0.5
Xylenes	0.0050	ND	ND	ND	0.5
TCLP Leachable Metals					
Antimony (Sb)	5.0	ND	ND	ND	500
Arsenic (As)	0.20	ND	ND	ND	5
Barium (Ba)	5.0	ND	ND	ND	100
Beryllium (Be)	0.50	ND	ND	ND	5
Boron (B)	5.0	ND	ND	ND	500
Cadmium (Cd)	0.050	ND	ND	ND	1
Chromium (Cr)	0.50	ND	ND	ND	5
Cobalt (Co)	5.0	ND	ND	ND	100
Copper (Cu)	5.0	ND	ND	ND	100
Iron (Fe)	5.0	ND	ND	ND	1,000
Lead (Pb)	0.50	ND	ND	ND	5
Mercury (Hg)	0.010	ND	ND	ND	0.2
Nickel (Ni)	0.50	ND	ND	ND	5
Selenium (Se)	0.20	ND	ND	ND	1
Silver (Ag)	0.50	ND	ND	ND	5
Thallium (Tl)	0.50	ND	ND	ND	5
Uranium (U)	1.0	ND	ND	ND	2
Vanadium (V)	5.0	ND	ND	ND	100
Zinc (Zn)	5.0	ND	ND	ND	500
Zirconium (Zr)	5.0	ND	ND	ND	500

Notes:

1) Class II Landfill Acceptance Criteria - per Table 2, Part 4 Schedule to the Alberta User Guide for Waste Managers 3/95. Applicable waste screening for The City of Red Deer Class II Waste Managment Facility.
2) All units are mg/L unless otherwise stated.
3) ND - Not Detected, less than the limit of method detection.
4) - - No value established.
5) Soil bags were sampled on Friday, June 28, Saturday, June 29 and Wednesday, July 10, 2013.
6) For further information, refer to the specific laboratory report in Appendix A.

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

Parameter	Unit	Detection Limit	TH-01 @ 13.1 m	TH-03 @ 5.5 m	TH-06 @ 12.8 - 13.4 m	TH-06 @ 17.7 m	TH-08 @ 4.6 m	TH-09 @ 4.6 m	Tier 1 Guideline
			12/07/13			07/13/2013			
Chloride (Cl)	mg/kg	3.7 - 16	ND	29	ND	ND	20	26	- -
Nitrate-N	mg/kg	0.19 - 0.80	ND	ND	ND	ND	ND	ND	- -
Nitrite-N	mg/kg	0.19 - 0.80	ND	ND	ND	ND	ND	ND	- -
Metals									
Antimony (Sb)	mg/kg	0.20	ND	0.36	0.33	0.40	0.68	0.58	40
Arsenic (As)	mg/kg	0.20	1.86	5.85	15.90	6.54	9.24	6.98	26
Barium (Ba)	mg/kg	5.0	54.4	223	93.5	213	728	315	2,000
Beryllium (Be)	mg/kg	1.0	ND	ND	ND	ND	ND	ND	8
Cadmium (Cd)	mg/kg	0.50	ND	ND	ND	ND	ND	ND	22
Chromium (Cr)	mg/kg	0.50	5.76	18.6	19.6	18.6	23.2	30.2	87
Cobalt (Co)	mg/kg	1.0	2.2	7.3	7.6	7.4	6.7	9.9	300
Copper (Cu)	mg/kg	2.0	3.7	16.4	10.2	15.8	17.7	23.0	91
Lead (Pb)	mg/kg	5.0	ND	8.4	7.4	8.7	10.9	11.2	260
Mercury (Hg)	mg/kg	0.050	ND	ND	ND	ND	ND	ND	24
Molybdenum (Mo)	mg/kg	1.0	ND	ND	ND	1.1	7	4.9	40
Nickel (Ni)	mg/kg	2.0	5.7	21.1	22.8	20.2	23.9	32.1	50
Selenium (Se)	mg/kg	0.50	ND	ND	ND	ND	ND	ND	2.9
Silver (Ag)	mg/kg	1.0	ND	ND	ND	ND	ND	ND	40
Thallium (Tl)	mg/kg	0.50	ND	ND	ND	ND	ND	ND	1.0
Tin (Sn)	mg/kg	2.0	ND	ND	ND	ND	ND	ND	300
Uranium (U)	mg/kg	2.0	ND	ND	ND	ND	ND	ND	33
Vanadium (V)	mg/kg	1.0	8.4	29.2	21.9	31.1	30.5	39.1	130
Zinc (Zn)	mg/kg	10	15	58	65	56	67	76	360
Hexavalent Chromium	mg/kg	0.10	ND	ND	ND	ND	ND	ND	1.4
Boron (B), Hot Water Ext.	mg/kg	0.10	0.21	0.12	0.22	0.87	0.42	0.62	2

Notes:

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

Table 3C
Analytical Results - Soil - VOCs

Parameter	Detection Limit	TH-01 @ 13.1 m	TH-03 @ 5.5 m	TH-06 @ 12.8 - 13.4 m	TH-06 @ 17.7 m	TH-08 @ 4.6 m	TH-09 @ 4.6 m	Tier 1 Guideline
		12/07/13			07/13/2013			
Hydrocarbons								
F1 (C_6-C_{10})	10	ND	ND	ND	ND	ND	ND	270
F2 (C_{10}-C_{16})	25	ND	ND	ND	ND	ND	ND	260
F3 (C_{16}-C_{34})	50	ND	ND	ND	271	ND	ND	1,700
F4 (C_{34}-C_{50})	50	ND	ND	ND	148	ND	ND	3,300
Total Hydrocarbons (C_6-C_{50})	50	ND	ND	ND	419	ND	ND	- -
Volatile Organic Compounds								
Benzene	0.0050	ND	ND	ND	ND	ND	ND	0.078
Bromobenzene	0.010	ND	ND	ND	ND	ND	ND	- -
Bromochloromethane	0.010	ND	ND	ND	ND	ND	ND	- -
Bromodichloromethane	0.010	ND	ND	ND	ND	ND	ND	- -
Bromoform	0.010	ND	ND	ND	ND	ND	ND	- -
Bromomethane	0.10	ND	ND	ND	ND	ND	ND	- -
n-Butylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
sec-Butylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
tert-Butylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
Carbon tetrachloride	0.010	ND	ND	ND	ND	ND	ND	0.0068
Chlorobenzene	0.010	ND	ND	ND	ND	ND	ND	0.22
Dibromochloromethane	0.010	ND	ND	ND	ND	ND	ND	1.5
Chloroethane	0.10	ND	ND	ND	ND	ND	ND	- -
Chloroform	0.010	ND	ND	ND	ND	ND	ND	0.003
Chloromethane	0.10	ND	ND	ND	ND	ND	ND	- -
2-Chlorotoluene	0.010	ND	ND	ND	ND	ND	ND	- -
4-Chlorotoluene	0.010	ND	ND	ND	ND	ND	ND	- -
1,2-Dibromo-3-chloropropane	0.010	ND	ND	ND	ND	ND	ND	- -
1,2-Dibromoethane	0.010	ND	ND	ND	ND	ND	ND	- -
Dibromomethane	0.010	ND	ND	ND	ND	ND	ND	- -
1,2-Dichlorobenzene	0.010	ND	ND	ND	ND	ND	ND	0.18
1,3-Dichlorobenzene	0.010	ND	ND	ND	ND	ND	ND	- -
1,4-Dichlorobenzene	0.010	ND	ND	ND	ND	ND	ND	0.098
Dichlorodifluoromethane	0.010	ND	ND	ND	ND	ND	ND	- -
1,1-Dichloroethane	0.010	ND	ND	ND	ND	ND	ND	- -
1,2-Dichloroethane	0.010	ND	ND	ND	ND	ND	ND	0.033
1,1-Dichloroethene	0.010	ND	ND	ND	ND	ND	ND	0.24
cis-1,2-Dichloroethene	0.010	ND	ND	ND	ND	ND	ND	- -
trans-1,2-Dichloroethene	0.010	ND	ND	ND	ND	ND	ND	- -
Methylene chloride	0.010	ND	ND	ND	ND	ND	0.039	0.095
1,2-Dichloropropane	0.010	ND	ND	ND	ND	ND	ND	- -
1,3-Dichloropropane	0.010	ND	ND	ND	ND	ND	ND	- -
2,2-Dichloropropane	0.010	ND	ND	ND	ND	ND	ND	- -
1,1-Dichloropropene	0.010	ND	ND	ND	ND	ND	ND	- -
cis-1,3-Dichloropropene	0.010	ND	ND	ND	ND	ND	ND	- -
trans-1,3-Dichloropropene	0.010	ND	ND	ND	ND	ND	ND	- -
Ethylbenzene	0.015	ND	ND	ND	ND	ND	ND	0.21
Hexachlorobutadiene	0.010	ND	ND	ND	ND	ND	ND	0.031
Isopropylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
p-Isopropyltoluene	0.010	ND	ND	ND	ND	ND	ND	- -
n-Propylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
Styrene	0.050	ND	ND	ND	ND	ND	ND	0.80
1,1,1,2-Tetrachloroethane	0.010	ND	ND	ND	ND	ND	ND	- -
1,1,2,2-Tetrachloroethane	0.050	ND	ND	ND	ND	ND	ND	- -
Tetrachloroethene	0.010	ND	ND	ND	ND	ND	ND	0.77
Toluene	0.050	ND	ND	ND	ND	ND	ND	0.49
1,2,3-Trichlorobenzene	0.010	ND	ND	ND	ND	ND	ND	0.31
1,2,4-Trichlorobenzene	0.010	ND	ND	ND	ND	ND	ND	0.93
1,1,1-Trichloroethane	0.010	ND	ND	ND	ND	ND	ND	- -
1,1,2-Trichloroethane	0.010	ND	ND	ND	ND	ND	ND	- -
Trichloroethene	0.010	ND	ND	ND	ND	ND	ND	0.081
Trichlorofluoromethane	0.010	ND	ND	ND	ND	ND	ND	- -
1,2,3-Trichloropropane	0.020	ND	ND	ND	ND	ND	ND	- -
1,2,4-Trimethylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
1,3,5-Trimethylbenzene	0.010	ND	ND	ND	ND	ND	ND	- -
Vinyl chloride	0.20	ND	ND	ND	ND	ND	ND	0.0043
Xylenes	0.10	ND	ND	ND	ND	ND	ND	28

Notes:

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

Table 4A
Groundwater Indices at Time of Sampling

Monitoring Well	pH	Electrical Conductivity (µg/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Total Dissolved Solid (mg/L)	Redox (±mV)
MW-01	7.91	1,239	7.6	2.6	1,202.50	-12.5
MW-02	7.50	2,021	7.3	1.83	1,976.00	+33.7
MW-03	6.99	1,909	11.9	0.81	1,644.50	-106.7

Notes:

1) Measurement of groundwater indices by YSI Pro Plus multimeter.
2) Wells sampled on Saturday, August 17, 2013.

Table 4B
Analytic Results - Groundwater - General Water Quality

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-03	Tier 1 Guideline
			08/17/2013			
General Water Quality						
Biochemical Oxygen Demand	mg/L	2.0	3.5	2	4.3	- -
Total Chemical Oxygen Demand	mg/L	5.0 - 50.0	100	310	460	- -
Conductivity	µS/cm	1.0	1,900	3,200	2,700	- -
pH	Unitless	NA	7.71	6.78	7.55	6.5-8.5
Total Organic Carbon (C)	mg/L	0.50 - 2.5	14	20	46	- -
Dissolved Cadmium (Cd)	µg/L	0.0050 - 0.013	0.087	0.12	0.039	- -
Total Cadmium (Cd)	µg/L	0.0050 - 0.013	**0.60**	**5.5**	**5.0**	0.060*
Alkalinity ($CaCO_3$)	mg/L	0.50	570	550	860	- -
Bicarbonate (HCO_3)	mg/L	0.50	690	670	1,100	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	ND	- -
Sulphate (SO_4)	mg/L	1.0 - 5.0	510	690	ND	- -
Chloride (Cl)	mg/L	1.0 - 5.0	4.7	360	360	- -
Total Ammonia (N)	mg/L	0.050 - 0.50	0.64	0.76	**4.6**	1.37*
Total Phosphorus (P)	mg/L	0.030 - 0.15	0.54	6.2	4.8	- -
Total Nitrogen (N)	mg/L	0.050	1.1	4.1	6.4	- -
Total Kjeldahl Nitrogen	mg/L	0.050 - 0.50	0.98	4.1	6.3	- -
Nitrite (NO_2)	mg/L	0.0030	0.010	ND	0.0090	- -
Nitrate (NO_3)	mg/L	0.0030	0.067	0.030	0.11	- -
Nitrate plus Nitrite (N)	mg/L	0.0030	0.077	0.030	0.12	- -
Trace Organics						
Acetic Acid	mg/L	50	ND	ND	ND	- -
Formic Acid	mg/L	50	ND	ND	ND	- -
Propionic Acid	mg/L	50	ND	ND	ND	- -
Adsorbable Organic Halogen	mg/L	0.002 - 0.02	0.05	0.023	0.13	- -

Notes:

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

Table 4C
Analytic Results - Groundwater - Metals

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-03	Tier 1 Guideline
			08/17/2013			
Total Metals						
Aluminum (Al)	mg/L	0.0030 - 0.0075	**4.3**	**100**	**74**	0.1*
Antimony (Sb)	mg/L	0.00060 - 0.0015	0.00074	ND	ND	0.006
Arsenic (As)	mg/L	0.00020 - 0.00050	**0.011**	**0.066**	**0.069**	0.005
Barium (Ba)	mg/L	0.010	0.320	**3.3**	**3.5**	1
Beryllium (Be)	mg/L	0.0010 - 0.0025	ND	0.0099	0.0072	- -
Boron (B)	mg/L	0.020	0.28	0.11	0.13	1.5
Calcium (Ca)	mg/L	0.30 - 1.5	270	730	1,000	- -
Chromium (Cr)	mg/L	0.0010 - 0.0025	**0.010**	**0.19**	**0.14**	0.001*
Cobalt (Co)	mg/L	0.00030 - 0.00075	0.014	0.12	0.13	- -
Copper (Cu)	mg/L	0.00020 - 0.00050	**0.025**	**0.25**	**0.23**	0.003*
Iron (Fe)	mg/L	0.060 - 0.30	**20**	**330**	**260**	0.3
Lead (Pb)	mg/L	0.00020 - 0.00050	**0.0068**	**0.11**	**0.11**	0.004*
Lithium (Li)	mg/L	0.020	0.093	0.32	0.15	- -
Magnesium (Mg)	mg/L	0.20	62	230	330	- -
Manganese (Mn)	mg/L	0.0040	**1.4**	**13.0**	**15.0**	0.05
Molybdenum (Mo)	mg/L	0.00020 - 0.00050	0.0021	0.012	0.0036	0.073*
Nickel (Ni)	mg/L	0.00050 - 0.0013	0.033	**0.29**	**0.29**	0.11*
Phosphorus (P)	mg/L	0.10	0.68	11	7.2	- -
Potassium (K)	mg/L	0.30	8.4	20	21	- -
Selenium (Se)	mg/L	0.00020 - 0.00050	0.0007	**0.0031**	**0.0014**	0.001
Silicon (Si)	mg/L	0.10	17	94	87	- -
Silver (Ag)	mg/L	0.00010 - 0.00025	ND	**0.001**	**0.0016**	0.0001*
Sodium (Na)	mg/L	0.50	160	230	160	- -
Strontium (Sr)	mg/L	0.020	1.4	3.7	2.5	- -
Sulphur (S)	mg/L	0.20	180	230	7.8	- -
Thallium (Tl)	mg/L	0.00020 - 0.00050	ND	**0.0011**	**0.00087**	0.0008*
Tin (Sn)	mg/L	0.0010 - 0.0025	0.0029	0.0044	ND	- -
Titanium (Ti)	mg/L	0.0010 - 0.0025	0.19	0.96	0.45	- -
Uranium (U)	mg/L	0.00010 - 0.00025	0.012	**0.045**	0.0075	0.02
Vanadium (V)	mg/L	0.0010 - 0.0025	0.018	0.300	0.200	- -
Zinc (Zn)	mg/L	0.0030 - 0.0075	**0.057**	**0.73**	**0.67**	0.03
Dissolved Metals						
Aluminum (Al)	mg/L	0.0030 - 0.0075	0.0044	0.017	0.088	- -
Antimony (Sb)	mg/L	0.00060 - 0.0015	ND	0.002	ND	- -
Arsenic (As)	mg/L	0.00020 - 0.00050	0.0027	0.0061	0.024	- -
Barium (Ba)	mg/L	0.010	0.083	0.081	0.72	- -
Beryllium (Be)	mg/L	0.0010 - 0.0025	ND	ND	ND	- -
Boron (B)	mg/L	0.020	0.27	0.12	0.12	- -
Calcium (Ca)	mg/L	0.30	220	310	210	- -
Chromium (Cr)	mg/L	0.0010 - 0.0025	ND	ND	ND	- -
Cobalt (Co)	mg/L	0.00030 - 0.00075	0.0043	0.0045	0.012	- -
Copper (Cu)	mg/L	0.00020 - 0.00050	0.0023	0.0021	0.0013	- -
Iron (Fe)	mg/L	0.060	0.19	0.24	27	- -
Lead (Pb)	mg/L	0.00020 - 0.00050	ND	ND	ND	- -
Lithium (Li)	mg/L	0.020	0.091	0.130	0.034	- -
Magnesium (Mg)	mg/L	0.20	56	110	120	- -
Manganese (Mn)	mg/L	0.0040	0.7	0.78	3.6	- -
Molybdenum (Mo)	mg/L	0.00020 - .00050	0.0015	0.0059	0.0021	- -
Nickel (Ni)	mg/L	0.00050 - 0.0013	0.011	0.013	0.016	- -
Phosphorus (P)	mg/L	0.10	ND	ND	ND	- -
Potassium (K)	mg/L	0.30	6.9	8.6	9.8	- -
Selenium (Se)	mg/L	0.00020 - 0.00050	0.00028	0.00050	ND	- -
Silicon (Si)	mg/L	0.10	7.4	6.5	15	- -
Silver (Ag)	mg/L	0.00010 - 0.00025	ND	ND	ND	- -
Sodium (Na)	mg/L	0.50	170	250	160	- -
Strontium (Sr)	mg/L	0.020	1.3	2.7	1.4	- -
Sulphur (S)	mg/L	0.20	180	220	3.9	- -
Thallium (Tl)	mg/L	0.00020 - 0.00050	ND	ND	ND	- -
Tin (Sn)	mg/L	0.0010 - 0.0025	ND	ND	ND	- -
Titanium (Ti)	mg/L	0.0010 - 0.0025	ND	ND	ND	- -
Uranium (U)	mg/L	0.00010 - 0.00025	0.011	0.021	0.0014	- -
Vanadium (V)	mg/L	0.0010 - 0.0025	ND	ND	ND	- -
Zinc (Zn)	mg/L	0.0030 - 0.0075	ND	ND	ND	- -

Notes:

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

Table 4D
Analytical Results - Groundwater - VOCs

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-03	Tier 1 Guideline
			08/17/2013			
Volatiles						
Benzene	mg/L	0.00040	ND	ND	ND	0.005
Toluene	mg/L	0.00040	ND	ND	ND	0.024
Ethylbenzene	mg/L	0.00040	ND	ND	ND	0.0024
Xylenes (Total)	mg/L	0.00080	ND	ND	ND	0.3
F1 (C_6-C_{10})	mg/L	0.10	ND	ND	ND	2.2
F2 (C_{10}-C_{16})	mg/L	0.10	ND	ND	ND	1.1
Total Trihalomethanes	mg/L	0.0020	ND	ND	ND	0.1
Bromodichloromethane	mg/L	0.00050	ND	ND	ND	- -
Bromoform	mg/L	0.00050	ND	ND	ND	- -
Bromomethane	mg/L	0.0020	ND	ND	ND	- -
Carbon tetrachloride	mg/L	0.00050	ND	ND	ND	0.005
Chlorobenzene	mg/L	0.00050	ND	ND	ND	0.0013
Chlorodibromomethane	mg/L	0.0010	ND	ND	ND	- -
Chloroethane	mg/L	0.0010	ND	ND	ND	- -
Chloroform	mg/L	0.00050	ND	ND	ND	0.0018
Chloromethane	mg/L	0.0020	ND	ND	ND	- -
1,2-dibromoethane	mg/L	0.00050	ND	ND	ND	- -
1,2-dichlorobenzene	mg/L	0.00050	ND	ND	ND	0.0007
1,3-dichlorobenzene	mg/L	0.00050	ND	ND	ND	- -
1,4-dichlorobenzene	mg/L	0.00050	ND	ND	ND	0.001
1,1-dichloroethane	mg/L	0.00050	ND	ND	ND	- -
1,2-dichloroethane	mg/L	0.00050	ND	ND	ND	0.005
1,1-dichloroethene	mg/L	0.00050	ND	ND	ND	0.014
cis-1,2-dichloroethene	mg/L	0.00050	ND	ND	ND	- -
trans-1,2-dichloroethene	mg/L	0.00050	ND	ND	ND	- -
Dichloromethane	mg/L	0.0020	ND	ND	ND	0.05
1,2-dichloropropane	mg/L	0.00050	ND	ND	ND	- -
cis-1,3-dichloropropene	mg/L	0.00050	ND	ND	ND	- -
trans-1,3-dichloropropene	mg/L	0.00050	ND	ND	ND	- -
Methyl methacrylate	mg/L	0.00050	ND	ND	ND	0.47
Methyl-tert-butylether (MTBE)	mg/L	0.00050	ND	ND	ND	0.015
Styrene	mg/L	0.00050	ND	ND	ND	0.072
1,1,1,2-tetrachloroethane	mg/L	0.0020	ND	ND	ND	- -
1,1,2,2-tetrachloroethane	mg/L	0.0020	ND	ND	ND	- -
Tetrachloroethene	mg/L	0.00050	ND	ND	ND	0.03
1,2,3-trichlorobenzene	mg/L	0.0010	ND	ND	ND	0.008
1,2,4-trichlorobenzene	mg/L	0.0010	ND	ND	ND	0.015
1,3,5-trichlorobenzene	mg/L	0.00050	ND	ND	ND	0.014
1,1,1-trichloroethane	mg/L	0.00050	ND	ND	ND	- -
1,1,2-trichloroethane	mg/L	0.00050	ND	ND	ND	- -
Trichloroethene	mg/L	0.00050	ND	ND	ND	0.005
Trichlorofluoromethane	mg/L	0.00050	ND	ND	ND	- -
1,2,4-trimethylbenzene	mg/L	0.00050	ND	ND	ND	- -
1,3,5-trimethylbenzene	mg/L	0.00050	ND	ND	ND	- -
Vinyl chloride	mg/L	0.00050	ND	ND	ND	0.002

Notes:

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

Table 5A
Summary of Parameters Measured During Sampling of Soil Vapour

Parameter	Well Diameter (mm)	Screen Length (cm)	Well Depth (m)	Headspace Volume (cm^3)	Purge Rate (cm^3/min)	Purge Time (min)	Pressure	
							Ambient (psi)	Vapour Well (psi)
VW-01	25	30	7.3	3,583.4	943.3	9	15.03	15.05

Notes:

1) Measurement of pressure by digital Cole-Parmer absolute pressure gauge.
2) Purge time is elapsed time prior to the collection of a soil vapour sample.
3) Screen set at base of well.
4) Soil vapour sampling was completed Saturday, August 17, 2013.

Table 5B
Analytical Results - Soil Vapour - General Indices

Parameters	Units	Detection Limit	VW-01
Gause Pressure			
pressure after sampling	psig	- -	-5.0
pressure on receipt	psig	- -	-4.6
Fixed Gases			
Oxygen	% v/v	0.3	14.2
Nitrogen	% v/v	0.3	78.8
Carbon Monoxide	% v/v	0.3	ND
Methane	% v/v	0.3	ND
Carbon Dioxide	% v/v	0.3	7.0

Notes:

1) Soil vapour sample collected on Saturday, August 17, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5C
Analytical Results - Soil Vapour - VOCs

Parameters	Unit	Detection Limit	VW-01 08/17/13
Hydrocarbon Fractions			
Aliphatic >C_5-C_6	µg/m^3	5.0	7.3
Aliphatic >C_6-C_8	µg/m^3	5.0	34.9
Aliphatic >C_8-C_{10}	µg/m^3	5.0	27.8
Aliphatic >C_{10}-C_{12}	µg/m^3	5.0	39.7
Aliphatic >C_{12}-C_{16}	µg/m^3	5.0	15.2
Aromatic >C_7-C_8 (TEX Excluded)	µg/m^3	5.0	ND
Aromatic >C_8-C_{10}	µg/m^3	5.0	6.7
Aromatic >C_{10}-C_{12}	µg/m^3	5.0	6.1
Aromatic >C_{12}-C_{16}	µg/m^3	5.0	ND
Select Volatile Gases			
Acetylene	ppm	0.26	ND
Ethane	ppm	0.26	ND
Ethylene	ppm	0.26	ND
Methane	ppm	5.1	ND
n-Butane	ppm	0.51	ND
n-Pentane	ppm	0.26	ND
Propane	ppm	0.26	ND
Propene	ppm	0.26	ND
Propyne	ppm	0.51	ND
Volatile Organic Compounds			
Dichlorodifluoromethane (FREON 12)	ppbv	0.20	1.08
1,2-Dichlorotetrafluoroethane	ppbv	0.17	ND
Chloromethane	ppbv	0.30	1.21
Vinyl Chloride	ppbv	0.18	ND
Chloroethane	ppbv	0.30	ND
1,3-Butadiene	ppbv	0.50	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.20	0.40
Ethanol (ethyl alcohol)	ppbv	2.3	21.8
Trichlorotrifluoroethane	ppbv	0.15	ND
2-propanol	ppbv	3.0	3.2
2-Propanone	ppbv	0.80	22.8
Methyl Ethyl Ketone (2-Butanone)	ppbv	5.0	ND
Methyl Isobutyl Ketone	ppbv	3.2	ND
Methyl Butyl Ketone (2-Hexanone)	ppbv	2.0	ND
Methyl t-butyl ether (MTBE)	ppbv	0.20	ND
Ethyl Acetate	ppbv	2.2	ND
1,1-Dichloroethylene	ppbv	0.25	ND
cis-1,2-Dichloroethylene	ppbv	0.19	ND
trans-1,2-Dichloroethylene	ppbv	0.20	ND
Methylene Chloride(Dichloromethane)	ppbv	0.80	ND
Chloroform	ppbv	0.15	0.33
Carbon Tetrachloride	ppbv	0.30	ND
1,1-Dichloroethane	ppbv	0.20	ND
1,2-Dichloroethane	ppbv	0.20	ND
Ethylene Dibromide	ppbv	0.17	ND
1,1,1-Trichloroethane	ppbv	0.30	ND
1,1,2-Trichloroethane	ppbv	0.15	ND
1,1,2,2-Tetrachloroethane	ppbv	0.20	ND
cis-1,3-Dichloropropene	ppbv	0.18	ND
trans-1,3-Dichloropropene	ppbv	0.17	ND
1,2-Dichloropropane	ppbv	0.40	ND
Bromomethane	ppbv	0.18	ND
Bromoform	ppbv	0.20	ND
Bromodichloromethane	ppbv	0.20	ND
Dibromochloromethane	ppbv	0.20	ND
Trichloroethylene	ppbv	0.30	ND
Tetrachloroethylene	ppbv	0.20	ND
Benzene	ppbv	0.18	0.48
Toluene	ppbv	0.20	1.86
Ethylbenzene	ppbv	0.20	0.55
p+m-Xylene	ppbv	0.37	2.53
o-Xylene	ppbv	0.20	0.84
Styrene	ppbv	0.20	ND
4-ethyltoluene	ppbv	2.2	ND
1,3,5-Trimethylbenzene	ppbv	0.50	ND
1,2,4-Trimethylbenzene	ppbv	0.50	ND
Chlorobenzene	ppbv	0.20	ND
Benzyl chloride	ppbv	1.0	ND
1,3-Dichlorobenzene	ppbv	0.40	ND
1,4-Dichlorobenzene	ppbv	0.40	ND
1,2-Dichlorobenzene	ppbv	0.40	ND
1,2,4-Trichlorobenzene	ppbv	2.0	ND
Hexachlorobutadiene	ppbv	3.0	ND
Hexane	ppbv	0.30	3.44
Heptane	ppbv	0.30	0.49
Cyclohexane	ppbv	0.20	0.40
Tetrahydrofuran	ppbv	0.40	3.49
1,4-Dioxane	ppbv	2.0	ND
Xylene (Total)	ppbv	0.60	3.37
Vinyl Bromide	ppbv	0.20	ND
Propene	ppbv	0.30	1.29
2,2,4-Trimethylpentane	ppbv	0.20	0.25
Carbon Disulfide	ppbv	0.50	6.98
Vinyl Acetate	ppbv	0.20	ND

Notes:

1) Results are from sampling performed on Saturday, August 17, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) For further information, the reader should refer to the laboratory report in Appendix A.

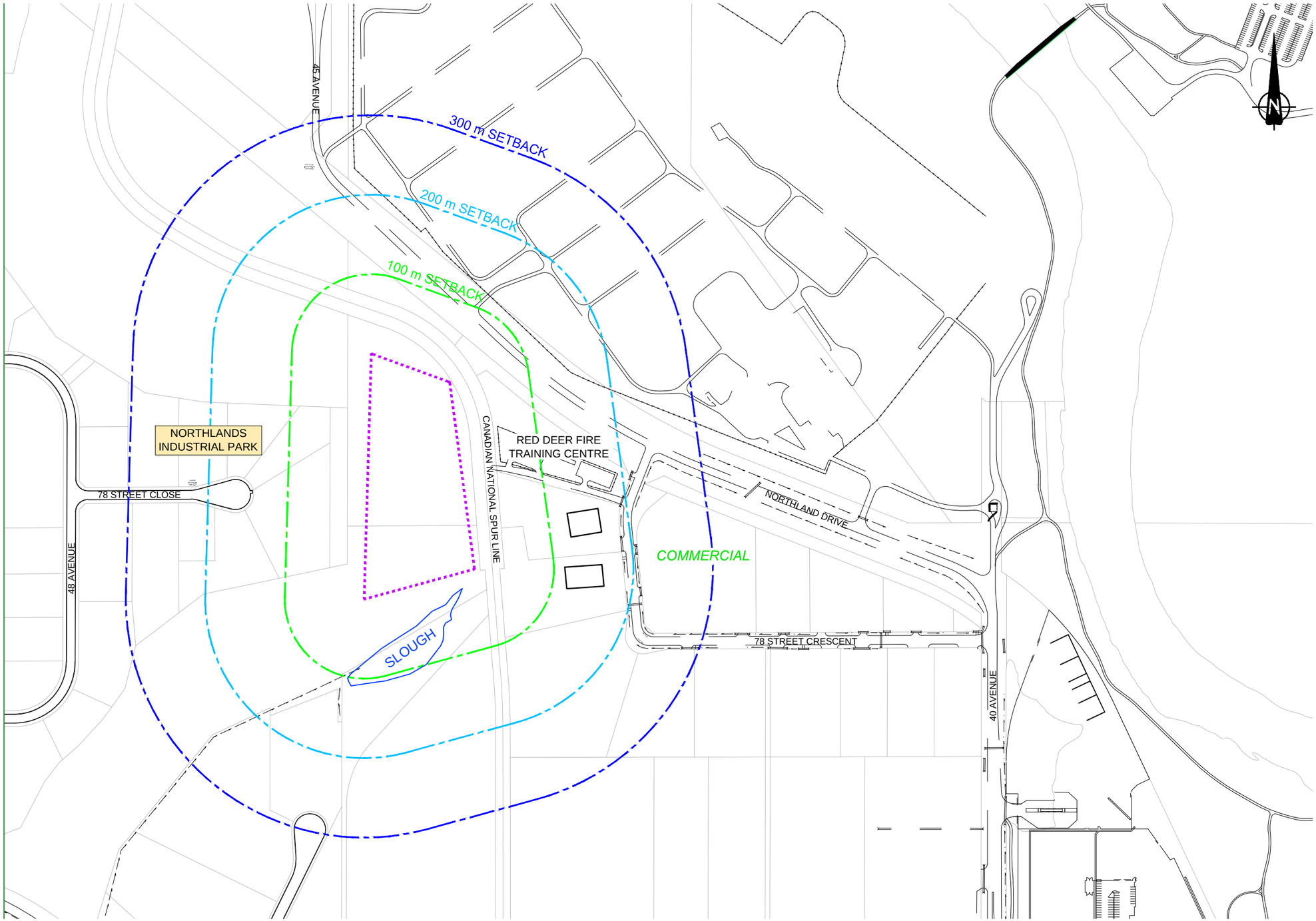
Table 5D
Analytical Results - Soil Vapour - Siloxanes

Parameter	Detection Limit		VW-01 08/17/2013	
	mg/m³	ppm	mg/m³	ppm
Trimethylsilyl Fluoride	- -	- -	0.0011	0.0003
Tetramethylsilane	0.0001	0.0001	ND	ND
Methoxytrimethylsilane	0.0019	0.0004	ND	ND
Ethoxytrimethylsilane	0.0018	0.0004	ND	ND
Trimethylsilanol	- -	- -	0.0526	0.0143
Isopropoxytrimethylsilane	0.0008	0.0001	ND	ND
Trimethoxymethyl Silane #	- -	- -	ND	ND
Hexamethyl Disiloxane - L2	- -	- -	0.0006	0.0001
Propoxytrimethylsilane	0.0021	0.0004	ND	ND
1-Methylbutoxytrimethylsilane *	- -	- -	ND	ND
Butoxytrimethylsilane *	- -	- -	ND	ND
Trimethoxyvinyl Silane #	- -	- -	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	- -	0.0111	0.0012
Octamethyl Trisiloxane - L3	0.0001	0.0001	ND	ND
Triethoxyvinyl Silane #	- -	- -	ND	ND
Triethoxyethyl Silane #	- -	- -	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	- -	0.0090	0.0007
Decamethyl Tetrasiloxane - L4	0.0002	0.0001	ND	ND
Tetraethylsilicate #	- -	- -	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	- -	0.0236	0.0016
Dodecamethyl Pentasiloxane - L5	0.0018	0.0001	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	- -	- -	0.1655	0.0091
Sum	- -	- -	0.2722	0.0288

Notes:

1) Soil vapour samples collected on Saturday, August 17, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) V=200 mL, where V is volume of air/gas sampled.
5) * - Semiquanititative (response factor set at 5).
6) # - Unstable, poor detectability, commercial standards tested.
7) For further information, the reader should refer to the laboratory report in Appendix A.

FIGURES



0 50 100 200m

Scale 1:5000

LEGEND

HISTORIC WASTE DISPOSAL

LOT BOUNDARY

100 m SETBACK

200 m SETBACK

300 m SETBACK

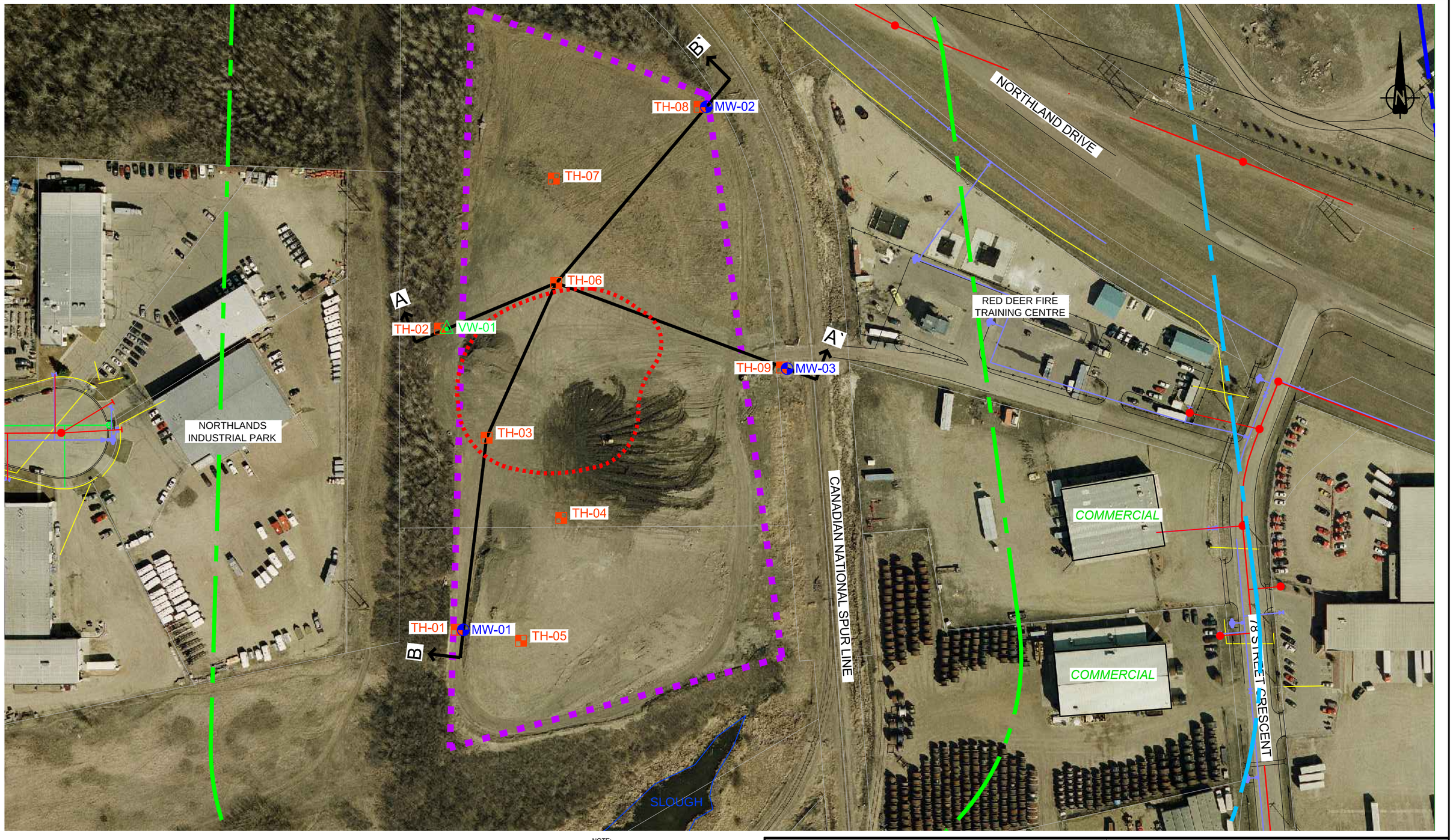
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE HEAVY DRY WASTE

TITLE: SITE PLAN SHOWING SURROUNDING LAND USES

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 5000	APR. 2/14	12-435	FIGURE 1
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA v1.06.dwg	



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

0 20 40 80m
Scale 1:1500

PHASE II TEST LOCATIONS
MW-## GROUNDWATER MONITORING WELL (3)
TH-## TESTHOLE (9)
VW-## SOIL VAPOUR MONITORING WELL (2)

LEGEND
HISTORIC WASTE DISPOSAL
MUNICIPAL SANITARY WASTE AREA
LOT BOUNDARY
CROSS SECTION LOCATION
ELECTRICAL
SANITARY
STORM
WATER

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

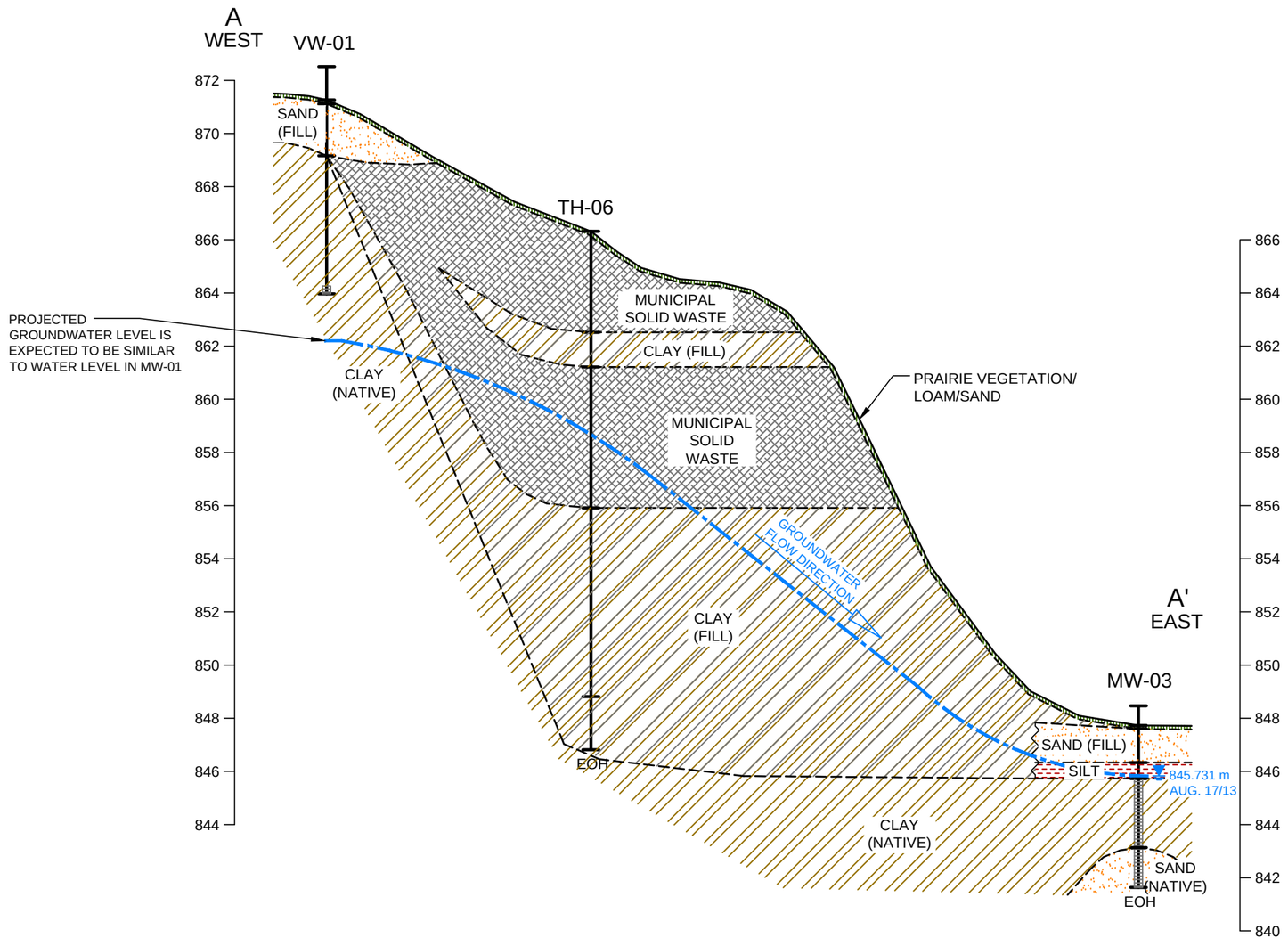
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES RIVERSIDE HEAVY DRY WASTE

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

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 1500	April 10/14	12-435	FIGURE 2
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA v1.06.dwg	



NOTE:

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

0 2 5 10m
Vertical Scale 1:200

0 10 30 50m
Horizontal Scale 1:1000

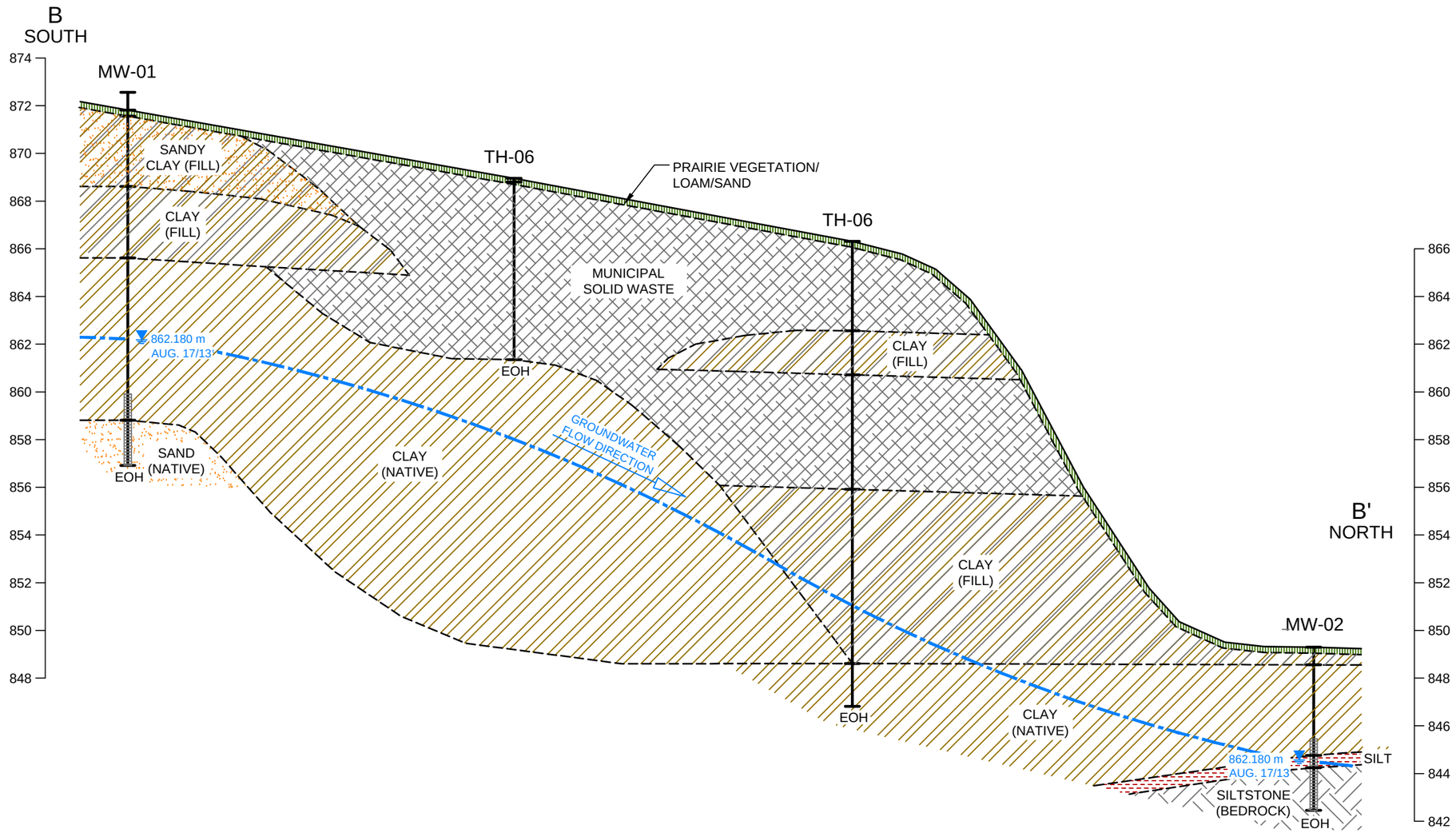
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE HEAVY DRY WASTE

TITLE: CROSS SECTION A - A'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	April 10/14	12-435	FIGURE 3A
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA Sections v1.05	



NOTE:

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

0 2 5 10m
Vertical Scale 1:200

0 10 30 50m
Horizontal Scale 1:1000

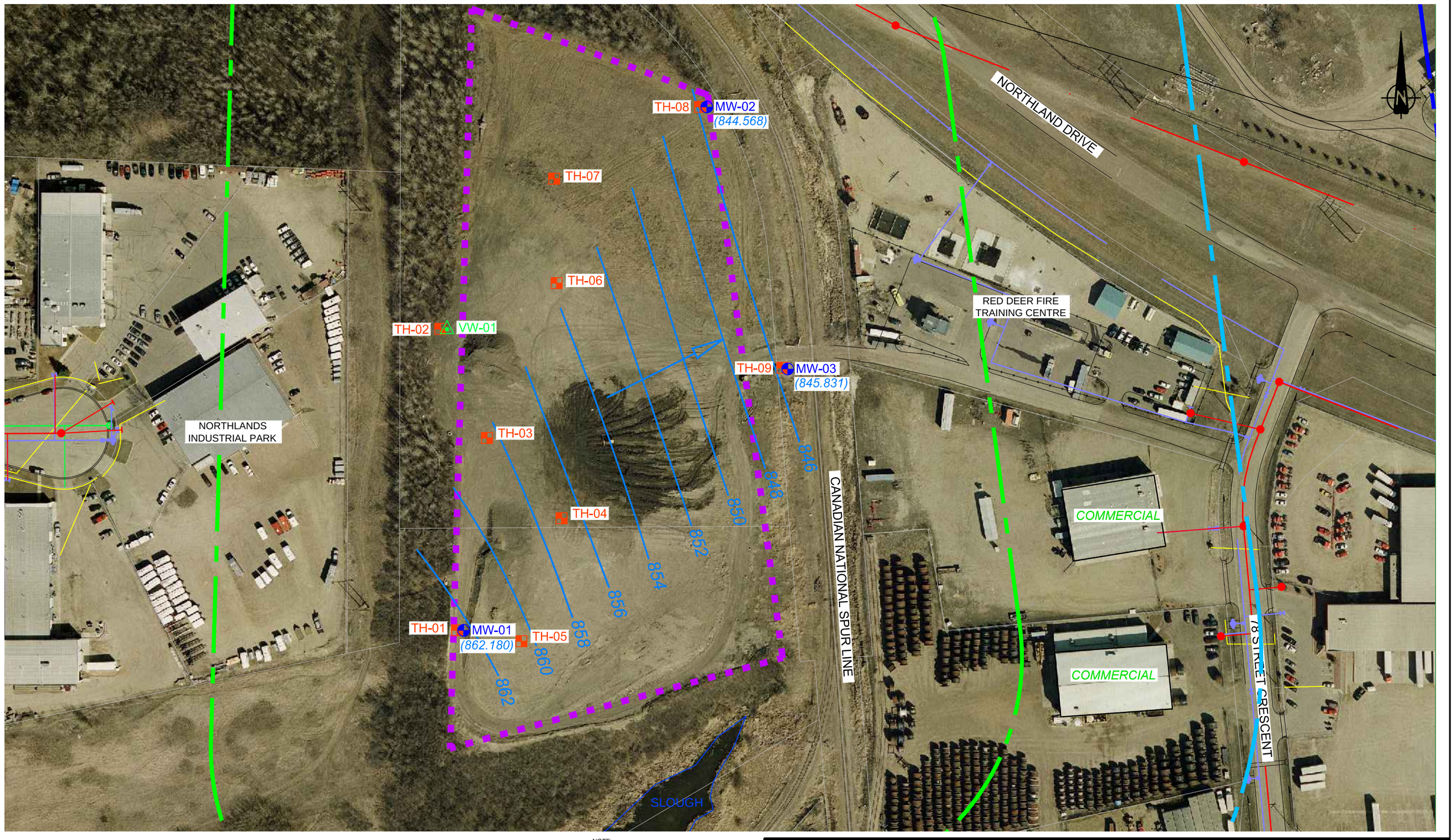
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE HEAVY DRY WASTE

TITLE: CROSS SECTION B - B'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	April 10/14	12-435	FIGURE 3B
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA Sections v1.05	



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

0 20 40 80m
Scale 1:1500

GROUNDWATER DATA
(850.150) GROUNDWATER ELEVATION (m) AUGUST 1, 2013
INTERPRETED GROUNDWATER CONTOUR (m)
INTERPRETED GROUNDWATER FLOW DIRECTION

PHASE II TEST LOCATIONS
MW-## GROUNDWATER MONITORING WELL (3)
TH-## TESTHOLE (9)
VW-## SOIL VAPOUR MONITORING WELL (2)

LEGEND
HISTORIC WASTE DISPOSAL
LOT BOUNDARY
ELECTRICAL
SANITARY
STORM
WATER

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

CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE HEAVY DRY WASTE

TITLE: INTERPRETED GROUNDWATER ELEVATIONS
AUGUST 17, 2013

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 1500	April 10/14	12-435	FIGURE 4
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA v1.06.dwg	

APPENDIX A

FIELD PROTOCOLS AND ANALYTICAL DATA, ASCM INFORMATION AND LABORATORY REPORTS

Field Protocols for Soil, Groundwater and Soil Vapour

Monitoring Headspace Vapours and Liquid Levels

Headspace Vapours

Headspace vapours were measured with an RKI Eagle II portable dual sensor gas meter. The combustible vapour sensor is calibrated to hexane; the volatile vapour sensor is calibrated to isobutylene. The sample pump operates at a flow rate of about 944 ml/minute and the instrument response time is rated at 90% reading within 30 seconds, more or less.

Below is a list of the general headspace vapour monitoring protocol employed by Tiamat staff.

1. Allow the combustible and volatile sensors in the RKI Eagle II to stabilize after turning the instrument on. Typically, the instrument will stabilize within 3 to 5 minutes. Check the display voltage for the instrument is within the specified normal operating range. Should the display not show zero in ambient air, verify there are no interfering sources of Volatile Organic Compound (VOC) or combustible vapours and perform an instrument "fresh air zero" in a fresh air environment.

2. Prior to measuring headspace vapours, the monitoring well screw caps were loosened just before monitoring was conducted.

3. The probe tip of the RKI Eagle II was inserted into the top section of the monitoring well using a gloved hand. The gloved hand is held against the top of the monitoring well to limit influences of air currents at the ground surface mixing with the headspace during the period of measurement. Measurement is for a minimum of 30 seconds and maximum of approximately 2 minutes.

4. The highest reading from each sensor of the RKI Eagle was recorded in ppm, unless otherwise noted.

5. Should a low oxygen alarm activate during the measurement period, monitor the display and withdraw the probe tip once the reading has peaked. Observe the reading while the probe draws fresh air. Record the maximum reading. Repeat this if necessary.

Liquid Levels

Liquid levels are measured by a Heron H.01L oil-water interface meter. The interface probe is lowered into the monitoring well until an audible signal is established by the probe. Liquid readings are taken during the lowering of the probe to minimize effects of surface tension and potential erroneous readings. The measurement is taken to the highest point on the monitoring well pipe.

The interface probe is washed with a detergent solution and thoroughly rinsed with clean water between each monitoring well.

Measurement of Water Quality Indices

Standard water quality parameters (pH, electrical conductivity, temperature, dissolved oxygen, total dissolved solids and redox potential) were field measured by a YSI Pro Plus multi-meter. The multi-meter is calibrated prior to each sampling event. Calibration is performed and documented in-house at Tiamat and re-checked by an independent third-party service provider between every third or fourth in-house instrument calibration event. Calibration and service records are maintained on file.

Groundwater Sampling

Groundwater sampling is conducted using either a disposable polyethylene bailer or portable stainless steel submersible pump. The specific sample pump utilizes a low flow sampling technique to minimize losses of VOCs by degassing during collection of water sample. In circumstances where insufficient water is present in a groundwater monitoring well, a dedicated polyethylene bailer is used.

Sampling by Disposable Polyethylene Bailer

Field procedures to perform groundwater sampling using a disposable polyethylene bailer are as follow:

1. Loosen the well screw caps and measure the liquid level with a Heron interface probe. Lower the interface probe to the highest side of the monitoring well pipe and take the first reading when an audible signal is established. The probe is rinsed with a detergent solution and clean water between each well.

2. Measure the nylon string to an approximate length of about 1 m or so greater than the expected sampling depth.

3. Tie the string to the bailer, make a big loop at the other end of the string and tie it to the sampler's hand.

4. Lower the bailer into the well, bail the stagnant water and dispose into a pail. Note subjectively any attributes of the purged ground water such as, odour, colour and phase-separate liquid.

5. During and following purging, the water indices (pH, electrical conductivity, temperature, dissolved O_2, total dissolved solids, and redox) are measured by a YSI multi-meter using a sample container and bailer or a flow cell and pump combination.

6. Repeat steps 4-5 until pH, electrical conductivity and temperature exhibit less than 10% variation, indicating a stabilized groundwater condition.

7. Once the indices indicate a stabilized state, water samples are bottled into laboratory supplied bottles and preservatives as per the laboratory instruction.

8. Note the approximate volume of water extracted, the visual quality of water, any unusual odour or discolouration and the water indices at the time of sample collection.

9. New bailer, nylon string and disposable nitrile gloves are used at each well to prevent cross contamination and preserve sample integrity.

Low Flow Sampling

Field procedures to perform low flow sampling are as follow:

1. Loosen the well screw caps and measure the liquid level with a Heron interface probe. Lower the interface probe to the highest side of the monitoring well pipe and take the first reading when an audible signal is established. The probe will be rinsed with a detergent solution and clean water between each well.

2. Once the liquid level is measured, the distance between the bottom of the monitoring well and the liquid level is calculated. The pump will be set near the middle of the water column in order to avoid stirring of sediments at the bottom of the well.

3. The required length of the Teflon tubing is determined by adding the length of the middle water column and an additional length to allow for water discharge into a pail. If the monitoring well is an aboveground casing, the length of the aboveground casing will be added as well.

4. New Teflon tubing is used at each well to avoid cross contamination.

5. Set up 12 V Monsoon stainless steel submersible pump and flow controller with Teflon tubing. Slowly lower the pump to the middle of the water column.

6. Adjust the voltage on the flow controller to acquire the required flow rate. Measure the liquid level using the interface probe from time to time. Minimal drawdown is attained once the liquid level drops and stays within the 10% range of the first measurement.

7. Once the required flow rate is achieved, attach the Teflon tubing to the inlet of the flow cell with the YSI multi-meter probe and measure the indices with the YSI multi-meter. Connect a discharge Teflon tube to the outlet of the flow cell to allow for water to discharge from the flow cell into a pail.

8. Collect groundwater samples after pH, electrical conductivity and temperature stabilize within 10% variation. Apply preservatives as per the laboratory instruction.

9. After collecting samples, transfer the pump into a clean pail filled with clean water and let it run for a moment to remove entrapped sediments. Then run the pump in a second pail to ensure thorough flush following the first rinse.

10. To avoid confusion, label pails in the sequence where the pump is rinsed. Replace with clean water in the pail as required.

Groundwater Sample Handling

The laboratory requires six (6) 40 ml clear glass vials and two (2) 250 ml amber bottles for analyses of Volatile Organic Compounds (VOCs), Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), petroleum hydrocarbon fractions F1 and F2. Check the white preservative tablets are present in each 40 ml vial and 250 ml amber bottle. As well, once filled and capped, confirm each vial and bottle exhibits no notable headspace. If necessary, discard and resample with new vials and bottles.

A 45 micron filter is used to field filter groundwater for analyses of dissolved metals. The filter outlet is placed on top of a sample bottle while water is decanted through a dedicated Teflon tubing attached to the inlet of the filter. Laboratory provided nitric acid is used to preserve the sample. New filter and Teflon tubing are used for each well location.

During field sampling disposable nitrile gloves are worn during sampling and changed between wells. In the event where suspicious cross-contamination occurs, nitrile gloves and sampling bottles are discarded and replaced. Each set of samples is properly labelled and bagged into a dedicated poly bag to prevent potential cross contamination between sample bottles from different well locations. Samples are stored in a cooler with ice to maintain temperature at about 5^{o} C. The coolers are dropped off at a secure laboratory depot with a completed chain of custody at the end of each sampling day for delivery to the laboratory in Calgary, Alberta.

Soil Sampling During Drilling

Soil samples were collected during the advancement of testholes using solid stem auger, hollow stem auger or ODEX tooling. A Geoprobe or small track or truck-mounted drill rig was determined pending the presence of soft ground and the ability to access test locations in a confined or steep slope (more than 10%).

Solid stem auger was used at most of the sites to enable collection of representative soil samples. However, in cases where the test location lies near the river bank or on top of gravels, hollow stem auger or ODEX was employed to drill through the hard sediments and prevent sloughing and enable the installation of a groundwater or soil vapour monitoring well.

When waste material is noted in soil, the drilling continues to the depth where the waste ends and/or the native soil is encountered to ensure complete profiling of the waste

material. Bulk soil samples underlying the waste were collected for laboratory analyses; soil samples from each soil bag were also submitted for laboratory analyses. Pending laboratory results, drill cuttings in the soil bags may be disposed at The City of Red Deer Waste Management Facility.

Sampling Soil Vapour Using Summa Canister®

1. Unlock the steel well casing and remove the brass cap from the vapour probe valve. Connect the lab provided Teflon tubing with Swagelok® fitting to the probe valve. Hand-tighten the fitting plus ¼ additional turn using a 9/16 inch wrench. To avoid damage and short circuit of the Swagelok®, care should be taken to avoid over tightening the Swagelok® fitting.

2. Connect the probe tip of the RKI Eagle II with the Teflon tubing attached to the vapour probe. Open the vapour valve to allow the vapour to flow into the monitoring instrument.

3. Start the stop watch to count the purge time. The purge time is calculated by dividing the volume of the 1 inch PVC pipe with the flow rate of the RKI Eagle II.

4. For sites with heavy municipal solid waste (MSW) i.e. Lindsay Thurber Comprehensive High School, McKenzie Trail, Montfort, Red Deer College and Red Deer Motors, a minimum of three (3) equivalent volumes of soil vapour are purged prior to collecting a well vapour sample.

5. Record combustible and volatile vapours between the initial 30 seconds to two (2) minutes during purging.

6. Using the digital Cole-Palmer absolute pressure gauge, record the ambient and probe barometric pressures. The probe pressure is measured by connecting the gauge tip with the Teflon tubing attached to the vapour probe. The vapour probe and the pressure gauge should be on during the measurement.

7. Remove the brass cap from the 1.4 L Summa Canister® valve with a 9/16 inch wrench.

8. Attach the flow controller to the canister and remove the brass cap from the gauge adapter. Hand tighten the fittings and tighten another ¼ turn using a 9/16 wrench.

9. Open the valve, record the canister vacuum (this should read between -29 to -25 in Hg and close the valve.

10. Connect the adapter with the Teflon tubing to the vapour probe. Hand-tighten the fitting and tighten another ¼ turn using a 9/16 inch wrench.

11. Open the vapour probe and open the canister valve. Check the gauge periodically to ensure sample flow rate is acceptable.

12. When the vacuum reads about -5 inches Hg, close the vapour probe and the valve, disassemble the flow controller and the Teflon tubing, then place the protective brass cap back on the canister valve. Hand tighten the cap and perform another ¼ turn using a 9/16 inch wrench.

13. It is always a good practice to maintain some vacuum in the canister following sampling. The residual vacuum serves as a check for the integrity of the canister during transport to the laboratory.

14. Record the canister and the flow controller serial numbers on the field sheet and the chain of custody.

15. A dedicated set of Teflon tubing, Swagelok® fitting and gauge with flow controller assembly must be used at each sample well location to prevent cross contamination.

Sampling Soil Vapour Using Tedlar Bag®

1. Place the 1 L Tedlar Bag® inside the lung box. Connect the Tedlar Bag® nozzle with the tubing attached to the brass nipple inside the lung box.

2. Perform a full turn counter clockwise to open the valve and go another ¼ turn clockwise. This is to ensure that the valve is properly opened for sampling.

3. Connect the Teflon tubing attached to the vapour probe with the exterior brass nipple on the lung box.

4. Connect the other exterior brass nipple of the lung box to the SKC pump. Ensure the lung box is closed to prevent air leak during sampling.

5. Open the vapour probe valve and activate the SKC pump. The pump will evacuate the lung box causing the Tedlar Bag® to expand drawing a sample of soil vapour.

6. The SKC pump was set at a flow rate of 0.5 L/min and the volume of the lung box is 4 L. The estimated sampling time is approximately 8 minutes. Check the Tedlar Bag® at about 8 minutes or periodically to verify the progress of sample collection.

7. When the Tedlar Bag® is approximately 80% full, close the bag valve by turning it clockwise until it is tight. Then turn off the SKC pump and close the vapour probe. To ensure the bag is sufficiently filled, repeat steps 5-7, if necessary.

8. Avoid over filling the Tedlar Bag®. This will prevent damage to the bag if exposure to change of temperature, altitude and barometric pressure occurs during transport by ground and/or air.

Validation of Analytical Data

Alberta Environment and Sustainable Resource Development (ESRD), formerly Alberta Environment, implemented a Laboratory Data Quality Assurance Policy in October 2001. This policy requires laboratories providing environmental analytical data to meet the accreditation standards set by ESRD. ALS Canada Ltd. and Maxxam Analytics are each accredited by Standards Council of Canada (SCC), which is administered by the Canadian Association for Laboratory Accreditation Inc. (CALA). This accreditation demonstrates ALS Canada Ltd. Laboratories and Maxxam Analytics have consistent laboratory procedures and quality controls meeting national and international standards for staff training, equipment maintenance and documentation of parameters. The laboratory protocols must be maintained to demonstrate the in lab quality assurance/quality control (QA/QC) procedures are consistently maintained and are paramount to the integrity and reliability of the reported results.

A data quality review was performed for all analytical results reported. The data quality review comprised of the following actions by Tiamat.

- Ensure the Chain of Custody form are properly completed and signed;
- Ensure the requested analyses were performed and reported for the correct samples;
- Calculate and review relative percent differences (RPD), where available, to assess the laboratory precision and analytical variability for each batch of samples;
- Perform independent review of the internal quality control (QC) and quality assurance (QA) practices for the laboratory;
- Confirm the applicable holding times and extraction times for each sample have been met by the laboratory;
- Identify and resolve additional data quality issues with the laboratory.

The Chain of Custody forms submitted for each work order for this project appeared to be properly completed. The Chain of Custody forms show the sample temperature (where applicable) upon receipt at the laboratory and the appropriate sample custody signatures.

Laboratory QC protocols include surrogate recoveries, laboratory duplicates, method blanks, matrix spikes and reference materials, where applicable. QC results published

with the sample report comply with the prescribed laboratory QC limits. Thus, analytical results are deemed to be within acceptable variability and a corresponding acceptable level of precision and accuracy.

Tiamat reviews all QA/QC outcomes published with the respective laboratory reports. Discrepancies are reported to the laboratory for follow-up. The laboratory's analytical processes for the specific testing program for this project appear to be acceptable.

The holding times experienced by all samples submitted met the recommended holding time limit for the specified parameter where applicable. Overall, the review and data validation process indicates the analytical results are valid and reliable.

For the Riverside Heavy Dry Waste Site, a total of 3 groundwater samples, 1 Summa Canister® and 1 Tedlar Bag® was collected for this Phase II ESA. Note, a duplicate Tedlar Bag® sample was collected for QA/QC purposes.

Sample containers were provided by the laboratory. Collected samples are appropriately packed in sample coolers and shipped from Red Deer to Calgary by a third-party courier contracted by the respective laboratory. It is presumed the courier handles the sample coolers with appropriate care. There were no reported issues with the samples upon receipt at the laboratory.

Tiamat applies a uniform field protocol consistent with industry practice to ensure the integrity of each sample collected for laboratory analysis. Coupled with the in-house laboratory control measures implemented by each laboratory, the overall QA/QC objectives are deemed to be satisfied.

Field Duplicate Evaluation

An evaluation of duplicate variation is undertaken to assess the precision of field sampling and laboratory analyses. For comparison, the relative percent difference (RPD) is calculated.

RPD is defined as the absolute difference between two results divided by the average of the two results multiplied by one hundred. Where one result is below detection limit, and its duplicate result is above detection limit, the non-detect concentration is assigned the detection limit for the purposes of calculating RPD.

Groundwater duplicates should be taken during groundwater sampling events at an average of every ten (10) samples or about 10% of the sample set.

For groundwater samples, the objective for RPD values is to be not more than 20%.

Field Blank Assessment

A field blank is a sample of laboratory-supplied reverse osmosis water poured into a laboratory supplied sample container in the field and shipped to the laboratory with the field samples using a unique sample identifier. The purpose of a field blank is to assess

potential cross contamination from field conditions during sampling. For this initial assessment, no previous site specific analyte data was available, thus field blanks were not deemed to be necessary.

Trip Blank Assessment

A trip blank is a clean sample container of reverse osmosis water that is taken to the sampling site and transported back to the laboratory for analysis without having been exposed to sampling procedures. The trip blanks prepared by the laboratory are kept within the sample containers at all times and never opened in the field. Analyses of trip blanks indicate whether a sample was contaminated during shipment from the laboratory to the field and from the field to the laboratory. Tiamat's standard sample bottle procedure is to have each set of sample bottles placed into clean new plastic bags. This prevents direct contact between other sample bottles in the sample cooler.

Field Duplicates

Duplicate samples are samples collected sequentially at the time of sampling. Generally the same compounds should be detected in both samples. For this initial assessment, there have been no history of problematic analytical parameters and field duplicates were not warranted.

Laboratory Quality Control

The following sections outline the quality control measures which the laboratory implements. Generally, Maxxam's and ALS's QA/QC samples were tested at least once per analytical batch.

Laboratory Duplicate Assessment

Lab duplicates are two separate aliquots of water (from one location but from different vials) that are analysed in the laboratory to assess laboratory analytical precision. For comparison between duplicates a calculation of relative percent difference (RPD) was carried out by the laboratory. No laboratory duplicate had any analytes with an RPD greater than the laboratory control limits. This quantitatively affirms the QA/QC and the precision of a sample result.

Matrix Spike Assessment

A matrix spike is a sample prepared by adding a known mass of a target analyte(s) to a specified amount of sample (matrix). Spiked samples are used to determine the effect of the matrix on a method's recovery efficiency. The laboratory states their control limits based on 99% confidence interval in the quality control report section of the laboratory analytical report. Control limits for recoveries are often statistically determined by the method, but under some conditions may revert to standard method limits.

Generally, matrix spike recoveries for groundwater tests were within laboratory control limits. The results of matrix spike recovery confirm the protocols and the acceptable limits established by the laboratory for precision and accuracy was met.

Terms and Conditions for use of Alberta Survey Control Marker Data

1. The distribution of this digital data is provided as a service to the user and is under copyright to the Government of Alberta.

2. Redistribution of the data in whole or in part, whether alone or part of a value added product, is not permitted without the prior written consent of Alberta Sustainable Resource Development on behalf of the Minister of Alberta Sustainable Resource Development, Government of Alberta.

3. In view of the dated nature of the data, it is the responsibility of the user of the data:
   a) Confirm with the Alberta Sustainable Resource Development whether later versions are available before making use of the data.
   b) Advise users of the age and status of the data if the Minister permits the user to provide the data to other users.

4. The user agrees that the data and each part thereof, any formatting or presentation thereof, any storage media on which it is provided, and any communication of any kind, incidental or in relation thereto, is provided to the user by the Minister and the Crown without warranty or representation as to any matter including but not limited to whether the data and storage media is correct, accurate or free from error, defect, danger, or hazard, and whether it is otherwise useful or suitable for any use the user may make of it.

5. The Crown in right of Alberta, the Minister and their employees and agents, shall not be liable for any claims, costs, losses, or damages, including any special, indirect, incidental or consequential loss or damage, which the user may incur or experience as a result of the use or possession of the data or associated storage media.

SURVEYING AND MAPPING DIVISION
Alberta Survey Control Marker (ASCM) Information
MASCOT DSS-1

Horz Datum NAD83 Updated: 1994-05-24 — ASCM 36574
Latitude 52 17 43.12829 dms — Marker Installed 67-03
Longitude 113 47 52.26311 dms — Tablet Markings 793+16.23.4
Horz Class INTEGRATED , ORDER 2 — Date Printed 2013-08-21
Last Updated 2003-03-12 — Mapsheet Name RED DEER
Vert Datum CVD28 Updated: 1983-12-08 — Mapsheet Number 5793 + 016
Elevation 850.471 m — For current information call Geodetic Survey
Vert Class INTEGRATED , SPIRIT LEVELS — (780) 427-3143 FAX: (780) 427-1493 — Marker Condition GOOD 92-02-20

3TM COORDINATES

Scale Factor 0.999900 At Ref Mer 114

Northing 5795642.746 m
Easting 13790.274 m
Convergence 0 09 35.77 dms
Station Ellipsoid Factor 0.999870
Station Combined Factor 0.999772

GEOID DATA (GSD95) Updated: 96-01-06

Component	Magnitude	Std Dev
Meridian Defl,XI(+N)	2.1 s	2 s
Prime Vert Defl,ETA(+E)	4.4 s	2 s
Geoid_Ellip Separation	-18.29 m	1 m

COORDINATE HISTORY	HORZ	VERT
Originating Project	70033	70033
Published	83-12-08	83-12-08
Revising Project	NAD83	
Published	94-05-24	
Revising Project		
Published		
Revising Project		
Published		

NON COORDINATE REVISIONS

1971-05-19 FIRST MARKER LOCATION DESCRIPTION ENTERED
2003-03-12 "MAPSHEET NAME" AND/OR "MAPSHEET NO" CHANGED

HISTORICAL/OTHER MARKER NAMES

OLD ASC # 57933 16 62

HISTORY 57933 16 62

ADJACENT MARKERS (calculated) Updated: 1994-06-07

ASCM To	Tablet Markings	Horizontal Distance (m)	Std Dev (cm)	PPM/ Order	Grid/ Grnd Factor	Grid Bearing (dms)	Std Dev (s)	T-t Corr (s)
67884	793+16.23.3	427.874	1	28/1	0.999774	29 42 37.77	2.4	0.01
14266	793+16.24.3	444.161	1	40/2	0.999769	297 38 36.48	3.4	0.01
39024	793+16.91	474.231	1	38/2	0.999770	292 23 06.92	3.2	0.01
124339	793+16.103	483.134	1	29/2	0.999771	186 38 49.27	2.5	-0.02
225466	793+16.96	491.603	1	45/2	0.999770	249 07 53.21	3.6	-0.01
266627	793+16.90	530.988	1	38/2	0.999770	301 13 12.35	3.1	0.01

MARKER TYPE Updated: 1992-03-27

ASC BRASS TABLET MKD 793+16.23.4 ON 7.0CM HEAVY WALL STEEL PIPE.
9 CM BGL IN A MH & COVER, LANDSCAPED

MARKER LOCATION Updated: 1988-12-01

LOCATED ON THE WEST SIDE OF RIVERSIDE DRIVE - SOUTH OF 42 AVENUE SHOWN ON PLAN #5495 MCL; 7.0 M NORTH OF CENTRE LINE OF RIVERSIDE DRIVE; 117.7 M SOUTH OF CENTRE LINE OF STORM SEWER CROSSING MARKED WITH SIGN "AUTHORIZED VEHICLES ONLY BEYOND THIS POINT"; COUNTER SUNK IN STEEL SLEEVE WITH REMOVABLE LID.

MARKER CONDITION COMMENTS	Inspected	Updated
MARKER REPORTED IN GOOD CONDITION	1992-02-20	1992-03-27
MARKER REPORTED IN GOOD CONDITION.	1989-02-08	1989-06-07
MARKER REPORTED IN GOOD CONDITION.	1988-11-24	1988-12-01

COORDINATE HISTORY COMMENTS

HORZ 94-05-24 ALBERTA NAD83 READJUSTMENT

VERT

SURVEYING AND MAPPING DIVISION
Alberta Survey Control Marker (ASCM) Information
MASCOT DSS-1

Horz Datum NAD83 Updated: 1994-05-24 — ASCM 124339
Latitude 52 17 27.60973 dms — Marker Installed 82-12
Longitude 113 47 55.28404 dms — Tablet Markings 793+16.103
Horz Class INTEGRATED , ORDER 2 — Date Printed 2013-08-21
Last Updated 2003-03-12 — Mapsheet Name RED DEER
Vert Datum CVD28 Updated: 1984-07-04 — Mapsheet Number 5793 + 016
Elevation 854.345 m — For current information call Geodetic Survey
Vert Class INTEGRATED , SPIRIT LEVELS — (780) 427-3143 FAX: (780) 427-1493 — Marker Condition GOOD 92-02-20

3TM COORDINATES

Scale Factor 0.999900 At Ref Mer 114

Northing 5795162.970 m
Easting 13734.363 m
Convergence 0 09 33.34 dms
Station Ellipsoid Factor 0.999869
Station Combined Factor 0.999771

GEOID DATA (GSD95) Updated: 96-01-06

Component	Magnitude	Std Dev
Meridian Defl,XI(+N)	2.1 s	2 s
Prime Vert Defl,ETA(+E)	4.3 s	2 s
Geoid_Ellip Separation	-18.28 m	1 m

COORDINATE HISTORY	HORZ	VERT
Originating Project	82042	82042
Published	84-07-04	84-07-04
Revising Project	NAD83	
Published	94-05-24	
Revising Project		
Published		
Revising Project		
Published		

NON COORDINATE REVISIONS

1984-07-04 FIRST MARKER LOCATION DESCRIPTION ENTERED
2003-03-12 "MAPSHEET NAME" AND/OR "MAPSHEET NO" CHANGED

HISTORICAL/OTHER MARKER NAMES

OLD ASC # 57933 16 103

HISTORY 57933 16 103

ADJACENT MARKERS (calculated) Updated: 1994-06-06

ASCM To	Tablet Markings	Horizontal Distance (m)	Std Dev (cm)	PPM/ Order	Grid/ Grnd Factor	Grid Bearing (dms)	Std Dev (s)	T-t Corr (s)
109843	793+16.104	314.801	1	73/2	0.999771	271 14 35.24	6.1	0.00
257030	085220	323.950	1	52/2	0.999769	216 07 36.98	4.3	-0.01
424036	424036	342.931	1	38/2	0.999769	177 09 24.74	3.1	-0.01
84251	793+16.13.2	373.193	1	40/2	0.999770	132 41 32.09	3.3	-0.01
41491	793+16.105	389.892	1	51/2	0.999771	243 18 24.12	4.3	-0.01
119826	793+16.97	473.445	1	40/2	0.999771	292 28 34.59	3.4	0.01

MARKER TYPE Updated: 1992-03-27

ASC BRASS TABLET ON A 5CM X 250CM HEAVY WALL SQ STEEL PIPE WITH HELIX.
FLUSH WITH GROUND. 1 GP, LANDSCAPED

MARKER LOCATION Updated: 1989-06-07

LOCATED ON THE WEST SIDE OF RIVERSIDE DRIVE AND NORTH OF 67 STREET (BRIDGE) RIGHT OF WAY NEAR THE NORTH SIDE OF CURVE IN RIVERSIDE DRIVE; ON THE EAST SIDE OF RAIL ROAD ABUTMENT IN GRAVEL; 3.0 M EAST OF EAST RAIL; 25.35 M SOUTH OF ANCHOR POLE FOR POWER POLE #856; 34.0 M WEST OF CENTRE LINE OF RIVERSIDE DRIVE; 52.4 M SOUTH OF FD I AT SOUTH POINT OF LOT 21, BLOCK 1, PLAN #782-2383; 23.3 M WEST OF THIRD LIGHT STANDARD NORTH OF BRIDGE ON OFF RAMP.

MARKER CONDITION COMMENTS	Inspected	Updated
MARKER REPORTED IN GOOD CONDITION	1992-02-20	1992-03-27
MARKER REPORTED IN GOOD CONDITION.	1989-02-08	1989-06-07
MARKER REPORTED IN GOOD CONDITION.	1988-11-24	1988-12-01

COORDINATE HISTORY COMMENTS

HORZ 94-05-24 ALBERTA NAD83 READJUSTMENT

VERT

SURVEYING AND MAPPING DIVISION
Alberta Survey Control Marker (ASCM) Information
MASCOT DSS-1

Horz Datum NAD83 Updated: 1994-05-24 ASCM 170910
Latitude 52 18 43.04220 dms Marker Installed 82-12
Longitude 113 47 51.41204 dms Tablet Markings 796+16.33
Horz Class INTEGRATED , ORDER 2 Date Printed 2013-08-21
Last Updated 2003-03-12 Mapsheet Name RED DEER
Vert Datum CVD28 Updated: 1984-07-04 Mapsheet Number 5796 + 016
Elevation 848.688 m For current information call Geodetic Survey
Vert Class INTEGRATED , SPIRIT LEVELS (780) 427-3143 FAX: (780) 427-1493 Marker Condition GOOD 82-12-01

3TM COORDINATES

Scale Factor 0.999900 At Ref Mer 114

Northing 5797494.494 m
Easting 13801.226 m
Convergence 0 09 36.57 dms
Station Ellipsoid Factor 0.999870
Station Combined Factor 0.999772

GEOID DATA (GSD95) Updated: 96-01-06

Component	Magnitude	Std Dev
Meridian Defl,XI(+N)	2.0 s	2 s
Prime Vert Defl,ETA(+E)	4.5 s	2 s
Geoid_Ellip Separation	-18.30 m	1 m

COORDINATE HISTORY

	HORZ	VERT
Originating Project	82042	82042
Published	84-07-04	84-07-04
Revising Project	NAD83	
Published	94-05-24	
Revising Project		
Published		
Revising Project		
Published		

NON COORDINATE REVISIONS

1984-07-04 FIRST MARKER LOCATION DESCRIPTION ENTERED
2003-03-12 "MAPSHEET NAME" AND/OR "MAPSHEET NO" CHANGED

HISTORICAL/OTHER MARKER NAMES

OLD ASC # 57963 16 33

HISTORY 57963 16 33

ADJACENT MARKERS (calculated) Updated: 1994-06-07

ASCM To	Tablet Markings	Horizontal Distance (m)	Std Dev (cm)	PPM/ Order	Grid/ Grnd Factor	Grid Bearing (dms)	Std Dev (s)	T-t Corr (s)
74005	796+16.38	398.598	1	40/2	0.999771	192 10 32.39	2.9	-0.01
69476	796+16.7.2	515.645	1	37/2	0.999769	239 44 03.25	3.2	-0.01
136630	796+16.13.3	527.995	1	32/2	0.999774	88 13 33.81	2.7	0.00
41335	796+16.18.1	613.459	1	29/2	0.999773	355 01 45.10	2.4	0.02
194324	796+16.39	615.482	1	31/2	0.999773	120 49 54.11	2.5	-0.01
218081	796+16.37	628.577	1	35/2	0.999769	256 24 28.97	3.0	-0.01

MARKER TYPE Updated: 1984-07-04

ASC CAP ON 5 CM SQ HEAVY WALL STEEL PIPE 2.4 M LONG WITH HELIX BASE

MARKER LOCATION Updated: 1984-07-04

ON N/S OF NORTHLAND DR W OF 78 ST CRES NEAR SEWAGE TREATMENT PLANT; IN BERM; 7.900 S OF & 13.840 E OF CHAIN LINK FE COR POST; 17.700 W OF OVERHEAD POW.P #8/768L; 51.450 E OF N FD I & 58.900 E OF S FD I OF UTILITY RIGHT-OF-WAY AT INT WITH BEGINNING OF CURVE OF NORTHLAND DR W OF 78 ST CRES (FD I'S 21.16 APART); AS SHOWN ON PLAN 812-2987; 0.500 S OF MP.

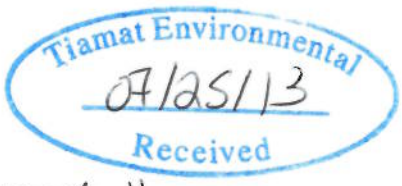
MARKER CONDITION COMMENTS Inspected Updated

COORDINATE HISTORY COMMENTS

HORZ 94-05-24 ALBERTA NAD83 READJUSTMENT

VERT

SOIL REPORTS



Riverside Heavy

TIAMAT ENVIRONMENTAL
ATTN: LEON MAH
UNIT 107, 2719 - 7TH AVENUE NE
CALGARY AB T2A 2L9

Date Received: 17-JUL-13
Report Date: 25-JUL-13 16:54 (MT)
Version: FINAL

Client Phone: 403-640-9009

Certificate of Analysis

Lab Work Order #:	***L1333995***
Project P.O. #:	NOT SUBMITTED
Job Reference:	12-435
C of C Numbers:	10-189192, 10-189193
Legal Site Desc:	

Monica Gibson

Monica Gibson
Account Manager

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-4	RIVERSIDE HEAVY TH-01 @ 43'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		F1 (C6-C10)	<10		10	mg/kg		24-JUL-13	
		F1-BTEX	<10		10	mg/kg		24-JUL-13	
		F2 (C10-C16)	<25		25	mg/kg		24-JUL-13	
		F3 (C16-C34)	<50		50	mg/kg		24-JUL-13	
		F4 (C34-C50)	<50		50	mg/kg		24-JUL-13	
		F4G-SG (GHH-Silica)	<500		500	mg/kg		24-JUL-13	
		Total Hydrocarbons (C6-C50)	<50		50	mg/kg		24-JUL-13	
		Chromatogram to baseline at nC50	YES					24-JUL-13	
		CCME Gravimetric Heavy Hydrocarbons (SG)							
		F4G Prep/Analysis Dates					21-JUL-13	22-JUL-13	VRP
		CCME F2-4 Hydrocarbons							
		Prep/Analysis Dates					18-JUL-13	19-JUL-13	MAQ
	Surrogate:	2-Bromobenzotrifluoride	92.3		N/A	%	18-JUL-13	19-JUL-13	MAQ
		BTEX, Styrene and F1 (C6-C10)							
		Benzene	<0.0050		0.005	mg/kg	18-JUL-13	22-JUL-13	BY
		Toluene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Ethylbenzene	<0.015		0.015	mg/kg	18-JUL-13	22-JUL-13	BY
		o-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		m+p-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Xylenes	<0.10		0.1	mg/kg	18-JUL-13	22-JUL-13	BY
		Styrene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
	Surrogate:	Chlorobenzene	106.2		N/A	%	18-JUL-13	22-JUL-13	BY
		Sum of NO2,NO3							
		Nitrate and Nitrite as N	<1.4		1.4	mg/L		25-JUL-13	
		Nitrite-N	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate (as N)	<1.0		1	mg/L		24-JUL-13	RMS
		% Moisture	13.8		0.1	%	18-JUL-13	19-JUL-13	VRP
		% Saturation	18.5		1	%		24-JUL-13	NHK
		Mercury (Hg)	<0.050		0.05	mg/kg	23-JUL-13	24-JUL-13	SHT
		Boron (B), Hot Water Ext.	0.21		0.1	mg/kg		25-JUL-13	AMCB
		Hexavalent Chromium	<0.10		0.1	mg/kg	23-JUL-13	23-JUL-13	JTV
		Chloride (Cl)	<20		20	mg/L		24-JUL-13	SCL
		Salinity in mg/kg							
		Chloride (Cl)	<3.7		3.7	mg/kg		25-JUL-13	
		Nitrate-N	<0.19		0.19	mg/kg		25-JUL-13	
		Nitrite-N	<0.19		0.19	mg/kg		25-JUL-13	
		EPA 8260 Volatile Organics							
		Dichlorodifluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloromethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Vinyl chloride	<0.20		0.2	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromomethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichlorofluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Methylene chloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-4	RIVERSIDE HEAVY TH-01 @ 43'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		EPA 8260 Volatile Organics							
		1,1-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Carbon tetrachloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromodichloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromomethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Tetrachloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromoethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1,2-Tetrachloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromoform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Isopropylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2,2-Tetrachloroethane	<0.050		0.05	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichloropropane	<0.020		0.02	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Propylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3,5-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		4-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		tert-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		sec-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		p-Isopropyltoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,4-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromo-3-chloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Hexachlorobutadiene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
Surrogate:		1,4-Difluorobenzene	110.5		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		4-Bromofluorobenzene	109.2		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		3,4-Dichlorotoluene	89.9		N/A	%	18-JUL-13	19-JUL-13	CFB
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Antimony (Sb)	<0.20		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Arsenic (As)	1.86		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-4	RIVERSIDE HEAVY TH-01 @ 43'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Barium (Ba)	54.4		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Beryllium (Be)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cadmium (Cd)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Chromium (Cr)	5.76		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cobalt (Co)	2.2		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Copper (Cu)	3.7		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Lead (Pb)	<5.0		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Molybdenum (Mo)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Nickel (Ni)	5.7		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Selenium (Se)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Silver (Ag)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Thallium (Tl)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Tin (Sn)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Uranium (U)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Vanadium (V)	8.4		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Zinc (Zn)	15		10	mg/kg	22-JUL-13	23-JUL-13	JPM
L1333995-5	RIVERSIDE HEAVY TH-03 @ 18'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Antimony (Sb)	0.36		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Arsenic (As)	5.85		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Barium (Ba)	223		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Beryllium (Be)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cadmium (Cd)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Chromium (Cr)	18.6		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cobalt (Co)	7.3		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Copper (Cu)	16.4		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Lead (Pb)	8.4		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Molybdenum (Mo)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Nickel (Ni)	21.1		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Selenium (Se)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Silver (Ag)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Thallium (Tl)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Tin (Sn)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Uranium (U)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Vanadium (V)	29.2		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Zinc (Zn)	58		10	mg/kg	22-JUL-13	23-JUL-13	JPM
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		F1 (C6-C10)	<10		10	mg/kg		24-JUL-13	
		F1-BTEX	<10		10	mg/kg		24-JUL-13	
		F2 (C10-C16)	<25		25	mg/kg		24-JUL-13	
		F3 (C16-C34)	<50		50	mg/kg		24-JUL-13	
		F4 (C34-C50)	<50		50	mg/kg		24-JUL-13	
		F4G-SG (GHH-Silica)	<500		500	mg/kg		24-JUL-13	
		Total Hydrocarbons (C6-C50)	<50		50	mg/kg		24-JUL-13	
		Chromatogram to baseline at nC50	YES					24-JUL-13	

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-5	RIVERSIDE HEAVY TH-03 @ 18'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Gravimetric Heavy Hydrocarbons (SG)							
		F4G Prep/Analysis Dates					21-JUL-13	22-JUL-13	VRP
		CCME F2-4 Hydrocarbons							
		Prep/Analysis Dates					18-JUL-13	19-JUL-13	MAQ
	Surrogate:	2-Bromobenzotrifluoride	108.7		N/A	%	18-JUL-13	19-JUL-13	MAQ
		BTEX, Styrene and F1 (C6-C10)							
		Benzene	<0.0050		0.005	mg/kg	18-JUL-13	22-JUL-13	BY
		Toluene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Ethylbenzene	<0.015		0.015	mg/kg	18-JUL-13	22-JUL-13	BY
		o-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		m+p-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Xylenes	<0.10		0.1	mg/kg	18-JUL-13	22-JUL-13	BY
		Styrene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
	Surrogate:	Chlorobenzene	91.0		N/A	%	18-JUL-13	22-JUL-13	BY
		Chloride (Cl)	58		20	mg/L		24-JUL-13	SCL
		% Moisture	18.7		0.1	%	18-JUL-13	19-JUL-13	VRP
		% Saturation	50.0		1	%		24-JUL-13	NHK
		Boron (B), Hot Water Ext.	0.12		0.1	mg/kg		25-JUL-13	AMCB
		Hexavalent Chromium	<0.10		0.1	mg/kg	23-JUL-13	23-JUL-13	JTV
		Mercury (Hg)	<0.050		0.05	mg/kg	23-JUL-13	24-JUL-13	SHT
		Salinity in mg/kg							
		Chloride (Cl)	29		10	mg/kg		25-JUL-13	
		Nitrate-N	<0.50		0.5	mg/kg		25-JUL-13	
		Nitrite-N	<0.50		0.5	mg/kg		25-JUL-13	
		EPA 8260 Volatile Organics							
		Dichlorodifluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloromethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Vinyl chloride	<0.20		0.2	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromomethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichlorofluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Methylene chloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Carbon tetrachloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromodichloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromomethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-5	RIVERSIDE HEAVY TH-03 @ 18'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		EPA 8260 Volatile Organics							
		trans-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Tetrachloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromoethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1,2-Tetrachloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromoform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Isopropylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2,2-Tetrachloroethane	<0.050		0.05	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichloropropane	<0.020		0.02	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Propylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3,5-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		4-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		tert-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		sec-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		p-Isopropyltoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,4-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromo-3-chloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Hexachlorobutadiene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
	Surrogate:	1,4-Difluorobenzene	110.7		N/A	%	18-JUL-13	19-JUL-13	CFB
	Surrogate:	4-Bromofluorobenzene	109.0		N/A	%	18-JUL-13	19-JUL-13	CFB
	Surrogate:	3,4-Dichlorotoluene	90.5		N/A	%	18-JUL-13	19-JUL-13	CFB
		Sum of NO2,NO3							
		Nitrite-N	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate and Nitrite as N	<1.4		1.4	mg/L		25-JUL-13	
		Nitrate (as N)	<1.0		1	mg/L		24-JUL-13	RMS
L1333995-6	RIVERSIDE HEAVY TH-06 @ 42-44'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		F1 (C6-C10)	<10		10	mg/kg		25-JUL-13	
		F1-BTEX	<10		10	mg/kg		25-JUL-13	
		F2 (C10-C16)	<25		25	mg/kg		25-JUL-13	
		F3 (C16-C34)	<50		50	mg/kg		25-JUL-13	
		F4 (C34-C50)	<50		50	mg/kg		25-JUL-13	
		F4G-SG (GHH-Silica)	<500		500	mg/kg		25-JUL-13	
		Total Hydrocarbons (C6-C50)	<50		50	mg/kg		25-JUL-13	

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-6	RIVERSIDE HEAVY TH-06 @ 42-44'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		Chromatogram to baseline at nC50	YES					25-JUL-13	
		CCME Gravimetric Heavy Hydrocarbons (SG)							
		F4G Prep/Analysis Dates					21-JUL-13	22-JUL-13	VRP
		CCME F2-4 Hydrocarbons							
		Prep/Analysis Dates					18-JUL-13	19-JUL-13	MAQ
	Surrogate:	2-Bromobenzotrifluoride	110.9		N/A	%	18-JUL-13	19-JUL-13	MAQ
		BTEX, Styrene and F1 (C6-C10)							
		Benzene	<0.0050		0.005	mg/kg	18-JUL-13	25-JUL-13	BY
		Toluene	<0.050		0.05	mg/kg	18-JUL-13	25-JUL-13	BY
		Ethylbenzene	<0.015		0.015	mg/kg	18-JUL-13	25-JUL-13	BY
		o-Xylene	<0.050		0.05	mg/kg	18-JUL-13	25-JUL-13	BY
		m+p-Xylene	<0.050		0.05	mg/kg	18-JUL-13	25-JUL-13	BY
		Xylenes	<0.10		0.1	mg/kg	18-JUL-13	25-JUL-13	BY
		Styrene	<0.050		0.05	mg/kg	18-JUL-13	25-JUL-13	BY
	Surrogate:	Chlorobenzene	103.3		N/A	%	18-JUL-13	25-JUL-13	BY
		Boron (B), Hot Water Ext.	0.22		0.1	mg/kg		25-JUL-13	AMCB
		% Moisture	12.4		0.1	%	18-JUL-13	19-JUL-13	VRP
		Hexavalent Chromium	<0.10		0.1	mg/kg	23-JUL-13	23-JUL-13	JTV
		Mercury (Hg)	<0.050		0.05	mg/kg	23-JUL-13	24-JUL-13	SHT
		Chloride (Cl)	<20		20	mg/L		24-JUL-13	SCL
		% Saturation	66.5		1	%		24-JUL-13	NHK
		Salinity in mg/kg							
		Chloride (Cl)	<13		13	mg/kg		25-JUL-13	
		Nitrate-N	<0.67		0.67	mg/kg		25-JUL-13	
		Nitrite-N	<0.67		0.67	mg/kg		25-JUL-13	
		EPA 8260 Volatile Organics							
		Dichlorodifluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloromethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Vinyl chloride	<0.20		0.2	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromomethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichlorofluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Methylene chloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Carbon tetrachloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromodichloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-6	RIVERSIDE HEAVY TH-06 @ 42-44'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		EPA 8260 Volatile Organics							
		Dibromomethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Tetrachloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromoethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1,2-Tetrachloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromoform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Isopropylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2,2-Tetrachloroethane	<0.050		0.05	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichloropropane	<0.020		0.02	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Propylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3,5-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		4-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		tert-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		sec-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		p-Isopropyltoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,4-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromo-3-chloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Hexachlorobutadiene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
	Surrogate:	1,4-Difluorobenzene	110.0		N/A	%	18-JUL-13	19-JUL-13	CFB
	Surrogate:	4-Bromofluorobenzene	109.3		N/A	%	18-JUL-13	19-JUL-13	CFB
	Surrogate:	3,4-Dichlorotoluene	89.0		N/A	%	18-JUL-13	19-JUL-13	CFB
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Antimony (Sb)	0.33		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Arsenic (As)	15.9		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Barium (Ba)	93.5		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Beryllium (Be)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cadmium (Cd)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Chromium (Cr)	19.6		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cobalt (Co)	7.6		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Copper (Cu)	10.2		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Lead (Pb)	7.4		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Molybdenum (Mo)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Nickel (Ni)	22.8		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Selenium (Se)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Silver (Ag)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Thallium (Tl)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-6	RIVERSIDE HEAVY TH-06 @ 42-44'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Tin (Sn)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Uranium (U)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Vanadium (V)	21.9		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Zinc (Zn)	65		10	mg/kg	22-JUL-13	23-JUL-13	JPM
		Sum of NO2,NO3							
		Nitrite-N	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate (as N)	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate and Nitrite as N	<1.4		1.4	mg/L		25-JUL-13	
L1333995-7	RIVERSIDE HEAVY TH-06 @ 58'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		Chloride (Cl)	<20		20	mg/L		24-JUL-13	SCL
		Hexavalent Chromium	<0.10		0.1	mg/kg	23-JUL-13	23-JUL-13	JTV
		% Moisture	12.3		0.1	%	18-JUL-13	19-JUL-13	VRP
		Mercury (Hg)	<0.050		0.05	mg/kg	23-JUL-13	24-JUL-13	SHT
		% Saturation	46.5		1	%		24-JUL-13	NHK
		Boron (B), Hot Water Ext.	0.87		0.1	mg/kg		25-JUL-13	AMCB
		Salinity in mg/kg							
		Chloride (Cl)	<9.3		9.3	mg/kg		25-JUL-13	
		Nitrate-N	<0.47		0.47	mg/kg		25-JUL-13	
		Nitrite-N	<0.47		0.47	mg/kg		25-JUL-13	
		EPA 8260 Volatile Organics							
		Dichlorodifluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloromethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Vinyl chloride	<0.20		0.2	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromomethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichlorofluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Methylene chloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Carbon tetrachloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromodichloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromomethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-7	RIVERSIDE HEAVY TH-06 @ 58'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		EPA 8260 Volatile Organics							
		1,1,2-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Tetrachloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromoethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1,2-Tetrachloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromoform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Isopropylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2,2-Tetrachloroethane	<0.050		0.05	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichloropropane	<0.020		0.02	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Propylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3,5-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		4-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		tert-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		sec-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		p-Isopropyltoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,4-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromo-3-chloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Hexachlorobutadiene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
Surrogate:		1,4-Difluorobenzene	109.0		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		4-Bromofluorobenzene	107.3		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		3,4-Dichlorotoluene	75.7		N/A	%	18-JUL-13	19-JUL-13	CFB
		Sum of NO2,NO3							
		Nitrite-N	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate and Nitrite as N	<1.4		1.4	mg/L		25-JUL-13	
		Nitrate (as N)	<1.0		1	mg/L		24-JUL-13	RMS
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		F1 (C6-C10)	<10		10	mg/kg		24-JUL-13	
		F1-BTEX	<10		10	mg/kg		24-JUL-13	
		F2 (C10-C16)	<25		25	mg/kg		24-JUL-13	
		F3 (C16-C34)	271		50	mg/kg		24-JUL-13	
		F4 (C34-C50)	148		50	mg/kg		24-JUL-13	
		F4G-SG (GHH-Silica)	960		500	mg/kg		24-JUL-13	
		Total Hydrocarbons (C6-C50)	419		50	mg/kg		24-JUL-13	
		Chromatogram to baseline at nC50	YES					24-JUL-13	
		CCME Gravimetric Heavy Hydrocarbons (SG)							
		F4G Prep/Analysis Dates					21-JUL-13	22-JUL-13	VRP
		CCME F2-4 Hydrocarbons							
		Prep/Analysis Dates					18-JUL-13	20-JUL-13	MAQ

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-7	RIVERSIDE HEAVY TH-06 @ 58'								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME F2-4 Hydrocarbons							
Surrogate:		2-Bromobenzotrifluoride	86.7		N/A	%	18-JUL-13	20-JUL-13	MAQ
		BTEX, Styrene and F1 (C6-C10)							
		Benzene	<0.0050		0.005	mg/kg	18-JUL-13	22-JUL-13	BY
		Toluene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Ethylbenzene	<0.015		0.015	mg/kg	18-JUL-13	22-JUL-13	BY
		o-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		m+p-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Xylenes	<0.10		0.1	mg/kg	18-JUL-13	22-JUL-13	BY
		Styrene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
Surrogate:		Chlorobenzene	84.6		N/A	%	18-JUL-13	22-JUL-13	BY
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Antimony (Sb)	0.40		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Arsenic (As)	6.54		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Barium (Ba)	213		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Beryllium (Be)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cadmium (Cd)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Chromium (Cr)	18.6		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cobalt (Co)	7.4		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Copper (Cu)	15.8		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Lead (Pb)	8.7		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Molybdenum (Mo)	1.1		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Nickel (Ni)	20.2		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Selenium (Se)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Silver (Ag)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Thallium (Tl)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Tin (Sn)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Uranium (U)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Vanadium (V)	31.1		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Zinc (Zn)	56		10	mg/kg	22-JUL-13	23-JUL-13	JPM
L1333995-8	RIVERSIDE HEAVY TH-09 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		F1 (C6-C10)	<10		10	mg/kg		24-JUL-13	
		F1-BTEX	<10		10	mg/kg		24-JUL-13	
		F2 (C10-C16)	<25		25	mg/kg		24-JUL-13	
		F3 (C16-C34)	<50		50	mg/kg		24-JUL-13	
		F4 (C34-C50)	<50		50	mg/kg		24-JUL-13	
		F4G-SG (GHH-Silica)	<500		500	mg/kg		24-JUL-13	
		Total Hydrocarbons (C6-C50)	<50		50	mg/kg		24-JUL-13	
		Chromatogram to baseline at nC50	YES					24-JUL-13	
		CCME Gravimetric Heavy Hydrocarbons (SG)							
		F4G Prep/Analysis Dates					21-JUL-13	22-JUL-13	VRP
		CCME F2-4 Hydrocarbons							
		Prep/Analysis Dates					18-JUL-13	19-JUL-13	MAQ
Surrogate:		2-Bromobenzotrifluoride	100.5		N/A	%	18-JUL-13	19-JUL-13	MAQ

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-8	RIVERSIDE HEAVY TH-09 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		BTEX, Styrene and F1 (C6-C10)							
		Benzene	<0.0050		0.005	mg/kg	18-JUL-13	22-JUL-13	BY
		Toluene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Ethylbenzene	<0.015		0.015	mg/kg	18-JUL-13	22-JUL-13	BY
		o-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		m+p-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Xylenes	<0.10		0.1	mg/kg	18-JUL-13	22-JUL-13	BY
		Styrene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
	Surrogate:	Chlorobenzene	93.2		N/A	%	18-JUL-13	22-JUL-13	BY
		% Saturation	80.0		1	%		24-JUL-13	NHK
		Hexavalent Chromium	<0.10		0.1	mg/kg	23-JUL-13	23-JUL-13	JTV
		Chloride (Cl)	33		20	mg/L		24-JUL-13	SCL
		% Moisture	14.5		0.1	%	18-JUL-13	19-JUL-13	VRP
		Boron (B), Hot Water Ext.	0.62		0.1	mg/kg		25-JUL-13	AMCB
		Mercury (Hg)	<0.050		0.05	mg/kg	23-JUL-13	24-JUL-13	SHT
		Salinity in mg/kg							
		Chloride (Cl)	26		16	mg/kg		25-JUL-13	
		Nitrate-N	<0.80		0.8	mg/kg		25-JUL-13	
		Nitrite-N	<0.80		0.8	mg/kg		25-JUL-13	
		EPA 8260 Volatile Organics							
		Dichlorodifluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloromethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Vinyl chloride	<0.20		0.2	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromomethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichlorofluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Methylene chloride	0.039		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Carbon tetrachloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromodichloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromomethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Tetrachloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-8	RIVERSIDE HEAVY TH-09 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		EPA 8260 Volatile Organics							
		1,2-Dibromoethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1,2-Tetrachloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromoform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Isopropylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2,2-Tetrachloroethane	<0.050		0.05	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichloropropane	<0.020		0.02	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Propylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3,5-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		4-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		tert-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		sec-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		p-Isopropyltoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,4-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromo-3-chloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Hexachlorobutadiene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
Surrogate:		1,4-Difluorobenzene	111.9		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		4-Bromofluorobenzene	108.6		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		3,4-Dichlorotoluene	86.7		N/A	%	18-JUL-13	19-JUL-13	CFB
		Sum of NO2,NO3							
		Nitrite-N	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate (as N)	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate and Nitrite as N	<1.4		1.4	mg/L		25-JUL-13	
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Antimony (Sb)	0.58		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Arsenic (As)	6.98		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Barium (Ba)	315		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Beryllium (Be)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cadmium (Cd)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Chromium (Cr)	30.2		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cobalt (Co)	9.9		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Copper (Cu)	23.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Lead (Pb)	11.2		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Molybdenum (Mo)	4.9		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Nickel (Ni)	32.1		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Selenium (Se)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Silver (Ag)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Thallium (Tl)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Tin (Sn)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Uranium (U)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-8	RIVERSIDE HEAVY TH-09 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Vanadium (V)	39.1		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Zinc (Zn)	76		10	mg/kg	22-JUL-13	23-JUL-13	JPM
L1333995-9	RIVERSIDE HEAVY TH-08 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		Metals in Soil by ICPMS (Alberta Tier 1)							
		Metals in Soil by CRC ICPMS							
		Antimony (Sb)	0.68		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Arsenic (As)	9.24		0.2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Barium (Ba)	728		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Beryllium (Be)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cadmium (Cd)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Chromium (Cr)	23.2		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Cobalt (Co)	6.7		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Copper (Cu)	17.7		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Lead (Pb)	10.9		5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Molybdenum (Mo)	7.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Nickel (Ni)	23.9		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Selenium (Se)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Silver (Ag)	<1.0		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Thallium (Tl)	<0.50		0.5	mg/kg	22-JUL-13	23-JUL-13	JPM
		Tin (Sn)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Uranium (U)	<2.0		2	mg/kg	22-JUL-13	23-JUL-13	JPM
		Vanadium (V)	30.5		1	mg/kg	22-JUL-13	23-JUL-13	JPM
		Zinc (Zn)	67		10	mg/kg	22-JUL-13	23-JUL-13	JPM
		Sum of NO2,NO3							
		Nitrite-N	<1.0		1	mg/L		24-JUL-13	RMS
		Nitrate and Nitrite as N	<1.4		1.4	mg/L		25-JUL-13	
		Nitrate (as N)	<1.0		1	mg/L		24-JUL-13	RMS
		Hexavalent Chromium	<0.10		0.1	mg/kg	23-JUL-13	23-JUL-13	JTV
		% Moisture	10.7		0.1	%	18-JUL-13	19-JUL-13	VRP
		Boron (B), Hot Water Ext.	0.42		0.1	mg/kg		25-JUL-13	AMCB
		% Saturation	51.0		1	%		24-JUL-13	NHK
		Chloride (Cl)	39		20	mg/L		24-JUL-13	SCL
		Mercury (Hg)	<0.050		0.05	mg/kg	23-JUL-13	24-JUL-13	SHT
		Salinity in mg/kg							
		Chloride (Cl)	20		10	mg/kg		25-JUL-13	
		Nitrate-N	<0.51		0.51	mg/kg		25-JUL-13	
		Nitrite-N	<0.51		0.51	mg/kg		25-JUL-13	
		EPA 8260 Volatile Organics							
		Dichlorodifluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloromethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Vinyl chloride	<0.20		0.2	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromomethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroethane	<0.10		0.1	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichlorofluoromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-9	RIVERSIDE HEAVY TH-08 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		EPA 8260 Volatile Organics							
		1,1-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Methylene chloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,2-Dichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chloroform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Carbon tetrachloride	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Trichloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromodichloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromomethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		cis-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		trans-1,3-Dichloropropene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2-Trichloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Tetrachloroethene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Dibromochloromethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromoethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Chlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,1,2-Tetrachloroethane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromoform	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Isopropylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,1,2,2-Tetrachloroethane	<0.050		0.05	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichloropropane	<0.020		0.02	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Propylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Bromobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3,5-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		2-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		4-Chlorotoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		tert-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trimethylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		sec-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		p-Isopropyltoluene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,3-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,4-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		n-Butylbenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2-Dibromo-3-chloropropane	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,4-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		Hexachlorobutadiene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
		1,2,3-Trichlorobenzene	<0.010		0.01	mg/kg	18-JUL-13	19-JUL-13	CFB
Surrogate:		1,4-Difluorobenzene	109.9		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		4-Bromofluorobenzene	109.8		N/A	%	18-JUL-13	19-JUL-13	CFB
Surrogate:		3,4-Dichlorotoluene	89.4		N/A	%	18-JUL-13	19-JUL-13	CFB
		CCME BTEX + Styrene, F1 TO F4 + F4G							

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-9	RIVERSIDE HEAVY TH-08 @ 15'								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		CCME BTEX + Styrene, F1 TO F4 + F4G							
		CCME Total Hydrocarbons							
		F1 (C6-C10)	<10		10	mg/kg		24-JUL-13	
		F1-BTEX	<10		10	mg/kg		24-JUL-13	
		F2 (C10-C16)	<25		25	mg/kg		24-JUL-13	
		F3 (C16-C34)	<50		50	mg/kg		24-JUL-13	
		F4 (C34-C50)	<50		50	mg/kg		24-JUL-13	
		F4G-SG (GHH-Silica)	<500		500	mg/kg		24-JUL-13	
		Total Hydrocarbons (C6-C50)	<50		50	mg/kg		24-JUL-13	
		Chromatogram to baseline at nC50	YES					24-JUL-13	
		CCME Gravimetric Heavy Hydrocarbons (SG)							
		F4G Prep/Analysis Dates					21-JUL-13	22-JUL-13	VRP
		CCME F2-4 Hydrocarbons							
		Prep/Analysis Dates					18-JUL-13	19-JUL-13	MAQ
	Surrogate:	2-Bromobenzotrifluoride	100.6		N/A	%	18-JUL-13	19-JUL-13	MAQ
		BTEX, Styrene and F1 (C6-C10)							
		Benzene	<0.0050		0.005	mg/kg	18-JUL-13	22-JUL-13	BY
		Toluene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Ethylbenzene	<0.015		0.015	mg/kg	18-JUL-13	22-JUL-13	BY
		o-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		m+p-Xylene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
		Xylenes	<0.10		0.1	mg/kg	18-JUL-13	22-JUL-13	BY
		Styrene	<0.050		0.05	mg/kg	18-JUL-13	22-JUL-13	BY
	Surrogate:	Chlorobenzene	93.4		N/A	%	18-JUL-13	22-JUL-13	BY
L1333995-10	RIVERSIDE HEAVY SOIL BAG #1								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		Total Organic Carbon -Inorg & Total C							
		Total Carbon by Combustion	3.5		0.1	%	20-JUL-13	20-JUL-13	XHY
		Inorganic and Organic Carbon							
		Inorganic Carbon	2.68		0.1	%	20-JUL-13	20-JUL-13	XHY
		Total Organic Carbon	0.86		0.1	%	20-JUL-13	20-JUL-13	XHY
		CaCO3 Equivalent	22.4		0.8	%	20-JUL-13	20-JUL-13	XHY
		Class II Landfill Pkg w/ Paint Filter							
		Paint Filter Test	PASS					19-JUL-13	NPA
		Flash Point	>75		30	Deg. C		19-JUL-13	NPA
		pH	8.42		0.1	pH		23-JUL-13	NHK
		Mercury (Hg)-Leachate	<0.010		0.01	mg/L		22-JUL-13	SHT
		TCLP Leachable Metals							
		Silver (Ag)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Arsenic (As)-Leachable	<0.20		0.2	mg/L		20-JUL-13	AMCB
		Boron (B)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Barium (Ba)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Beryllium (Be)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Cadmium (Cd)-Leachable	<0.050		0.05	mg/L		20-JUL-13	AMCB
		Cobalt (Co)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Chromium (Cr)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Copper (Cu)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Iron (Fe)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Nickel (Ni)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-10	RIVERSIDE HEAVY SOIL BAG #1								
Sample Date:	LTM on 12-JUL-13								
Matrix:	SOIL								
		Class II Landfill Pkg w/ Paint Filter							
		TCLP Leachable Metals							
		Lead (Pb)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Antimony (Sb)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Selenium (Se)-Leachable	<0.20		0.2	mg/L		20-JUL-13	AMCB
		Thallium (Tl)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Uranium (U)-Leachable	<1.0		1	mg/L		20-JUL-13	AMCB
		Vanadium (V)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Zinc (Zn)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Zirconium (Zr)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		TCLP Leachable BTEX							
		Benzene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
		Toluene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
		Ethylbenzene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
		Xylenes	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
L1333995-11	RIVERSIDE HEAVY SOIL BAG #2								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		Total Organic Carbon -Inorg & Total C							
		Total Carbon by Combustion	2.8		0.1	%	20-JUL-13	20-JUL-13	XHY
		Inorganic and Organic Carbon							
		Inorganic Carbon	0.85		0.1	%	20-JUL-13	20-JUL-13	XHY
		Total Organic Carbon	1.99		0.1	%	20-JUL-13	20-JUL-13	XHY
		CaCO3 Equivalent	7.10		0.8	%	20-JUL-13	20-JUL-13	XHY
		Class II Landfill Pkg w/ Paint Filter							
		pH	7.90		0.1	pH		23-JUL-13	NHK
		Paint Filter Test	PASS					19-JUL-13	NPA
		Flash Point	>75		30	Deg. C		19-JUL-13	NPA
		Mercury (Hg)-Leachate	<0.010		0.01	mg/L		22-JUL-13	SHT
		TCLP Leachable Metals							
		Silver (Ag)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Arsenic (As)-Leachable	<0.20		0.2	mg/L		20-JUL-13	AMCB
		Boron (B)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Barium (Ba)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Beryllium (Be)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Cadmium (Cd)-Leachable	<0.050		0.05	mg/L		20-JUL-13	AMCB
		Cobalt (Co)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Chromium (Cr)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Copper (Cu)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Iron (Fe)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Nickel (Ni)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Lead (Pb)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Antimony (Sb)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Selenium (Se)-Leachable	<0.20		0.2	mg/L		20-JUL-13	AMCB
		Thallium (Tl)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Uranium (U)-Leachable	<1.0		1	mg/L		20-JUL-13	AMCB
		Vanadium (V)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Zinc (Zn)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Zirconium (Zr)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		TCLP Leachable BTEX							

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1333995-11	RIVERSIDE HEAVY SOIL BAG #2								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		Class II Landfill Pkg w/ Paint Filter							
		TCLP Leachable BTEX							
		Benzene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	BY
		Toluene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	BY
		Ethylbenzene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	BY
		Xylenes	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	BY
L1333995-12	RIVERSIDE HEAVY SOIL BAG #3								
Sample Date:	LTM on 13-JUL-13								
Matrix:	SOIL								
		Total Organic Carbon -Inorg & Total C							
		Total Carbon by Combustion	1.8		0.1	%	20-JUL-13	20-JUL-13	XHY
		Inorganic and Organic Carbon							
		Inorganic Carbon	1.01		0.1	%	20-JUL-13	20-JUL-13	XHY
		Total Organic Carbon	0.84		0.1	%	20-JUL-13	20-JUL-13	XHY
		CaCO3 Equivalent	8.44		0.8	%	20-JUL-13	20-JUL-13	XHY
		Class II Landfill Pkg w/ Paint Filter							
		Mercury (Hg)-Leachate	<0.010		0.01	mg/L		22-JUL-13	SHT
		Paint Filter Test	PASS					19-JUL-13	NPA
		Flash Point	>75		30	Deg. C		19-JUL-13	NPA
		pH	7.74		0.1	pH		23-JUL-13	NHK
		TCLP Leachable Metals							
		Silver (Ag)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Arsenic (As)-Leachable	<0.20		0.2	mg/L		20-JUL-13	AMCB
		Boron (B)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Barium (Ba)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Beryllium (Be)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Cadmium (Cd)-Leachable	<0.050		0.05	mg/L		20-JUL-13	AMCB
		Cobalt (Co)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Chromium (Cr)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Copper (Cu)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Iron (Fe)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Nickel (Ni)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Lead (Pb)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Antimony (Sb)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Selenium (Se)-Leachable	<0.20		0.2	mg/L		20-JUL-13	AMCB
		Thallium (Tl)-Leachable	<0.50		0.5	mg/L		20-JUL-13	AMCB
		Uranium (U)-Leachable	<1.0		1	mg/L		20-JUL-13	AMCB
		Vanadium (V)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Zinc (Zn)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		Zirconium (Zr)-Leachable	<5.0		5	mg/L		20-JUL-13	AMCB
		TCLP Leachable BTEX							
		Benzene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
		Toluene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
		Ethylbenzene	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP
		Xylenes	<0.0050		0.005	mg/L	21-JUL-13	21-JUL-13	VRP

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By

Methodology Reference

ALS Test Code	Test Description	Methodology Reference (In-House Standard Operating Procedures which Generally Follow:)
F4G-TMB-CL	CCME Gravimetric Heavy Hydrocarbons (SG)	CCME CWS-PHC Dec-2000 - Pub# 1310
NO2-SAR-CL	Nitrite-N	APHA 4110 B - ION CHROMATOGRAPHY
F2-4-TMB-CL	CCME F2-4 Hydrocarbons	CCME CWS-PHC Dec-2000 - Pub# 1310
HG-200.2-CVAFS-CL	Mercury (Hg) in soil	EPA 1631E
N2N3-SAR-CALC-CL	Nitrate/Nitrite-N	CALCULATION
C-INORG-ORG-SK	Inorganic and Organic Carbon	SSSA (1996) P455-456
C-TOT-LECO-SK	Total Carbon by combustion method	SSSA (1996) P. 973-974
HG-TCLP-CL	Mercury (Hg) - TCLP	APHA 3112 B-AAS Cold Vapor
NO3-SAR-CL	Nitrate-N	APHA 4110 B - IC
SAL-MG/KG-CALC-CL	Salinity in mg/kg	Manual Calculation
SAT-PCNT-CL	% Saturation	CSSS 18.2-Calculation
CL-SAR-CL	Chloride (Cl) (Saturated Paste)	CSSS CH15/EPA300.1
BTX-TCLP-CL	TCLP Leachable BTEX	EPA 5030/8015& 8260-P&T GC-MS/FID
MET-200.2-CCMS-ED	Metals in Soil by CRC ICPMS	EPA 200.2/6020A
PREP-200.2-ED	Acid Digestion Prep for Metals in Soil	EPA 200.2
PREP-MOISTURE-CL	% Moisture	Oven dry 105C-Gravimetric
VOC-8260-CL	EPA 8260 Volatile Organics	SW 846 8260-GC-MS
FLASH-PMCC-AUTO-CL	Pensky-Martens Closed Cup Flashpoint	ASTM D-93-10a Flash point tester
BTXS,F1-CL	BTEX, Styrene and F1 (C6-C10)	CCME CWS-PHC Dec-2000 - Pub# 1310
PAINT FILTER-CL	Paint Filter Test	EPA SW846-9095
PH-1:2-CL	pH (1:2 Soil:Water Extraction)	CSSS 16.3 - pH of 1:2 water extract
CR-CR6-3060-ED	Chromium, Hexavalent (Cr +6)	APHA 3500-CR C, EPA 3060A ALKALINE
F1-4-CALC-CL	CCME Total Hydrocarbons	CCME CWS-PHC Dec-2000 - Pub# 1310
MET-TCLP-ICP-CL	TCLP Leachable Metals	EPA SW846 METHODS 1311 AND 6010B
B-HOTW-CL	Available Boron, Hot Water	APHA 3120/CSSS 9.2.2-ICP-OES

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.

GROUNDWATER REPORTS

Maxxam

Success Through Science®

Your Project #: 12-435
Site Location: RIVERSIDE HEAVY
Your C.O.C. #: N/A

Attention:JESSICA LEE

TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107,
2719-7 Avenue NE
CALGARY, AB
CANADA T2A 2L9

Report Date: 2013/12/11
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B372952
Received: 2013/08/18, 16:35

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Acetic Acid, Formic Acid, Propionic Acid	2	N/A	2013/08/23	CAL SOP-00063	Dionex #031181, R05
Acetic Acid, Formic Acid, Propionic Acid	1	N/A	2013/09/06	CAL SOP-00063	Dionex #031181, R05
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2013/08/22	AB SOP-00005	SM 2320-B
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2013/09/06	AB SOP-00005	SM 2320-B
Organic Halogen (Adsorbable) (1)	3	N/A	2013/08/26	EINDSOP-00056	Coulometric - Titr.
Biochemical Oxygen Demand	2	2013/08/19	2013/08/24	AB SOP-00017	SM 5210 B
Biochemical Oxygen Demand	1	2013/08/20	2013/08/25	AB SOP-00017	SM 5210 B
BTEX/F1 in Water by HS GC/MS	3	N/A	2013/08/23	AB SOP-00039	CCME, EPA 8260C
Cadmium - low level CCME - Dissolved	2	N/A	2013/09/04	AB SOP-00043	EPA 200.8
Cadmium - low level CCME - Dissolved	1	N/A	2013/09/05	AB SOP-00043	EPA 200.8
Cadmium - low level CCME (Total)	3	2013/08/21	2013/09/05	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	2	N/A	2013/08/31	AB SOP-00020	SM 4500 Cl-G
Chloride by Automated Colourimetry	1	N/A	2013/09/07	AB SOP-00020	SM 4500 Cl-G
Chemical Oxygen Demand	3	N/A	2013/09/04	AB SOP-00016	SM 5220-D
Conductivity @25C	2	N/A	2013/08/22	AB SOP-00005	SM 2510-B
Conductivity @25C	1	N/A	2013/09/06	AB SOP-00005	SM 2510-B
CCME Hydrocarbons in Water (F2; C10-C16)	3	2013/08/23	2013/08/24	AB SOP-00040AB SOP-000	EPA3510C/CCME PHCCWS
Elements by ICP - Dissolved	3	N/A	2013/09/05	AB SOP-00042	EPA 200.7
Elements by ICP - Total	3	2013/08/30	2013/09/03	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	2	N/A	2013/09/03	AB SOP-00043	EPA 200.8
Elements by ICPMS - Dissolved	1	N/A	2013/09/05	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	2	2013/08/30	2013/09/03	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	1	2013/08/30	2013/09/05	AB SOP-00043	EPA 200.8
Nitrogen (total), Calc. TKN, NO3, NO2	2	N/A	2013/09/04	AB WI-00065	SM 4500-N A
Nitrogen (total), Calc. TKN, NO3, NO2	1	N/A	2013/09/06	AB WI-00065	SM 4500-N A
Ammonia-N (Total)	3	N/A	2013/08/28	AB SOP-00007	EPA 350.1
Nitrate and Nitrite	2	N/A	2013/08/23	AB SOP-00023	SM4110B
Nitrate and Nitrite	1	N/A	2013/09/06	AB SOP-00023	SM4110B
Nitrate + Nitrite-N (calculated)	2	N/A	2013/08/23	AB SOP-00023	SM 4110-B
Nitrate + Nitrite-N (calculated)	1	N/A	2013/09/06	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	2	N/A	2013/08/22	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2013/09/06	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	2	N/A	2013/08/22	AB SOP-00005	SM 4500-H+B
pH @25°C (Alkalinity titrator)	1	N/A	2013/09/06	AB SOP-00005	SM 4500-H+B

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 12-435
Site Location: RIVERSIDE HEAVY
Your C.O.C. #: N/A

Attention:JESSICA LEE

TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107,
2719-7 Avenue NE
CALGARY, AB
CANADA T2A 2L9

Report Date: 2013/12/11
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B372952
Received: 2013/08/18, 16:35

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sulphate by Automated Colourimetry	2	N/A	2013/08/31	AB SOP-00018	SM 4500 SO4-E
Sulphate by Automated Colourimetry	1	N/A	2013/09/07	AB SOP-00018	SM 4500 SO4-E
Total Trihalomethanes Calculation	3	N/A	2013/08/26	CAL SOP-00104	EPA 8260 C
Total Kjeldahl Nitrogen	3	2013/09/04	2013/09/04	AB SOP-00008	EPA 351.1, 351.2
Carbon (Total Organic) (2)	3	N/A	2013/09/02	CAL SOP-00077	MMCW 119
Total Phosphorus	3	2013/09/04	2013/09/04	AB SOP-00024	SM 4500-P
VOCs in Water by HS GC/MS (Std List)	3	N/A	2013/08/24	CAL SOP-00227	EPA 8260 C

Remarks:

All Blank values are reported. Associated data are not blank corrected.
'MDL' = Method Detection Limit, '<' = Less than MDL, '---' Not Analyzed
Solids results are based on dry weight except Biota Analyses & Special Waste Oil & Grease
Organic analyses are not corrected for extraction recovery standards except for Isotope Dilution methods, (i.e. CARB 429 PAH, all PCDD/F and DBD/DBF analyses)
All CCME results met required criteria unless otherwise stated in the report. All data on final reports are validated by technical personnel. Signature on file at the laboratory. Deviations from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method:
F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction
All Groundwater samples except BTEX/VOC's or Purgeable Hydrocarbons are decanted and/or filtered prior to analysis unless otherwise mandated by regulatory agency
All analysis data reported was generated when the analytical methods were in statistical control and criteria for spike recoveries, reference material recoveries, method blanks data and duplicate precision were met unless otherwise stated

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

Methods used by Maxxam are based upon those found in 'Standard Methods for the Examination of Water and Wastewater', 22nd Edition, published by the American Public Health Association, or on US EPA, protocols found in the ' Test Methods for Evaluating Solid Waste, Physical/Chemical Method, SW846, 3rd Edition. Other procedures are based on the methodologies accepted by the appropriate regulatory agency. Methodology briefs are available by written request.

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies, quality assurance and quality control procedures except where otherwise agreed to by the client and testing company in writing. Liability for any and all use of these test results shall be limited to the actual cost of the pertinent analysis done. There is no other warranty expressed or implied. Your samples will be retained at Maxxam for a period of 60 days from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: 12-435
Site Location: RIVERSIDE HEAVY
Your C.O.C. #: N/A

Attention:JESSICA LEE

TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107,
2719-7 Avenue NE
CALGARY, AB
CANADA T2A 2L9

Report Date: 2013/12/11
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B372952
Received: 2013/08/18, 16:35

(1) This test was performed by Maxxam Edmonton Petroleum
(2) TOC present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Kayla Brassard, Project Manager
Email: KBrassard@maxxam.ca
Phone# (403)735-2258

==========

This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		HF9789	HF9790	HF9791		
Sampling Date		2013/08/17	2013/08/17	2013/08/17		
COC Number		N/A	N/A	N/A		
	Units	MW-01	MW-02	MW-03	RDL	QC Batch
Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	0.10	7104191
Volatiles						
Benzene	ug/L	<0.40	<0.40	<0.40	0.40	7106093
Toluene	ug/L	<0.40	<0.40	<0.40	0.40	7106093
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	0.40	7106093
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	0.80	7106093
o-Xylene	ug/L	<0.40	<0.40	<0.40	0.40	7106093
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	0.80	7106093
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	100	7106093
(C6-C10)	ug/L	<100	<100	<100	100	7106093
1,4-Difluorobenzene (sur.)	%	113	113	112		7106093
4-BROMOFLUOROBENZENE (sur.)	%	101	103	102		7106093
D4-1,2-DICHLOROETHANE (sur.)	%	104	105	104		7106093
O-TERPHENYL (sur.)	%	83	83	83		7104191
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		HF9789		HF9790	HF9791		
Sampling Date		2013/08/17		2013/08/17	2013/08/17		
COC Number		N/A		N/A	N/A		
	Units	MW-01	RDL	MW-02	MW-03	RDL	QC Batch
Elements							
Aluminum (Al)	mg/L	0.0044	0.0030	0.017	0.088	0.0075	7136620
Antimony (Sb)	mg/L	<0.00060	0.00060	0.0020 (1)	<0.0015	0.0015	7136620
Arsenic (As)	mg/L	0.0027	0.00020	0.0061	0.024	0.00050	7136620
Barium (Ba)	mg/L	0.083	0.010	0.081	0.72	0.010	7139263
Beryllium (Be)	mg/L	<0.0010	0.0010	<0.0025	<0.0025	0.0025	7136620
Boron (B)	mg/L	0.27	0.020	0.12 (2)	0.12	0.020	7139263
Calcium (Ca)	mg/L	220	0.30	310	210	0.30	7139263
Chromium (Cr)	mg/L	<0.0010	0.0010	<0.0025	<0.0025	0.0025	7136620
Cobalt (Co)	mg/L	0.0043	0.00030	0.0045	0.012	0.00075	7136620
Copper (Cu)	mg/L	0.0023	0.00020	0.0021	0.0013	0.00050	7136620
Iron (Fe)	mg/L	0.19	0.060	0.24	27	0.060	7139263
Lead (Pb)	mg/L	<0.00020	0.00020	<0.00050	<0.00050	0.00050	7136620
Lithium (Li)	mg/L	0.091	0.020	0.13	0.034	0.020	7139263
Magnesium (Mg)	mg/L	56	0.20	110	120	0.20	7139263
Manganese (Mn)	mg/L	0.70	0.0040	0.78	3.6	0.0040	7139263
Molybdenum (Mo)	mg/L	0.0015	0.00020	0.0059	0.0021	0.00050	7136620
Nickel (Ni)	mg/L	0.011	0.00050	0.013	0.016	0.0013	7136620
Phosphorus (P)	mg/L	<0.10	0.10	<0.10	<0.10	0.10	7139263
Potassium (K)	mg/L	6.9	0.30	8.6	9.8	0.30	7139263
Selenium (Se)	mg/L	0.00028	0.00020	0.00050	<0.00050	0.00050	7136620
Silicon (Si)	mg/L	7.4	0.10	6.5	15	0.10	7139263
Silver (Ag)	mg/L	<0.00010	0.00010	<0.00025	<0.00025	0.00025	7136620
Sodium (Na)	mg/L	170 (2)	0.50	250 (2)	160	0.50	7139263
Strontium (Sr)	mg/L	1.3	0.020	2.7	1.4	0.020	7139263
Sulphur (S)	mg/L	180	0.20	220	3.9	0.20	7139263
Thallium (Tl)	mg/L	<0.00020	0.00020	<0.00050	<0.00050	0.00050	7136620
Tin (Sn)	mg/L	<0.0010	0.0010	<0.0025	<0.0025	0.0025	7136620
Titanium (Ti)	mg/L	<0.0010	0.0010	<0.0025	<0.0025	0.0025	7136620
Uranium (U)	mg/L	0.011	0.00010	0.021	0.0014	0.00025	7136620
Vanadium (V)	mg/L	<0.0010	0.0010	<0.0025	<0.0025	0.0025	7136620
Zinc (Zn)	mg/L	<0.0030	0.0030	<0.0075	<0.0075	0.0075	7136620
Low Level Elements							
Cadmium (Cd)	ug/L	0.087	0.0050	0.12	0.039	0.013	7098769

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results are within limits of uncertainty(MU).
(2) Dissolved greater than total. Results within acceptable limits of precision.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		HF9789		HF9790	HF9791		
Sampling Date		2013/08/17		2013/08/17	2013/08/17		
COC Number		N/A		N/A	N/A		
	Units	MW-01	RDL	MW-02	MW-03	RDL	QC Batch
Elements							
Aluminum (Al)	mg/L	4.3	0.0030	100	74	0.0075	7131192
Antimony (Sb)	mg/L	0.00074	0.00060	<0.0015	<0.0015	0.0015	7131192
Arsenic (As)	mg/L	0.011	0.00020	0.066	0.069	0.00050	7131192
Barium (Ba)	mg/L	0.32	0.010	3.3	3.5	0.010	7131233
Beryllium (Be)	mg/L	<0.0010	0.0010	0.0099	0.0072	0.0025	7131192
Boron (B)	mg/L	0.28	0.020	0.11	0.13	0.020	7131233
Calcium (Ca)	mg/L	270	0.30	730 (1)	1000 (1)	1.5	7131233
Chromium (Cr)	mg/L	0.010	0.0010	0.19	0.14	0.0025	7131192
Cobalt (Co)	mg/L	0.014	0.00030	0.12	0.13	0.00075	7131192
Copper (Cu)	mg/L	0.025	0.00020	0.25	0.23	0.00050	7131192
Iron (Fe)	mg/L	20	0.060	330 (1)	260 (1)	0.30	7131233
Lead (Pb)	mg/L	0.0068	0.00020	0.11	0.11	0.00050	7131192
Lithium (Li)	mg/L	0.093	0.020	0.32	0.15	0.020	7131233
Magnesium (Mg)	mg/L	62	0.20	230	330	0.20	7131233
Manganese (Mn)	mg/L	1.4	0.0040	13	15	0.0040	7131233
Molybdenum (Mo)	mg/L	0.0021	0.00020	0.012	0.0036	0.00050	7131192
Nickel (Ni)	mg/L	0.033	0.00050	0.29	0.29	0.0013	7131192
Phosphorus (P)	mg/L	0.68	0.10	11	7.2	0.10	7131233
Potassium (K)	mg/L	8.4	0.30	20	21	0.30	7131233
Selenium (Se)	mg/L	0.00070	0.00020	0.0031	0.0014	0.00050	7131192
Silicon (Si)	mg/L	17	0.10	94	87	0.10	7131233
Silver (Ag)	mg/L	<0.00010	0.00010	0.0010	0.0016	0.00025	7131192
Sodium (Na)	mg/L	160	0.50	230	160	0.50	7131233
Strontium (Sr)	mg/L	1.4	0.020	3.7	2.5	0.020	7131233
Sulphur (S)	mg/L	180	0.20	230	7.8	0.20	7131233
Thallium (Tl)	mg/L	<0.00020	0.00020	0.0011	0.00087	0.00050	7131192
Tin (Sn)	mg/L	0.0029	0.0010	0.0044	<0.0025	0.0025	7131192
Titanium (Ti)	mg/L	0.19	0.0010	0.96	0.45	0.0025	7131192
Uranium (U)	mg/L	0.012	0.00010	0.045	0.0075	0.00025	7131192
Vanadium (V)	mg/L	0.018	0.0010	0.30	0.20	0.0025	7131192
Zinc (Zn)	mg/L	0.057	0.0030	0.73	0.67	0.0075	7131192
Low Level Elements							
Cadmium (Cd)	ug/L	0.60	0.0050	5.5	5.0	0.013	7099525

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HF9789	HF9789			HF9790		
Sampling Date		2013/08/17	2013/08/17			2013/08/17		
COC Number		N/A	N/A			N/A		
	Units	MW-01	MW-01 Lab-Dup	RDL	QC Batch	MW-02	RDL	QC Batch
Calculated Parameters								
Nitrate (NO3)	mg/L	0.30		0.013	7099527	0.13	0.013	7149898
Nitrate plus Nitrite (N)	mg/L	0.077		0.003	7099528	0.030	0.0030	7149899
Nitrite (NO2)	mg/L	0.033		0.009	7099527	<0.0099	0.0099	7149898
Demand Parameters								
Biochemical Oxygen Demand	mg/L	3.5	3.1	2.0	7095396	2.0	2.0	7095396
Chemical Oxygen Demand	mg/L	100 (1)		25	7140829	310 (1)	50	7140829
Misc. Inorganics								
Conductivity	uS/cm	1900		1.0	7106228	3200	1.0	7149791
pH	pH	7.71			7106230	6.78 (2)		7149793
Organic Carbon (C)	mg/L	14		0.50	7135686	20	0.50	7135686
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50		0.50	7106226	<0.50 (2)	0.50	7149784
Alkalinity (Total as CaCO3)	mg/L	570		0.50	7106226	550 (2)	0.50	7149784
Bicarbonate (HCO3)	mg/L	690		0.50	7106226	670 (2)	0.50	7149784
Carbonate (CO3)	mg/L	<0.50		0.50	7106226	<0.50 (2)	0.50	7149784
Hydroxide (OH)	mg/L	<0.50		0.50	7106226	<0.50 (2)	0.50	7149784
Sulphate (SO4)	mg/L	510 (3)		5.0	7134062	690 (3)	5.0	7152270
Chloride (Cl)	mg/L	4.7		1.0	7134060	360 (3)	5.0	7152268
Nutrients								
Ammonia (N)	mg/L	0.64		0.050	7122307	0.76	0.050	7122307
Nitrogen (N)	mg/L	1.1		0.050	7100356	4.1	0.050	7100356
Phosphorus (P)	mg/L	0.54 (1)		0.030	7141844	6.2 (3)	0.15	7141844
Total Kjeldahl Nitrogen	mg/L	0.98		0.050	7141763	4.1 (1)	0.50	7141763
Nitrite (N)	mg/L	0.010		0.003	7106770	<0.0030	0.0030	7149651
Nitrate (N)	mg/L	0.067		0.003	7106770	0.030	0.0030	7149651
Organic Acids								
Acetic Acid	mg/L	<50		50	7108564	<50	50	7150856
Formic Acid	mg/L	<50		50	7108564	<50	50	7150856
Propionic Acid	mg/L	<50		50	7108564	<50	50	7150856
Misc. Organics								
Organic halogen	mg/L	0.05		0.02	7105406	0.023	0.002	7105406

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Sample ran past hold time.
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HF9791		
Sampling Date		2013/08/17		
COC Number		N/A		
	Units	**MW-03**	**RDL**	**QC Batch**
Calculated Parameters				
Nitrate (NO3)	mg/L	0.47	0.013	7099527
Nitrate plus Nitrite (N)	mg/L	0.12	0.0030	7099528
Nitrite (NO2)	mg/L	0.030	0.0099	7099527
Demand Parameters				
Biochemical Oxygen Demand	mg/L	4.3 (1)	2.0	7096409
Chemical Oxygen Demand	mg/L	460 (2)	50	7140829
Misc. Inorganics				
Conductivity	uS/cm	2700	1.0	7106228
pH	pH	7.55		7106230
Organic Carbon (C)	mg/L	46 (3)	2.5	7135686
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7106226
Alkalinity (Total as CaCO3)	mg/L	860	0.50	7106226
Bicarbonate (HCO3)	mg/L	1100	0.50	7106226
Carbonate (CO3)	mg/L	<0.50	0.50	7106226
Hydroxide (OH)	mg/L	<0.50	0.50	7106226
Sulphate (SO4)	mg/L	<1.0	1.0	7134062
Chloride (Cl)	mg/L	360 (3)	5.0	7134060
Nutrients				
Ammonia (N)	mg/L	4.6 (3)	0.50	7126399
Nitrogen (N)	mg/L	6.4	0.050	7100356
Phosphorus (P)	mg/L	4.8 (2)	0.030	7141844
Total Kjeldahl Nitrogen	mg/L	6.3 (2)	0.50	7141763
Nitrite (N)	mg/L	0.0090	0.0030	7106770
Nitrate (N)	mg/L	0.11	0.0030	7106770
Organic Acids				
Acetic Acid	mg/L	<50	50	7108564
Formic Acid	mg/L	<50	50	7108564
Propionic Acid	mg/L	<50	50	7108564

RDL = Reportable Detection Limit

(1) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time. Sample analyzed 64.0 hrs. after sample collection. Sample analysis is recommended within 48 hrs. of sampling.

(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HF9791		
Sampling Date		2013/08/17		
COC Number		N/A		
	Units	**MW-03**	**RDL**	**QC Batch**
Misc. Organics				
Organic halogen	mg/L	0.13	0.02	7105406
RDL = Reportable Detection Limit				

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		HF9789	HF9790	HF9791		
Sampling Date		2013/08/17	2013/08/17	2013/08/17		
COC Number		N/A	N/A	N/A		
	Units	MW-01	MW-02	MW-03	RDL	QC Batch
Volatiles						
Total Trihalomethanes	ug/L	<2.0	<2.0	<2.0	2.0	7099273
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Bromoform	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Bromomethane	ug/L	<2.0	<2.0	<2.0	2.0	7106763
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Chlorodibromomethane	ug/L	<1.0	<1.0	<1.0	1.0	7106763
Chloroethane	ug/L	<1.0	<1.0	<1.0	1.0	7106763
Chloroform	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Chloromethane	ug/L	<2.0	<2.0	<2.0	2.0	7106763
1,2-dibromoethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Dichloromethane	ug/L	<2.0	<2.0	<2.0	2.0	7106763
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Styrene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,1,1,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	2.0	7106763
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	2.0	7106763
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	1.0	7106763
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	1.0	7106763
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Trichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	0.50	7106763
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		HF9789	HF9790	HF9791		
Sampling Date		2013/08/17	2013/08/17	2013/08/17		
COC Number		N/A	N/A	N/A		
	Units	**MW-01**	**MW-02**	**MW-03**	**RDL**	**QC Batch**
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	0.50	7106763
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	0.50	7106763
1,4-Difluorobenzene (sur.)	%	98	98	98		7106763
4-BROMOFLUOROBENZENE (sur.)	%	104	100	104		7106763
D4-1,2-DICHLOROETHANE (sur.)	%	96	92	95		7106763
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.7°C

REGULATED METALS (CCME/AT1) - DISSOLVED Comments

Sample HF9790-04 Elements by ICPMS - Dissolved: Detection limits raised due to matrix interference.
Sample HF9791-04 Elements by ICPMS - Dissolved: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

REGULATED METALS (CCME/AT1) - TOTAL Comments

Sample HF9790-03 Elements by ICPMS - Total: Detection limits raised due to matrix interference.
Sample HF9791-03 Elements by ICPMS - Total: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

RESULTS OF CHEMICAL ANALYSES OF WATER Comments

Sample HF9741-01 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.
Sample HF9789-01 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.
Sample HK0079-02 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.
Sample HF9790-01 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix. Sample was past hold time when received.
Sample HF9791-01 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
7095396	LS0	Spiked Blank	Biochemical Oxygen Demand	2013/08/24		103	%	85 - 115
	LS0	Blank	Biochemical Oxygen Demand	2013/08/24	<2.0		mg/L	
		RPD [HF9789]	Biochemical Oxygen Demand	2013/08/24	NC		%	20
7096409		Spiked Blank	Biochemical Oxygen Demand	2013/08/25		88	%	85 - 115
	LS0	Blank	Biochemical Oxygen Demand	2013/08/25	<2.0		mg/L	
		RPD	Biochemical Oxygen Demand	2013/08/25	4		%	20
7104191	DO1	Matrix Spike	O-TERPHENYL (sur.)	2013/08/24		90	%	50 - 130
	DO1	Matrix Spike	F2 (C10-C16 Hydrocarbons)	2013/08/24		99	%	50 - 130
		Spiked Blank	O-TERPHENYL (sur.)	2013/08/24		91	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2013/08/24		97	%	70 - 130
		Blank	O-TERPHENYL (sur.)	2013/08/24		87	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2013/08/24	<0.10		mg/L	
		RPD	F2 (C10-C16 Hydrocarbons)	2013/08/24	NC		%	40
7105406	MN2	QC Standard	Organic halogen	2013/08/26		89	%	84 - 111
	MN2	Blank	Organic halogen	2013/08/26	<0.5		mg/L	
7106093	GP4	Matrix Spike	1,4-Difluorobenzene (sur.)	2013/08/23		118	%	70 - 130
	GP4	Matrix Spike	4-BROMOFLUOROBENZENE (sur.)	2013/08/23		111	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/23		105	%	70 - 130
			Benzene	2013/08/23		87	%	70 - 130
			Toluene	2013/08/23		89	%	70 - 130
			Ethylbenzene	2013/08/23		92	%	70 - 130
			m & p-Xylene	2013/08/23		98	%	70 - 130
			o-Xylene	2013/08/23		94	%	70 - 130
			(C6-C10)	2013/08/23		92	%	70 - 130
		Spiked Blank	1,4-Difluorobenzene (sur.)	2013/08/23		118	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/23		114	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/23		104	%	70 - 130
			Benzene	2013/08/23		80	%	70 - 130
			Toluene	2013/08/23		84	%	70 - 130
			Ethylbenzene	2013/08/23		89	%	70 - 130
			m & p-Xylene	2013/08/23		95	%	70 - 130
			o-Xylene	2013/08/23		90	%	70 - 130
			(C6-C10)	2013/08/23		100	%	70 - 130
		Blank	1,4-Difluorobenzene (sur.)	2013/08/23		114	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/23		100	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/23		103	%	70 - 130
			Benzene	2013/08/23	<0.40		ug/L	
			Toluene	2013/08/23	<0.40		ug/L	
			Ethylbenzene	2013/08/23	<0.40		ug/L	
			m & p-Xylene	2013/08/23	<0.80		ug/L	
			o-Xylene	2013/08/23	<0.40		ug/L	
			Xylenes (Total)	2013/08/23	<0.80		ug/L	
			F1 (C6-C10) - BTEX	2013/08/23	<100		ug/L	
			(C6-C10)	2013/08/23	<100		ug/L	
		RPD	Benzene	2013/08/23	NC		%	40
			Toluene	2013/08/23	NC		%	40
			Ethylbenzene	2013/08/23	NC		%	40
			m & p-Xylene	2013/08/23	NC		%	40
			o-Xylene	2013/08/23	NC		%	40
			Xylenes (Total)	2013/08/23	NC		%	40
			F1 (C6-C10) - BTEX	2013/08/23	NC		%	40
			(C6-C10)	2013/08/23	NC		%	40
7106226	FT2	Spiked Blank	Alkalinity (Total as CaCO3)	2013/08/22		94	%	80 - 120
	FT2	Blank	Alkalinity (PP as CaCO3)	2013/08/22	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2013/08/22	<0.50		mg/L	
			Bicarbonate (HCO3)	2013/08/22	<0.50		mg/L	
			Carbonate (CO3)	2013/08/22	<0.50		mg/L	
			Hydroxide (OH)	2013/08/22	<0.50		mg/L	
		RPD	Alkalinity (PP as CaCO3)	2013/08/22	NC		%	20
			Alkalinity (Total as CaCO3)	2013/08/22	1		%	20
			Bicarbonate (HCO3)	2013/08/22	1		%	20
			Carbonate (CO3)	2013/08/22	NC		%	20
			Hydroxide (OH)	2013/08/22	NC		%	20
7106228		Spiked Blank	Conductivity	2013/08/22		101	%	90 - 110

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
	FT2	Blank	Conductivity	2013/08/22	<1.0		uS/cm	
		RPD	Conductivity	2013/08/22	0		%	20
7106230		Spiked Blank	pH	2013/08/22		100	%	97 - 102
	FT2	RPD	pH	2013/08/22	0.4		%	5
7106763	MJ0	Matrix Spike	1,4-Difluorobenzene (sur.)	2013/08/22		120	%	70 - 130
	MJ0	Matrix Spike	4-BROMOFLUOROBENZENE (sur.)	2013/08/22		106	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/22		120	%	70 - 130
			Bromodichloromethane	2013/08/22		116	%	70 - 130
			Bromoform	2013/08/22		100	%	70 - 130
			Bromomethane	2013/08/22		94	%	70 - 130
			Carbon tetrachloride	2013/08/22		117	%	70 - 130
			Chlorobenzene	2013/08/22		94	%	70 - 130
			Chlorodibromomethane	2013/08/22		96	%	70 - 130
			Chloroethane	2013/08/22		99	%	70 - 130
			Chloroform	2013/08/22		111	%	70 - 130
			Chloromethane	2013/08/22		65(1)	%	70 - 130
			1,2-dibromoethane	2013/08/22		96	%	70 - 130
			1,2-dichlorobenzene	2013/08/22		96	%	70 - 130
			1,3-dichlorobenzene	2013/08/22		93	%	70 - 130
			1,4-dichlorobenzene	2013/08/22		91	%	70 - 130
			1,1-dichloroethane	2013/08/22		111	%	70 - 130
			1,2-dichloroethane	2013/08/22		115	%	70 - 130
			1,1-dichloroethene	2013/08/22		108	%	70 - 130
			cis-1,2-dichloroethene	2013/08/22		108	%	70 - 130
			trans-1,2-dichloroethene	2013/08/22		107	%	70 - 130
			Dichloromethane	2013/08/22		104	%	70 - 130
			1,2-dichloropropane	2013/08/22		115	%	70 - 130
			cis-1,3-dichloropropene	2013/08/22		118	%	70 - 130
			trans-1,3-dichloropropene	2013/08/22		116	%	70 - 130
			Methyl methacrylate	2013/08/22		129	%	70 - 130
			Methyl-tert-butylether (MTBE)	2013/08/22		121	%	70 - 130
			Styrene	2013/08/22		107	%	70 - 130
			1,1,1,2-tetrachloroethane	2013/08/22		97	%	70 - 130
			1,1,2,2-tetrachloroethane	2013/08/22		93	%	70 - 130
			Tetrachloroethene	2013/08/22		94	%	70 - 130
			1,2,3-trichlorobenzene	2013/08/22		95	%	70 - 130
			1,2,4-trichlorobenzene	2013/08/22		99	%	70 - 130
			1,3,5-trichlorobenzene	2013/08/22		99	%	70 - 130
			1,1,1-trichloroethane	2013/08/22		114	%	70 - 130
			1,1,2-trichloroethane	2013/08/22		117	%	70 - 130
			Trichloroethene	2013/08/22		108	%	70 - 130
			Trichlorofluoromethane	2013/08/22		100	%	70 - 130
			1,2,4-trimethylbenzene	2013/08/22		98	%	70 - 130
			1,3,5-trimethylbenzene	2013/08/22		99	%	70 - 130
			Vinyl chloride	2013/08/22		86	%	70 - 130
		Spiked Blank	1,4-Difluorobenzene (sur.)	2013/08/22		108	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/22		107	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/22		106	%	70 - 130
			Bromodichloromethane	2013/08/22		95	%	70 - 130
			Bromoform	2013/08/22		90	%	70 - 130
			Bromomethane	2013/08/22		79	%	70 - 130
			Carbon tetrachloride	2013/08/22		97	%	70 - 130
			Chlorobenzene	2013/08/22		86	%	70 - 130
			Chlorodibromomethane	2013/08/22		93	%	70 - 130
			Chloroethane	2013/08/22		82	%	70 - 130
			Chloroform	2013/08/22		92	%	70 - 130
			Chloromethane	2013/08/22		80	%	70 - 130
			1,2-dibromoethane	2013/08/22		88	%	70 - 130
			1,2-dichlorobenzene	2013/08/22		87	%	70 - 130
			1,3-dichlorobenzene	2013/08/22		86	%	70 - 130
			1,4-dichlorobenzene	2013/08/22		83	%	70 - 130
			1,1-dichloroethane	2013/08/22		92	%	70 - 130
			1,2-dichloroethane	2013/08/22		93	%	70 - 130
			1,1-dichloroethene	2013/08/22		90	%	70 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		Spiked Blank	cis-1,2-dichloroethene	2013/08/22		88	%	70 - 130
			trans-1,2-dichloroethene	2013/08/22		89	%	70 - 130
			Dichloromethane	2013/08/22		85	%	70 - 130
			1,2-dichloropropane	2013/08/22		95	%	70 - 130
			cis-1,3-dichloropropene	2013/08/22		96	%	70 - 130
			trans-1,3-dichloropropene	2013/08/22		95	%	70 - 130
			Methyl methacrylate	2013/08/22		104	%	70 - 130
			Methyl-tert-butylether (MTBE)	2013/08/22		98	%	70 - 130
			Styrene	2013/08/22		99	%	70 - 130
			1,1,1,2-tetrachloroethane	2013/08/22		90	%	70 - 130
			1,1,2,2-tetrachloroethane	2013/08/22		84	%	70 - 130
			Tetrachloroethene	2013/08/22		88	%	70 - 130
			1,2,3-trichlorobenzene	2013/08/22		84	%	70 - 130
			1,2,4-trichlorobenzene	2013/08/22		87	%	70 - 130
			1,3,5-trichlorobenzene	2013/08/22		88	%	70 - 130
			1,1,1-trichloroethane	2013/08/22		95	%	70 - 130
			1,1,2-trichloroethane	2013/08/22		94	%	70 - 130
			Trichloroethene	2013/08/22		87	%	70 - 130
			Trichlorofluoromethane	2013/08/22		83	%	70 - 130
			1,2,4-trimethylbenzene	2013/08/22		91	%	70 - 130
			1,3,5-trimethylbenzene	2013/08/22		92	%	70 - 130
			Vinyl chloride	2013/08/22		72	%	70 - 130
		Blank	1,4-Difluorobenzene (sur.)	2013/08/23		98	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/23		98	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/23		92	%	70 - 130
			Bromodichloromethane	2013/08/23	<0.50		ug/L	
			Bromoform	2013/08/23	<0.50		ug/L	
			Bromomethane	2013/08/23	<2.0		ug/L	
			Carbon tetrachloride	2013/08/23	<0.50		ug/L	
			Chlorobenzene	2013/08/23	<0.50		ug/L	
			Chlorodibromomethane	2013/08/23	<1.0		ug/L	
			Chloroethane	2013/08/23	<1.0		ug/L	
			Chloroform	2013/08/23	<0.50		ug/L	
			Chloromethane	2013/08/23	<2.0		ug/L	
			1,2-dibromoethane	2013/08/23	<0.50		ug/L	
			1,2-dichlorobenzene	2013/08/23	<0.50		ug/L	
			1,3-dichlorobenzene	2013/08/23	<0.50		ug/L	
			1,4-dichlorobenzene	2013/08/23	<0.50		ug/L	
			1,1-dichloroethane	2013/08/23	<0.50		ug/L	
			1,2-dichloroethane	2013/08/23	<0.50		ug/L	
			1,1-dichloroethene	2013/08/23	<0.50		ug/L	
			cis-1,2-dichloroethene	2013/08/23	<0.50		ug/L	
			trans-1,2-dichloroethene	2013/08/23	<0.50		ug/L	
			Dichloromethane	2013/08/23	<2.0		ug/L	
			1,2-dichloropropane	2013/08/23	<0.50		ug/L	
			cis-1,3-dichloropropene	2013/08/23	<0.50		ug/L	
			trans-1,3-dichloropropene	2013/08/23	<0.50		ug/L	
			Methyl methacrylate	2013/08/23	<0.50		ug/L	
			Methyl-tert-butylether (MTBE)	2013/08/23	<0.50		ug/L	
			Styrene	2013/08/23	<0.50		ug/L	
			1,1,1,2-tetrachloroethane	2013/08/23	<2.0		ug/L	
			1,1,2,2-tetrachloroethane	2013/08/23	<2.0		ug/L	
			Tetrachloroethene	2013/08/23	<0.50		ug/L	
			1,2,3-trichlorobenzene	2013/08/23	<1.0		ug/L	
			1,2,4-trichlorobenzene	2013/08/23	<1.0		ug/L	
			1,3,5-trichlorobenzene	2013/08/23	<0.50		ug/L	
			1,1,1-trichloroethane	2013/08/23	<0.50		ug/L	
			1,1,2-trichloroethane	2013/08/23	<0.50		ug/L	
			Trichloroethene	2013/08/23	<0.50		ug/L	
			Trichlorofluoromethane	2013/08/23	<0.50		ug/L	
			1,2,4-trimethylbenzene	2013/08/23	<0.50		ug/L	
			1,3,5-trimethylbenzene	2013/08/23	<0.50		ug/L	
			Vinyl chloride	2013/08/23	<0.50		ug/L	
		RPD	Bromodichloromethane	2013/08/23	NC		%	40

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		RPD	Bromoform	2013/08/23	NC		%	40
			Bromomethane	2013/08/23	NC		%	40
			Carbon tetrachloride	2013/08/23	NC		%	40
			Chlorobenzene	2013/08/23	NC		%	40
			Chlorodibromomethane	2013/08/23	NC		%	40
			Chloroethane	2013/08/23	NC		%	40
			Chloroform	2013/08/23	NC		%	40
			Chloromethane	2013/08/23	NC		%	40
			1,2-dibromoethane	2013/08/23	NC		%	40
			1,2-dichlorobenzene	2013/08/23	NC		%	40
			1,3-dichlorobenzene	2013/08/23	NC		%	40
			1,4-dichlorobenzene	2013/08/23	NC		%	40
			1,1-dichloroethane	2013/08/23	NC		%	40
			1,2-dichloroethane	2013/08/23	NC		%	40
			1,1-dichloroethene	2013/08/23	NC		%	40
			cis-1,2-dichloroethene	2013/08/23	15		%	40
			trans-1,2-dichloroethene	2013/08/23	NC		%	40
			Dichloromethane	2013/08/23	NC		%	40
			1,2-dichloropropane	2013/08/23	NC		%	40
			cis-1,3-dichloropropene	2013/08/23	NC		%	40
			trans-1,3-dichloropropene	2013/08/23	NC		%	40
			Methyl methacrylate	2013/08/23	NC		%	40
			Methyl-tert-butylether (MTBE)	2013/08/23	NC		%	40
			Styrene	2013/08/23	NC		%	40
			1,1,1,2-tetrachloroethane	2013/08/23	NC		%	40
			1,1,2,2-tetrachloroethane	2013/08/23	NC		%	40
			Tetrachloroethene	2013/08/23	0.3		%	40
			1,2,3-trichlorobenzene	2013/08/23	NC		%	40
			1,2,4-trichlorobenzene	2013/08/23	NC		%	40
			1,3,5-trichlorobenzene	2013/08/23	NC		%	40
			1,1,1-trichloroethane	2013/08/23	NC		%	40
			1,1,2-trichloroethane	2013/08/23	NC		%	40
			Trichloroethene	2013/08/23	NC		%	40
			Trichlorofluoromethane	2013/08/23	NC		%	40
			1,2,4-trimethylbenzene	2013/08/23	NC		%	40
			1,3,5-trimethylbenzene	2013/08/23	NC		%	40
			Vinyl chloride	2013/08/23	NC		%	40
7106770	RP0	Matrix Spike	Nitrite (N)	2013/08/22		100	%	80 - 120
	RP0	Matrix Spike	Nitrate (N)	2013/08/22		101	%	80 - 120
		Spiked Blank	Nitrite (N)	2013/08/22		99	%	90 - 110
			Nitrate (N)	2013/08/22		101	%	90 - 110
		Blank	Nitrite (N)	2013/08/22	<0.0030		mg/L	
			Nitrate (N)	2013/08/22	0.0030, RDL=0.003		mg/L	
		RPD	Nitrite (N)	2013/08/22	NC		%	20
			Nitrate (N)	2013/08/22	NC		%	20
7108564	FM0	Matrix Spike	Acetic Acid	2013/08/23		94	%	70 - 130
	FM0	Matrix Spike	Formic Acid	2013/08/23		97	%	70 - 130
			Propionic Acid	2013/08/23		87	%	70 - 130
		Spiked Blank	Acetic Acid	2013/08/23		96	%	70 - 130
			Formic Acid	2013/08/23		104	%	70 - 130
			Propionic Acid	2013/08/23		86	%	70 - 130
		Blank	Acetic Acid	2013/08/23	<0.50		mg/L	
			Formic Acid	2013/08/23	<0.50		mg/L	
			Propionic Acid	2013/08/23	<0.50		mg/L	
		RPD	Acetic Acid	2013/08/23	NC		%	40
			Formic Acid	2013/08/23	NC		%	40
			Propionic Acid	2013/08/23	NC		%	40
7122307	RM9	Matrix Spike	Ammonia (N)	2013/08/28		101	%	80 - 120
	RM9	Spiked Blank	Ammonia (N)	2013/08/28		102	%	80 - 120
		Blank	Ammonia (N)	2013/08/28	<0.050		mg/L	
		RPD	Ammonia (N)	2013/08/28	NC		%	20
7126399	SK9	Matrix Spike	Ammonia (N)	2013/08/28		90	%	80 - 120
	SK9	Spiked Blank	Ammonia (N)	2013/08/28		100	%	80 - 120
		Blank	Ammonia (N)	2013/08/28	<0.050		mg/L	

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		RPD	Ammonia (N)	2013/08/28	NC		%	20
7131192	MB5	Matrix Spike	Aluminum (Al)	2013/09/03		101	%	80 - 120
	MB5	Matrix Spike	Antimony (Sb)	2013/09/03		119	%	80 - 120
			Arsenic (As)	2013/09/03		109	%	80 - 120
			Beryllium (Be)	2013/09/03		108	%	80 - 120
			Chromium (Cr)	2013/09/03		107	%	80 - 120
			Cobalt (Co)	2013/09/03		109	%	80 - 120
			Copper (Cu)	2013/09/03		109	%	80 - 120
			Lead (Pb)	2013/09/03		108	%	80 - 120
			Molybdenum (Mo)	2013/09/03		110	%	80 - 120
			Nickel (Ni)	2013/09/03		108	%	80 - 120
			Selenium (Se)	2013/09/03		106	%	80 - 120
			Silver (Ag)	2013/09/03		110	%	80 - 120
			Thallium (Tl)	2013/09/03		104	%	80 - 120
			Tin (Sn)	2013/09/03		106	%	80 - 120
			Titanium (Ti)	2013/09/03		98	%	80 - 120
			Uranium (U)	2013/09/03		109	%	80 - 120
			Vanadium (V)	2013/09/03		104	%	80 - 120
			Zinc (Zn)	2013/09/03		104	%	80 - 120
		Spiked Blank	Aluminum (Al)	2013/09/03		100	%	80 - 120
			Antimony (Sb)	2013/09/03		111	%	80 - 120
			Arsenic (As)	2013/09/03		103	%	80 - 120
			Beryllium (Be)	2013/09/03		105	%	80 - 120
			Chromium (Cr)	2013/09/03		104	%	80 - 120
			Cobalt (Co)	2013/09/03		107	%	80 - 120
			Copper (Cu)	2013/09/03		106	%	80 - 120
			Lead (Pb)	2013/09/03		100	%	80 - 120
			Molybdenum (Mo)	2013/09/03		104	%	80 - 120
			Nickel (Ni)	2013/09/03		103	%	80 - 120
			Selenium (Se)	2013/09/03		99	%	80 - 120
			Silver (Ag)	2013/09/03		103	%	80 - 120
			Thallium (Tl)	2013/09/03		99	%	80 - 120
			Tin (Sn)	2013/09/03		103	%	80 - 120
			Titanium (Ti)	2013/09/03		97	%	80 - 120
			Uranium (U)	2013/09/03		102	%	80 - 120
			Vanadium (V)	2013/09/03		103	%	80 - 120
			Zinc (Zn)	2013/09/03		108	%	80 - 120
		Blank	Aluminum (Al)	2013/09/03	<0.0030		mg/L	
			Antimony (Sb)	2013/09/03	<0.00060		mg/L	
			Arsenic (As)	2013/09/03	<0.00020		mg/L	
			Beryllium (Be)	2013/09/03	<0.0010		mg/L	
			Chromium (Cr)	2013/09/03	<0.0010		mg/L	
			Cobalt (Co)	2013/09/03	<0.00030		mg/L	
			Copper (Cu)	2013/09/03	<0.00020		mg/L	
			Lead (Pb)	2013/09/03	<0.00020		mg/L	
			Molybdenum (Mo)	2013/09/03	<0.00020		mg/L	
			Nickel (Ni)	2013/09/03	<0.00050		mg/L	
			Selenium (Se)	2013/09/03	<0.00020		mg/L	
			Silver (Ag)	2013/09/03	<0.00010		mg/L	
			Thallium (Tl)	2013/09/03	<0.00020		mg/L	
			Tin (Sn)	2013/09/03	<0.0010		mg/L	
			Titanium (Ti)	2013/09/03	<0.0010		mg/L	
			Uranium (U)	2013/09/03	<0.00010		mg/L	
			Vanadium (V)	2013/09/03	<0.0010		mg/L	
			Zinc (Zn)	2013/09/03	<0.0030		mg/L	
		RPD	Aluminum (Al)	2013/09/03	NC		%	20
			Antimony (Sb)	2013/09/03	NC		%	20
			Arsenic (As)	2013/09/03	NC		%	20
			Beryllium (Be)	2013/09/03	NC		%	20
			Chromium (Cr)	2013/09/03	NC		%	20
			Cobalt (Co)	2013/09/03	NC		%	20
			Copper (Cu)	2013/09/03	NC		%	20
			Lead (Pb)	2013/09/03	NC		%	20
			Molybdenum (Mo)	2013/09/03	NC		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		RPD	Nickel (Ni)	2013/09/03	NC		%	20
			Selenium (Se)	2013/09/03	NC		%	20
			Silver (Ag)	2013/09/03	NC		%	20
			Thallium (Tl)	2013/09/03	NC		%	20
			Tin (Sn)	2013/09/03	NC		%	20
			Titanium (Ti)	2013/09/03	NC		%	20
			Uranium (U)	2013/09/03	NC		%	20
			Vanadium (V)	2013/09/03	NC		%	20
			Zinc (Zn)	2013/09/03	NC		%	20
7131233	PK0	Matrix Spike	Barium (Ba)	2013/09/03		96	%	80 - 120
	PK0	Matrix Spike	Boron (B)	2013/09/03		114	%	80 - 120
			Calcium (Ca)	2013/09/03		101	%	80 - 120
			Iron (Fe)	2013/09/03		95	%	80 - 120
			Lithium (Li)	2013/09/03		101	%	80 - 120
			Magnesium (Mg)	2013/09/03		100	%	80 - 120
			Manganese (Mn)	2013/09/03		98	%	80 - 120
			Phosphorus (P)	2013/09/03		100	%	80 - 120
			Potassium (K)	2013/09/03		104	%	80 - 120
			Silicon (Si)	2013/09/03		111	%	80 - 120
			Sodium (Na)	2013/09/03		102	%	80 - 120
			Strontium (Sr)	2013/09/03		98	%	80 - 120
		Spiked Blank	Barium (Ba)	2013/09/03		96	%	80 - 120
			Boron (B)	2013/09/03		114	%	80 - 120
			Calcium (Ca)	2013/09/03		101	%	80 - 120
			Iron (Fe)	2013/09/03		96	%	80 - 120
			Lithium (Li)	2013/09/03		102	%	80 - 120
			Magnesium (Mg)	2013/09/03		100	%	80 - 120
			Manganese (Mn)	2013/09/03		98	%	80 - 120
			Phosphorus (P)	2013/09/03		100	%	80 - 120
			Potassium (K)	2013/09/03		105	%	80 - 120
			Silicon (Si)	2013/09/03		112	%	80 - 120
			Sodium (Na)	2013/09/03		102	%	80 - 120
			Strontium (Sr)	2013/09/03		98	%	80 - 120
		Blank	Barium (Ba)	2013/09/03	<0.010		mg/L	
			Boron (B)	2013/09/03	<0.020		mg/L	
			Calcium (Ca)	2013/09/03	<0.30		mg/L	
			Iron (Fe)	2013/09/03	<0.060		mg/L	
			Lithium (Li)	2013/09/03	<0.020		mg/L	
			Magnesium (Mg)	2013/09/03	<0.20		mg/L	
			Manganese (Mn)	2013/09/03	<0.0040		mg/L	
			Phosphorus (P)	2013/09/03	<0.10		mg/L	
			Potassium (K)	2013/09/03	<0.30		mg/L	
			Silicon (Si)	2013/09/03	<0.10		mg/L	
			Sodium (Na)	2013/09/03	<0.50		mg/L	
			Strontium (Sr)	2013/09/03	<0.020		mg/L	
			Sulphur (S)	2013/09/03	<0.20		mg/L	
		RPD	Barium (Ba)	2013/09/03	NC		%	20
			Boron (B)	2013/09/03	NC		%	20
			Calcium (Ca)	2013/09/03	NC		%	20
			Iron (Fe)	2013/09/03	NC		%	20
			Lithium (Li)	2013/09/03	NC		%	20
			Magnesium (Mg)	2013/09/03	NC		%	20
			Manganese (Mn)	2013/09/03	NC		%	20
			Potassium (K)	2013/09/03	NC		%	20
			Silicon (Si)	2013/09/03	NC		%	20
			Sodium (Na)	2013/09/03	NC		%	20
			Strontium (Sr)	2013/09/03	NC		%	20
			Sulphur (S)	2013/09/03	NC		%	20
7134060	ZI	Matrix Spike	Chloride (Cl)	2013/08/31		110	%	80 - 120
	ZI	Spiked Blank	Chloride (Cl)	2013/08/31		104	%	80 - 120
		Blank	Chloride (Cl)	2013/08/31	<1.0		mg/L	
		RPD	Chloride (Cl)	2013/08/31	4.9		%	20
7134062	ZI	Matrix Spike	Sulphate (SO4)	2013/08/31		NC	%	80 - 120
	ZI	Spiked Blank	Sulphate (SO4)	2013/08/31		108	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		Blank	Sulphate (SO4)	2013/08/31	<1.0		mg/L	
		RPD	Sulphate (SO4)	2013/08/31	2.3		%	20
7135686	AP1	Matrix Spike	Organic Carbon (C)	2013/09/02		NC	%	80 - 120
	AP1	Spiked Blank	Organic Carbon (C)	2013/09/02		107	%	80 - 120
		Blank	Organic Carbon (C)	2013/09/02	<0.50		mg/L	
		RPD	Organic Carbon (C)	2013/09/02	2.3		%	20
7136620	TDB	Matrix Spike	Aluminum (Al)	2013/09/04		107	%	80 - 120
	TDB	Matrix Spike	Antimony (Sb)	2013/09/04		83	%	80 - 120
			Arsenic (As)	2013/09/04		98	%	80 - 120
			Beryllium (Be)	2013/09/04		104	%	80 - 120
			Chromium (Cr)	2013/09/04		98	%	80 - 120
			Cobalt (Co)	2013/09/04		95	%	80 - 120
			Copper (Cu)	2013/09/04		96	%	80 - 120
			Lead (Pb)	2013/09/04		95	%	80 - 120
			Molybdenum (Mo)	2013/09/04		100	%	80 - 120
			Nickel (Ni)	2013/09/04		94	%	80 - 120
			Selenium (Se)	2013/09/04		101	%	80 - 120
			Silver (Ag)	2013/09/04		93	%	80 - 120
			Thallium (Tl)	2013/09/04		94	%	80 - 120
			Tin (Sn)	2013/09/04		86	%	80 - 120
			Titanium (Ti)	2013/09/04		98	%	80 - 120
			Uranium (U)	2013/09/04		99	%	80 - 120
			Vanadium (V)	2013/09/04		100	%	80 - 120
			Zinc (Zn)	2013/09/04		90	%	80 - 120
		Spiked Blank	Aluminum (Al)	2013/09/03		108	%	80 - 120
			Antimony (Sb)	2013/09/03		91	%	80 - 120
			Arsenic (As)	2013/09/03		103	%	80 - 120
			Beryllium (Be)	2013/09/03		101	%	80 - 120
			Chromium (Cr)	2013/09/03		100	%	80 - 120
			Cobalt (Co)	2013/09/03		100	%	80 - 120
			Copper (Cu)	2013/09/03		100	%	80 - 120
			Lead (Pb)	2013/09/03		98	%	80 - 120
			Molybdenum (Mo)	2013/09/03		99	%	80 - 120
			Nickel (Ni)	2013/09/03		100	%	80 - 120
			Selenium (Se)	2013/09/03		103	%	80 - 120
			Silver (Ag)	2013/09/03		98	%	80 - 120
			Thallium (Tl)	2013/09/03		97	%	80 - 120
			Tin (Sn)	2013/09/03		94	%	80 - 120
			Titanium (Ti)	2013/09/03		103	%	80 - 120
			Uranium (U)	2013/09/03		103	%	80 - 120
			Vanadium (V)	2013/09/03		101	%	80 - 120
			Zinc (Zn)	2013/09/03		96	%	80 - 120
		Blank	Aluminum (Al)	2013/09/03	0.0031, RDL=0.003		mg/L	
			Antimony (Sb)	2013/09/03	<0.00060		mg/L	
			Arsenic (As)	2013/09/03	<0.00020		mg/L	
			Beryllium (Be)	2013/09/03	<0.0010		mg/L	
			Chromium (Cr)	2013/09/03	<0.0010		mg/L	
			Cobalt (Co)	2013/09/03	<0.00030		mg/L	
			Copper (Cu)	2013/09/03	<0.00020		mg/L	
			Lead (Pb)	2013/09/03	<0.00020		mg/L	
			Molybdenum (Mo)	2013/09/03	<0.00020		mg/L	
			Nickel (Ni)	2013/09/03	<0.00050		mg/L	
			Selenium (Se)	2013/09/03	<0.00020		mg/L	
			Silver (Ag)	2013/09/03	<0.00010		mg/L	
			Thallium (Tl)	2013/09/03	<0.00020		mg/L	
			Tin (Sn)	2013/09/03	<0.0010		mg/L	
			Titanium (Ti)	2013/09/03	<0.0010		mg/L	
			Uranium (U)	2013/09/03	<0.00010		mg/L	
			Vanadium (V)	2013/09/03	<0.0010		mg/L	
			Zinc (Zn)	2013/09/03	<0.0030		mg/L	
		RPD	Aluminum (Al)	2013/09/03	NC		%	20
			Antimony (Sb)	2013/09/03	NC		%	20
			Arsenic (As)	2013/09/03	NC		%	20
			Beryllium (Be)	2013/09/03	NC		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		RPD	Chromium (Cr)	2013/09/03	NC		%	20
			Cobalt (Co)	2013/09/03	NC		%	20
			Copper (Cu)	2013/09/03	NC		%	20
			Lead (Pb)	2013/09/03	NC		%	20
			Molybdenum (Mo)	2013/09/03	NC		%	20
			Nickel (Ni)	2013/09/03	NC		%	20
			Selenium (Se)	2013/09/03	NC		%	20
			Silver (Ag)	2013/09/03	NC		%	20
			Thallium (Tl)	2013/09/03	NC		%	20
			Tin (Sn)	2013/09/03	NC		%	20
			Titanium (Ti)	2013/09/03	NC		%	20
			Uranium (U)	2013/09/03	NC		%	20
			Vanadium (V)	2013/09/03	NC		%	20
			Zinc (Zn)	2013/09/03	NC		%	20
7139263	PK0	Matrix Spike	Barium (Ba)	2013/09/05		93	%	80 - 120
	PK0	Matrix Spike	Boron (B)	2013/09/05		99	%	80 - 120
			Calcium (Ca)	2013/09/05		98	%	80 - 120
			Iron (Fe)	2013/09/05		97	%	80 - 120
			Lithium (Li)	2013/09/05		99	%	80 - 120
			Magnesium (Mg)	2013/09/05		100	%	80 - 120
			Manganese (Mn)	2013/09/05		97	%	80 - 120
			Phosphorus (P)	2013/09/05		100	%	80 - 120
			Potassium (K)	2013/09/05		101	%	80 - 120
			Silicon (Si)	2013/09/05		98	%	80 - 120
			Sodium (Na)	2013/09/05		98	%	80 - 120
			Strontium (Sr)	2013/09/05		94	%	80 - 120
		Spiked Blank	Barium (Ba)	2013/09/04		85	%	80 - 120
			Boron (B)	2013/09/04		92	%	80 - 120
			Calcium (Ca)	2013/09/04		109	%	80 - 120
			Iron (Fe)	2013/09/04		96	%	80 - 120
			Lithium (Li)	2013/09/04		83	%	80 - 120
			Magnesium (Mg)	2013/09/04		95	%	80 - 120
			Manganese (Mn)	2013/09/04		98	%	80 - 120
			Phosphorus (P)	2013/09/04		97	%	80 - 120
			Potassium (K)	2013/09/04		93	%	80 - 120
			Silicon (Si)	2013/09/04		95	%	80 - 120
			Sodium (Na)	2013/09/04		98	%	80 - 120
			Strontium (Sr)	2013/09/04		89	%	80 - 120
		Blank	Barium (Ba)	2013/09/05	<0.010		mg/L	
			Boron (B)	2013/09/05	<0.020		mg/L	
			Calcium (Ca)	2013/09/05	<0.30		mg/L	
			Iron (Fe)	2013/09/05	<0.060		mg/L	
			Lithium (Li)	2013/09/05	<0.020		mg/L	
			Magnesium (Mg)	2013/09/05	<0.20		mg/L	
			Manganese (Mn)	2013/09/05	<0.0040		mg/L	
			Phosphorus (P)	2013/09/05	<0.10		mg/L	
			Potassium (K)	2013/09/05	<0.30		mg/L	
			Silicon (Si)	2013/09/05	<0.10		mg/L	
			Sodium (Na)	2013/09/05	<0.50		mg/L	
			Strontium (Sr)	2013/09/05	<0.020		mg/L	
			Sulphur (S)	2013/09/05	<0.20		mg/L	
		RPD	Barium (Ba)	2013/09/05	NC		%	20
			Boron (B)	2013/09/05	NC		%	20
			Calcium (Ca)	2013/09/05	NC		%	20
			Iron (Fe)	2013/09/05	NC		%	20
			Lithium (Li)	2013/09/05	NC		%	20
			Magnesium (Mg)	2013/09/05	NC		%	20
			Manganese (Mn)	2013/09/05	NC		%	20
			Silicon (Si)	2013/09/05	NC		%	20
			Sodium (Na)	2013/09/05	NC		%	20
			Strontium (Sr)	2013/09/05	NC		%	20
			Sulphur (S)	2013/09/05	NC		%	20
7140829	LY	Matrix Spike	Chemical Oxygen Demand	2013/09/04		99	%	80 - 120
	LY	Spiked Blank	Chemical Oxygen Demand	2013/09/04		101	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		Blank	Chemical Oxygen Demand	2013/09/04	9.0, RDL=5.0		mg/L	
		RPD	Chemical Oxygen Demand	2013/09/04	3.6		%	20
7141763	RM9	Matrix Spike	Total Kjeldahl Nitrogen	2013/09/04		105	%	80 - 120
	RM9	QC Standard	Total Kjeldahl Nitrogen	2013/09/04		111	%	75 - 125
		Spiked Blank	Total Kjeldahl Nitrogen	2013/09/04		87	%	80 - 120
		Blank	Total Kjeldahl Nitrogen	2013/09/04	<0.050		mg/L	
		RPD	Total Kjeldahl Nitrogen	2013/09/04	3.5		%	20
7141844		Matrix Spike	Phosphorus (P)	2013/09/04		100	%	80 - 120
	RM9	QC Standard	Phosphorus (P)	2013/09/04		96	%	80 - 120
		Spiked Blank	Phosphorus (P)	2013/09/04		102	%	83 - 111
		Blank	Phosphorus (P)	2013/09/04	<0.0030		mg/L	
		RPD	Phosphorus (P)	2013/09/04	NC		%	20
7149651	DA4	Matrix Spike	Nitrite (N)	2013/09/06		100	%	80 - 120
	DA4	Matrix Spike	Nitrate (N)	2013/09/06		101	%	80 - 120
		Spiked Blank	Nitrite (N)	2013/09/06		101	%	90 - 110
			Nitrate (N)	2013/09/06		101	%	90 - 110
		Blank	Nitrite (N)	2013/09/06	<0.0030		mg/L	
			Nitrate (N)	2013/09/06	<0.0030		mg/L	
		RPD	Nitrite (N)	2013/09/06	NC		%	20
			Nitrate (N)	2013/09/06	NC		%	20
7149784	JLD	Spiked Blank	Alkalinity (Total as CaCO3)	2013/09/06		99	%	80 - 120
	JLD	Blank	Alkalinity (PP as CaCO3)	2013/09/06	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2013/09/06	<0.50		mg/L	
			Bicarbonate (HCO3)	2013/09/06	<0.50		mg/L	
			Carbonate (CO3)	2013/09/06	<0.50		mg/L	
			Hydroxide (OH)	2013/09/06	<0.50		mg/L	
		RPD	Alkalinity (PP as CaCO3)	2013/09/06	NC		%	20
			Alkalinity (Total as CaCO3)	2013/09/06	9.2		%	20
			Bicarbonate (HCO3)	2013/09/06	9.2		%	20
			Carbonate (CO3)	2013/09/06	NC		%	20
			Hydroxide (OH)	2013/09/06	NC		%	20
7149791		Spiked Blank	Conductivity	2013/09/06		100	%	90 - 110
	JLD	Blank	Conductivity	2013/09/06	<1.0		uS/cm	
		RPD	Conductivity	2013/09/06	2.1		%	20
7149793		Spiked Blank	pH	2013/09/06		99	%	97 - 102
	JLD	RPD	pH	2013/09/06	0.9		%	5
7150856	FM0	Matrix Spike	Acetic Acid	2013/09/06		97	%	70 - 130
	FM0	Matrix Spike	Formic Acid	2013/09/06		99	%	70 - 130
			Propionic Acid	2013/09/06		94	%	70 - 130
		Spiked Blank	Acetic Acid	2013/09/06		96	%	70 - 130
			Formic Acid	2013/09/06		101	%	70 - 130
			Propionic Acid	2013/09/06		87	%	70 - 130
		Blank	Acetic Acid	2013/09/06	<0.50		mg/L	
			Formic Acid	2013/09/06	<0.50		mg/L	
			Propionic Acid	2013/09/06	<0.50		mg/L	
		RPD	Acetic Acid	2013/09/06	NC		%	40
			Formic Acid	2013/09/06	NC		%	40
			Propionic Acid	2013/09/06	NC		%	40
7152268	ZI	Matrix Spike	Chloride (Cl)	2013/09/07		NC	%	80 - 120
	ZI	Spiked Blank	Chloride (Cl)	2013/09/07		103	%	80 - 120
		Blank	Chloride (Cl)	2013/09/07	<1.0		mg/L	
		RPD	Chloride (Cl)	2013/09/07	2.1		%	20
7152270	ZI	Matrix Spike	Sulphate (SO4)	2013/09/07		125(1)	%	80 - 120
	ZI	Spiked Blank	Sulphate (SO4)	2013/09/07		106	%	80 - 120
		Blank	Sulphate (SO4)	2013/09/07	<1.0		mg/L	

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
		RPD	Sulphate (SO4)	2013/09/07	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

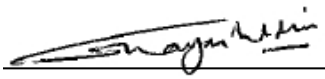
Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B372952
Report Date: 2013/12/11

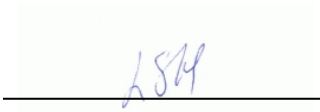
TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE HEAVY

VALIDATION SIGNATURE PAGE

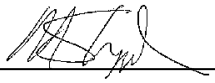
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



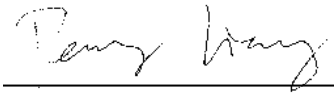
Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Scientific Specialist



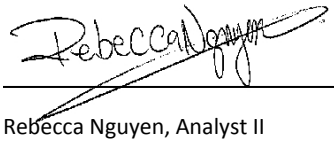
Luba Shymushovska, Senior Analyst, Organic Department



Michael Sheppard, Organics Supervisor



Peng Liang, Analyst II



Rebecca Nguyen, Analyst II

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Received: 1 X Large cooler with samples (NO COC)
3 X Large coolers (Returns)
1 X Box (Suma Canisters)

Missing: 1 X Medium cooler (written on Tazoo waybill)

Helen D 1635
2013/05/18 ~~1900~~ 1100

3/4/4

18-Aug-13 16:35

B372952
AD8 INS-0014

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody A146706

Page: 1 of 1

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	TAMAT	
Contact:	JESS ZEE	
Address:	107, 2719 7 AVE NE	
	Prov: AB PC: T2A 2L9	Prov: PC:
Contact #s:	Ph: 403-680-9089 Cell: 403-620-9008	Ph: Cell:

Report Distribution (E-Mail): Jessica@tamatgroup.ca; kelly@tamatgroup.ca

REGULATORY GUIDELINES: ☐ AT1 ☐ CCME ☐ Regulated Drinking Water ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 12-685
Site Location:
Quote #: B30617
Sampled By: JAMES

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☐ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs ☐BTEX F1 ☐BTEX F1-F2	☐BTEX F1-F4 ☐BTEX F1-F2 ☐Routine Water ☐Turb ☐F ☐TOC ☐DOC	Regulated Metals (CCME/AT1) Total / Dissolved	☐Total ☐Dissolved Mercury	Other Analysis: O-, Sat., NH3-N	P, Alkalinity, COD	BOD	Nitrates / Nitrites	N, Total	pH	BTEX, Volatile	Texture Acode			HOLD - Do not Analyze	# of Containers Submitted
1	MW-01 (Chromatography)		GW	13/08/17 AM							✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			
2	MW-02										✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			
3	MW-03						372952				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			
4	MW-04										✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			
5	MW-01 (Chromatography)		GW	13/08/17 PM							✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			
6	MW-02										✓	✓		✓	✓	✓	✓	✓	✓	✓					
7	MW-03						372940				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			
8	MW-05										✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	3	PLS SEE INSTRUCTIONS	
9																									
10																									
11																									
12																									F/P

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD): 13/08/17	Time (24:00): 2320
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Couldn't fill up all bottles due to slow recovery only submitted 1 set of BTEX, F1-F2

# of Jars Used & Not Submitted

AOX 2 bottle, Move bottles to cool PLS conserve during analysis.

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:			
Aicha Delbouh	2013/8/30	15 50		Custody Seal	Temperature	Ice
Lab Comments:					15.16.15	

1X08-749

CONFIRMATION-RECEIPT OF SAMPLES FOR ANALYSIS

Maxxam Job # B372952

Client Project #: 12-435
Quote #: B30736

3 Samples

Samples Received 2013/08/18
Client Confirmation 2013/08/21
Expected Report Delivery 2013/09/05 18:00

Report will be sent to:
JESSICA LEE
TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107, 2719-7 Avenue NE
CALGARY
T2A 2L9
Ph 403-640-9009
Fax 403-640-9006
jessica@tiamatgroup.ca

Invoice will be sent to:
JESSICA LEE
TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107, 2719-7 Avenue NE
CALGARY
T2A 2L9
jessica@tiamatgroup.ca

Copy of Report will be sent to:
KELLY

We have received the following samples:

MW-01 Sampled 2013/08/17 COC# N/A Matrix: WATER
Maxxam #: HF9789

AT1 BTEX and F1-F2
*Regulated Metals (CCME/AT1) - Dissolved
*Regulated Metals (CCME/AT1) - Total
Acetic Acid, Formic Acid, Propionic Acid
Acid Digestion for Total Metals - Waters
Alkalinity @25C (pp, total), CO3,HCO3,OH
Ammonia-N (Total)
Biochemical Oxygen Demand
Carbon (Total Organic)
Chemical Oxygen Demand
Chloride by Automated Colourimetry
Conductivity @25C
Environmental Sample Disposal Fee
Nitrate + Nitrite-N (calculated)
Nitrate and Nitrite
Nitrogen (total), Calc. TKN, NO3, NO2
Nitrogen, (Nitrite, Nitrate) by IC
Organic Halogen (Adsorbable)
pH @25°C (Alkalinity titrator)
Sulphate by Automated Colourimetry
Total Kjeldahl Nitrogen
Total Phosphorus
Total Trihalomethanes Calculation
*VOCs in Water by HS GC/MS (Std List)

MW-02 Sampled 2013/08/17
Maxxam #: HF9790

AT1 BTEX and F1-F2

*Regulated Metals (CCME/AT1) - Dissolved
*Regulated Metals (CCME/AT1) - Total
Acid Digestion for Total Metals - Waters
Ammonia-N (Total)
Biochemical Oxygen Demand
Carbon (Total Organic)
Chemical Oxygen Demand
Environmental Sample Disposal Fee
Nitrogen (total), Calc. TKN, NO3, NO2
Organic Halogen (Adsorbable)
Send Part to Archive
Total Kjeldahl Nitrogen
Total Phosphorus
Total Trihalomethanes Calculation
*VOCs in Water by HS GC/MS (Std List)

MW-03 Sampled 2013/08/17

Maxxam #: HF9791

AT1 BTEX and F1-F2
*Regulated Metals (CCME/AT1) - Dissolved
*Regulated Metals (CCME/AT1) - Total
Acetic Acid, Formic Acid, Propionic Acid
Acid Digestion for Total Metals - Waters
Alkalinity @25C (pp, total), CO3,HCO3,OH
Ammonia-N (Total)
Biochemical Oxygen Demand
Carbon (Total Organic)
Chemical Oxygen Demand
Chloride by Automated Colourimetry
Conductivity @25C
Environmental Sample Disposal Fee
Nitrate + Nitrite-N (calculated)
Nitrate and Nitrite
Nitrogen (total), Calc. TKN, NO3, NO2
Nitrogen, (Nitrite, Nitrate) by IC
Organic Halogen (Adsorbable)
pH @25°C (Alkalinity titrator)
Sulphate by Automated Colourimetry
Total Kjeldahl Nitrogen
Total Phosphorus
Total Trihalomethanes Calculation
*VOCs in Water by HS GC/MS (Std List)

Comments:

- Unless special storage arrangements are made, all samples will be discarded 60 days after receipt of samples.
- Non-regular samples are flagged as (C) Composite by lab, (H) Hold, or (L) Leachate.
- If there are any problems with the submitted samples, a Sample Integrity Form (SIF) detailing conditions will be included in this confirmation.
- For revisions please contact your Maxxam Project Management team at Ph (403) 291-3077 or Fax (403) 291-9468. Your Project Manager is: Kayla Brassard

Received: 1 X Large cooler
with samples (NO COC)
3 X Large coolers (Returns)
1 X Box (Suma Canisters)

Missing: 1 X Medium cooler (written on Jazoo waybill)

Helen D
2013/05/18 1635
~~1900~~ 1100

3/4/4

18-Aug-13 16:35

B372952
AD8 INS-0014

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody

A146706

Page: 1 of 1

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	TMMAT		Jessica@tmmatgroup.ca
Contact:	JESS ZEE		kelly@tmmatgroup.ca
Address:	107, 2719 7 AVE NE		
	Prov: AB PC: T2A 2L9	Prov: PC:	
Contact #s:	Ph: 403-680-9009 Cell: 403-680-9008	Ph: Cell:	

REGULATORY GUIDELINES:
☐ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 12635
Site Location:
Quote #: B30017
Sampled By: JM/JES

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☐ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Dissolved	☐ Total ☐ Dissolved Mercury	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	MW-01 (Riverside Heavy)		GW	13/08/17 AM							✓	✓		✓	✓	✓		✓		
2											✓	✓		✓	✓	✓		✓		
3	MW-02						372952				✓	✓		✓	✓	✓		✓		
4	MW-03										✓	✓		✓	✓	✓		✓		
5	MW-01 (Mackenzie Jr)		GW	13/08/17 PM							✓	✓		✓	✓	✓		✓		
6	MW-02										✓	✓		✓	✓			✓		
7	MW-03						372940				✓	✓		✓	✓	✓		-		
8	MW-05										✓	✓		✓	✓	✓		✓	PLS SEE INSTRUCTIONS	
9																				
10																				
11																				
12																				

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD): 13/08/17	Time (24:00): 2020
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Couldnt fill up all bottles due to slow recovery only submitted 1 set of BTEX.F1-F2 AOX 2 bottle, More bottles to come. Pls conserve during analysis.

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
Aicha Delbouh	20/3/8/30	1650	Custody Seal	Temperature	Ice
Lab Comments:				15.16.15	

1X08-749

SOIL VAPOUR REPORTS

Maxxam

Success Through Science®

ACCREDITED IN ACCORDANCE WITH nelac

Your Project #: 12-435
Your C.O.C. #: na

Attention: Leon T. Mah
Tiamat Environmental
107, 2719-7 Ave. NE
Calgary, AB
CANADA T2A 2L9

Report Date: 2014/01/20
Report #: R2781355
Version: 4R

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B3D8051
Received: 2013/08/20, 10:45

Sample Matrix: AIR
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
BTEX Fractionation in Air (TO-15mod)	1	N/A	2013/08/28	BRL SOP-00304	EPA TO-15mod
Canister Pressure (TO-15)	1	N/A	2013/08/28	BRL SOP-00304	EPA TO-15
Light Hydrocarbons	1	N/A	2013/09/05	CAM SOP-00227	GC/FID
Matrix Gases	1	N/A	2013/09/04	CAM SOP-00225, CAM SOP-00209	ASTM D1946-90
Volatile Organics in Air (TO-15) (1)	1	N/A	2013/08/28	BRL SOP-00304	EPA TO-15

(1) Air sampling canisters have been cleaned in accordance with U.S. EPA Method TO14A. At the end of the cleaning, evacuation, and pressurization cycles, one canister was selected and was pressurized with Zero Air. This canister was then analyzed via TO14A on a GC/MS. The canister must have been found to contain <0.2 ppbv concentration of all target analytes in order for the batch to have been considered clean. Each canister also underwent a leak check prior to shipment.

Please Note: SUMMA® canister samples will be retained by Maxxam for a period of 5 calendar days or as contractually agreed from the date of this report, after which time they will be cleaned for reuse. If you require a longer sample storage period, please contact your service representative.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Theresa Stephenson, Project Manager
Email: TStephenson@maxxam.ca
Phone# (905) 817-5763

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your Project #: 12-435
Your C.O.C. #: na

Attention: Leon T. Mah
Tiamat Environmental
107, 2719-7 Ave. NE
Calgary, AB
CANADA T2A 2L9

Report Date: 2014/01/20
Report #: R2781355
Version: 4R

CERTIFICATE OF ANALYSIS – REVISED REPORT

Total cover pages: 2

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

RESULTS OF ANALYSES OF AIR

Maxxam ID		SS7158			
Sampling Date		2013/08/17			
COC Number		na			
	Units	**RIVERSIDE HEAVT / 2067**	**RDL**	**QC Batch**	**MDL**
Gas					
Acetylene	ppm	ND	0.26	3338537	0.02
Ethane	ppm	ND	0.26	3338537	0.02
Ethylene	ppm	ND	0.26	3338537	0.02
Methane	ppm	ND	5.1	3338537	0.4
n-Butane	ppm	ND	0.51	3338537	0.02
n-Pentane	ppm	ND	0.26	3338537	0.02
Propane	ppm	ND	0.26	3338537	0.02
Propene	ppm	ND	0.26	3338537	0.02
Propyne	ppm	ND	0.51	3338537	0.02
Volatile Organics					
Pressure on Receipt	psig	(-4.6)	N/A	3333394	N/A

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

COMPRESSED GAS PARAMETERS (AIR)

Maxxam ID		SS7158			
Sampling Date		2013/08/17			
COC Number		na			
	Units	**RIVERSIDE HEAVT / 2067**	**RDL**	**QC Batch**	**MDL**
Fixed Gases					
Oxygen	% v/v	14.2	0.3	3337413	0.02
Nitrogen	% v/v	78.8	0.3	3337413	0.02
Carbon Monoxide	% v/v	ND	0.3	3337413	0.02
Carbon Dioxide	% v/v	7.0	0.3	3337413	0.02

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

VOLATILE ORGANIC HYDROCARBONS BY GC/MS (AIR)

Maxxam ID		SS7158			
Sampling Date		2013/08/17			
COC Number		na			
	Units	**RIVERSIDE HEAVT / 2067**	**RDL**	**QC Batch**	**MDL**
Volatile Organics					
Aliphatic >C5-C6	ug/m3	7.3	5.0	3333554	1.0
Aliphatic >C6-C8	ug/m3	34.9	5.0	3333554	1.0
Aliphatic >C8-C10	ug/m3	27.8	5.0	3333554	1.0
Aliphatic >C10-C12	ug/m3	39.7	5.0	3333554	1.0
Aliphatic >C12-C16	ug/m3	15.2	5.0	3333554	1.0
Aromatic >C7-C8 (TEX Excluded)	ug/m3	ND	5.0	3333554	1.0
Aromatic >C8-C10	ug/m3	6.7	5.0	3333554	1.0
Aromatic >C10-C12	ug/m3	6.1	5.0	3333554	1.0
Aromatic >C12-C16	ug/m3	ND	5.0	3333554	1.0

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SS7158					
Sampling Date		2013/08/17					
COC Number		na					
	Units	**RIVERSIDE HEAVT / 2067**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**	**MDL**
Volatile Organics							
Dichlorodifluoromethane (FREON 12)	ppbv	1.08	0.20	5.33	0.989	3333448	0.10
1,2-Dichlorotetrafluoroethane	ppbv	<0.17	0.17	<1.19	1.19	3333448	0.10
Chloromethane	ppbv	1.21	0.30	2.49	0.620	3333448	0.10
Vinyl Chloride	ppbv	<0.18	0.18	<0.460	0.460	3333448	0.10
Chloroethane	ppbv	<0.30	0.30	<0.792	0.792	3333448	0.10
1,3-Butadiene	ppbv	<0.50	0.50	<1.11	1.11	3333448	0.10
Trichlorofluoromethane (FREON 11)	ppbv	0.40	0.20	2.25	1.12	3333448	0.10
Ethanol (ethyl alcohol)	ppbv	21.8	2.3	41.1	4.33	3333448	0.50
Trichlorotrifluoroethane	ppbv	<0.15	0.15	<1.15	1.15	3333448	0.10
2-propanol	ppbv	3.2	3.0	7.83	7.37	3333448	0.60
2-Propanone	ppbv	22.8	0.80	54.3	1.90	3333448	0.20
Methyl Ethyl Ketone (2-Butanone)	ppbv	<5.0	5.0	<14.7	14.7	3333448	0.60
Methyl Isobutyl Ketone	ppbv	<3.2	3.2	<13.1	13.1	3333448	0.70
Methyl Butyl Ketone (2-Hexanone)	ppbv	<2.0	2.0	<8.19	8.19	3333448	0.40
Methyl t-butyl ether (MTBE)	ppbv	<0.20	0.20	<0.721	0.721	3333448	0.10
Ethyl Acetate	ppbv	<2.2	2.2	<7.93	7.93	3333448	0.50
1,1-Dichloroethylene	ppbv	<0.25	0.25	<0.991	0.991	3333448	0.10
cis-1,2-Dichloroethylene	ppbv	<0.19	0.19	<0.753	0.753	3333448	0.10
trans-1,2-Dichloroethylene	ppbv	<0.20	0.20	<0.793	0.793	3333448	0.10
Methylene Chloride(Dichloromethane)	ppbv	<0.80	0.80	<2.78	2.78	3333448	0.10
Chloroform	ppbv	0.33	0.15	1.59	0.732	3333448	0.10
Carbon Tetrachloride	ppbv	<0.30	0.30	<1.89	1.89	3333448	0.10
1,1-Dichloroethane	ppbv	<0.20	0.20	<0.809	0.809	3333448	0.10
1,2-Dichloroethane	ppbv	<0.20	0.20	<0.809	0.809	3333448	0.10
Ethylene Dibromide	ppbv	<0.17	0.17	<1.31	1.31	3333448	0.10
1,1,1-Trichloroethane	ppbv	<0.30	0.30	<1.64	1.64	3333448	0.10
1,1,2-Trichloroethane	ppbv	<0.15	0.15	<0.818	0.818	3333448	0.10
1,1,2,2-Tetrachloroethane	ppbv	<0.20	0.20	<1.37	1.37	3333448	0.10
cis-1,3-Dichloropropene	ppbv	<0.18	0.18	<0.817	0.817	3333448	0.10
trans-1,3-Dichloropropene	ppbv	<0.17	0.17	<0.772	0.772	3333448	0.10
1,2-Dichloropropane	ppbv	<0.40	0.40	<1.85	1.85	3333448	0.10

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SS7158					
Sampling Date		2013/08/17					
COC Number		na					
	Units	**RIVERSIDE HEAVT / 2067**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**	**MDL**
Bromomethane	ppbv	<0.18	0.18	<0.699	0.699	3333448	0.10
Bromoform	ppbv	<0.20	0.20	<2.07	2.07	3333448	0.10
Bromodichloromethane	ppbv	<0.20	0.20	<1.34	1.34	3333448	0.10
Dibromochloromethane	ppbv	<0.20	0.20	<1.70	1.70	3333448	0.10
Trichloroethylene	ppbv	<0.30	0.30	<1.61	1.61	3333448	0.10
Tetrachloroethylene	ppbv	<0.20	0.20	<1.36	1.36	3333448	0.10
Benzene	ppbv	0.48	0.18	1.55	0.575	3333448	0.10
Toluene	ppbv	1.86	0.20	7.01	0.753	3333448	0.10
Ethylbenzene	ppbv	0.55	0.20	2.38	0.868	3333448	0.10
p+m-Xylene	ppbv	2.53	0.37	11.0	1.61	3333448	0.10
o-Xylene	ppbv	0.84	0.20	3.67	0.868	3333448	0.10
Styrene	ppbv	<0.20	0.20	<0.852	0.852	3333448	0.10
4-ethyltoluene	ppbv	<2.2	2.2	<10.8	10.8	3333448	0.50
1,3,5-Trimethylbenzene	ppbv	<0.50	0.50	<2.46	2.46	3333448	0.10
1,2,4-Trimethylbenzene	ppbv	<0.50	0.50	<2.46	2.46	3333448	0.10
Chlorobenzene	ppbv	<0.20	0.20	<0.921	0.921	3333448	0.10
Benzyl chloride	ppbv	<1.0	1.0	<5.18	5.18	3333448	0.20
1,3-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3333448	0.10
1,4-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3333448	0.10
1,2-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3333448	0.10
1,2,4-Trichlorobenzene	ppbv	<2.0	2.0	<14.8	14.8	3333448	0.40
Hexachlorobutadiene	ppbv	<3.0	3.0	<32.0	32.0	3333448	0.60
Hexane	ppbv	3.44	0.30	12.1	1.06	3333448	0.10
Heptane	ppbv	0.49	0.30	1.99	1.23	3333448	0.10
Cyclohexane	ppbv	0.40	0.20	1.39	0.688	3333448	0.10
Tetrahydrofuran	ppbv	3.49	0.40	10.3	1.18	3333448	0.10
1,4-Dioxane	ppbv	<2.0	2.0	<7.21	7.21	3333448	0.40
Xylene (Total)	ppbv	3.37	0.60	14.7	2.61	3333448	0.10
Vinyl Bromide	ppbv	<0.20	0.20	<0.875	0.875	3333448	0.10
Propene	ppbv	1.29	0.30	2.22	0.516	3333448	0.10
2,2,4-Trimethylpentane	ppbv	0.25	0.20	1.18	0.934	3333448	0.10
Carbon Disulfide	ppbv	6.98	0.50	21.7	1.56	3333448	0.10
Vinyl Acetate	ppbv	<0.20	0.20	<0.704	0.704	3333448	0.10

QC Batch = Quality Control Batch

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SS7158					
Sampling Date		2013/08/17					
COC Number		na					
	Units	**RIVERSIDE HEAVT / 2067**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**	**MDL**
Surrogate Recovery (%)							
Bromochloromethane	%	84		N/A	N/A	3333448	
D5-Chlorobenzene	%	67		N/A	N/A	3333448	
Difluorobenzene	%	83		N/A	N/A	3333448	

N/A = Not Applicable
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

Test Summary

Maxxam ID SS7158 **Collected** 2013/08/17
Sample ID RIVERSIDE HEAVT / 2067 **Shipped**
Matrix AIR **Received** 2013/08/20

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
BTEX Fractionation in Air (TO-15mod)	GC/MS	3333554	N/A	2013/08/28	Diane Temniuk
Canister Pressure (TO-15)	PRES	3333394	N/A	2013/08/28	Diane Temniuk
Light Hydrocarbons	GC/FID	3338537	N/A	2013/09/05	Vijay Lad
Matrix Gases	GC/TCD	3337413	N/A	2013/09/04	Vijay Lad
Volatile Organics in Air (TO-15)	GC/MS	3333448	N/A	2013/08/28	Diane Temniuk

Maxxam ID SS7158 Dup **Collected** 2013/08/17
Sample ID RIVERSIDE HEAVT / 2067 **Shipped**
Matrix AIR **Received** 2013/08/20

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
BTEX Fractionation in Air (TO-15mod)	GC/MS	3333554	N/A	2013/08/28	Diane Temniuk
Volatile Organics in Air (TO-15)	GC/MS	3333448	N/A	2013/08/28	Diane Temniuk

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3D8051
Report Date: 2014/01/20

Tiamat Environmental
Client Project #: 12-435

Sampler Initials: JAL

GENERAL COMMENTS

WS#3333448
1,2,4-Trichlorobenzene exceeds 150% in the Reference Spike. No positives were found, therefore Data was accepted.

Matrix Gas Analysis: Canisters were pressurized with Helium to enable sampling. Results and DLs adjusted accordingly.

Matrix Gas Analysis: Results normalized to 100% dry volume.

Sample SS7158-01: DL raised for 2-Butanone due to matrix interference.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Leon T. Mah
Client Project #: 12-435
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: GB3D8051

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3333448	DVO	Spiked Blank	Bromochloromethane	2013/08/28		93	%	60 - 140
			D5-Chlorobenzene	2013/08/28		96	%	60 - 140
			Difluorobenzene	2013/08/28		95	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2013/08/28		112	%	70 - 130
			1,2-Dichlorotetrafluoroethane	2013/08/28		123	%	70 - 130
			Chloromethane	2013/08/28		115	%	70 - 130
			Vinyl Chloride	2013/08/28		109	%	70 - 130
			Chloroethane	2013/08/28		108	%	70 - 130
			1,3-Butadiene	2013/08/28		107	%	70 - 130
			Trichlorofluoromethane (FREON 11)	2013/08/28		114	%	70 - 130
			Ethanol (ethyl alcohol)	2013/08/28		124	%	70 - 130
			Trichlorotrifluoroethane	2013/08/28		106	%	70 - 130
			2-propanol	2013/08/28		109	%	70 - 130
			2-Propanone	2013/08/28		120	%	70 - 130
			Methyl Ethyl Ketone (2-Butanone)	2013/08/28		113	%	70 - 130
			Methyl Isobutyl Ketone	2013/08/28		117	%	70 - 130
			Methyl Butyl Ketone (2-Hexanone)	2013/08/28		123	%	70 - 130
			Methyl t-butyl ether (MTBE)	2013/08/28		109	%	70 - 130
			Ethyl Acetate	2013/08/28		113	%	70 - 130
			1,1-Dichloroethylene	2013/08/28		109	%	70 - 130
			cis-1,2-Dichloroethylene	2013/08/28		112	%	70 - 130
			trans-1,2-Dichloroethylene	2013/08/28		110	%	70 - 130
			Methylene Chloride(Dichloromethane)	2013/08/28		109	%	70 - 130
			Chloroform	2013/08/28		112	%	70 - 130
			Carbon Tetrachloride	2013/08/28		109	%	70 - 130
			1,1-Dichloroethane	2013/08/28		112	%	70 - 130
			1,2-Dichloroethane	2013/08/28		116	%	70 - 130
			Ethylene Dibromide	2013/08/28		113	%	70 - 130
			1,1,1-Trichloroethane	2013/08/28		112	%	70 - 130
			1,1,2-Trichloroethane	2013/08/28		113	%	70 - 130
			1,1,2,2-Tetrachloroethane	2013/08/28		110	%	70 - 130
			cis-1,3-Dichloropropene	2013/08/28		116	%	70 - 130
			trans-1,3-Dichloropropene	2013/08/28		117	%	70 - 130
			1,2-Dichloropropane	2013/08/28		113	%	70 - 130
			Bromomethane	2013/08/28		107	%	70 - 130
			Bromoform	2013/08/28		104	%	70 - 130
			Bromodichloromethane	2013/08/28		112	%	70 - 130
			Dibromochloromethane	2013/08/28		110	%	70 - 130
			Trichloroethylene	2013/08/28		108	%	70 - 130
			Tetrachloroethylene	2013/08/28		109	%	70 - 130
			Benzene	2013/08/28		110	%	70 - 130
			Toluene	2013/08/28		111	%	70 - 130
			Ethylbenzene	2013/08/28		110	%	70 - 130
			p+m-Xylene	2013/08/28		108	%	70 - 130
			o-Xylene	2013/08/28		110	%	70 - 130
			Styrene	2013/08/28		107	%	70 - 130
			4-ethyltoluene	2013/08/28		111	%	70 - 130
			1,3,5-Trimethylbenzene	2013/08/28		112	%	70 - 130
			1,2,4-Trimethylbenzene	2013/08/28		113	%	70 - 130
			Chlorobenzene	2013/08/28		110	%	70 - 130
			Benzyl chloride	2013/08/28		103	%	70 - 130
			1,3-Dichlorobenzene	2013/08/28		115	%	70 - 130
			1,4-Dichlorobenzene	2013/08/28		113	%	70 - 130
			1,2-Dichlorobenzene	2013/08/28		110	%	70 - 130
			1,2,4-Trichlorobenzene	2013/08/28		153 (1)	%	70 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Leon T. Mah
Client Project #: 12-435
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: GB3D8051

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3333448	DVO	Spiked Blank	Hexachlorobutadiene	2013/08/28		129	%	70 - 130
			Hexane	2013/08/28		109	%	70 - 130
			Heptane	2013/08/28		112	%	70 - 130
			Cyclohexane	2013/08/28		109	%	70 - 130
			Tetrahydrofuran	2013/08/28		113	%	70 - 130
			1,4-Dioxane	2013/08/28		108	%	70 - 130
			Xylene (Total)	2013/08/28		109	%	70 - 130
			Vinyl Bromide	2013/08/28		100	%	70 - 130
			Propene	2013/08/28		107	%	70 - 130
			2,2,4-Trimethylpentane	2013/08/28		107	%	70 - 130
			Carbon Disulfide	2013/08/28		110	%	70 - 130
			Vinyl Acetate	2013/08/28		106	%	70 - 130
		Method Blank	Bromochloromethane	2013/08/28		87	%	60 - 140
			D5-Chlorobenzene	2013/08/28		84	%	60 - 140
			Difluorobenzene	2013/08/28		89	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2013/08/28	ND, RDL=0.20		ppbv	
			1,2-Dichlorotetrafluoroethane	2013/08/28	ND, RDL=0.17		ppbv	
			Chloromethane	2013/08/28	ND, RDL=0.30		ppbv	
			Vinyl Chloride	2013/08/28	ND, RDL=0.18		ppbv	
			Chloroethane	2013/08/28	ND, RDL=0.30		ppbv	
			1,3-Butadiene	2013/08/28	ND, RDL=0.50		ppbv	
			Trichlorofluoromethane (FREON 11)	2013/08/28	ND, RDL=0.20		ppbv	
			Ethanol (ethyl alcohol)	2013/08/28	ND, RDL=2.3		ppbv	
			Trichlorotrifluoroethane	2013/08/28	ND, RDL=0.15		ppbv	
			2-propanol	2013/08/28	ND, RDL=3.0		ppbv	
			2-Propanone	2013/08/28	ND, RDL=0.80		ppbv	
			Methyl Ethyl Ketone (2-Butanone)	2013/08/28	ND, RDL=3.0		ppbv	
			Methyl Isobutyl Ketone	2013/08/28	ND, RDL=3.2		ppbv	
			Methyl Butyl Ketone (2-Hexanone)	2013/08/28	ND, RDL=2.0		ppbv	
			Methyl t-butyl ether (MTBE)	2013/08/28	ND, RDL=0.20		ppbv	
			Ethyl Acetate	2013/08/28	ND, RDL=2.2		ppbv	
			1,1-Dichloroethylene	2013/08/28	ND, RDL=0.25		ppbv	
			cis-1,2-Dichloroethylene	2013/08/28	ND, RDL=0.19		ppbv	
			trans-1,2-Dichloroethylene	2013/08/28	ND, RDL=0.20		ppbv	
			Methylene Chloride(Dichloromethane)	2013/08/28	ND, RDL=0.80		ppbv	
			Chloroform	2013/08/28	ND, RDL=0.15		ppbv	
			Carbon Tetrachloride	2013/08/28	ND, RDL=0.30		ppbv	
			1,1-Dichloroethane	2013/08/28	ND, RDL=0.20		ppbv	
			1,2-Dichloroethane	2013/08/28	ND, RDL=0.20		ppbv	
			Ethylene Dibromide	2013/08/28	ND, RDL=0.17		ppbv	
			1,1,1-Trichloroethane	2013/08/28	ND, RDL=0.30		ppbv	
			1,1,2-Trichloroethane	2013/08/28	ND, RDL=0.15		ppbv	
			1,1,2,2-Tetrachloroethane	2013/08/28	ND, RDL=0.20		ppbv	
			cis-1,3-Dichloropropene	2013/08/28	ND, RDL=0.18		ppbv	
			trans-1,3-Dichloropropene	2013/08/28	ND, RDL=0.17		ppbv	
			1,2-Dichloropropane	2013/08/28	ND, RDL=0.40		ppbv	
			Bromomethane	2013/08/28	ND, RDL=0.18		ppbv	
			Bromoform	2013/08/28	ND, RDL=0.20		ppbv	
			Bromodichloromethane	2013/08/28	ND, RDL=0.20		ppbv	
			Dibromochloromethane	2013/08/28	ND, RDL=0.20		ppbv	
			Trichloroethylene	2013/08/28	ND, RDL=0.30		ppbv	
			Tetrachloroethylene	2013/08/28	ND, RDL=0.20		ppbv	
			Benzene	2013/08/28	ND, RDL=0.18		ppbv	
			Toluene	2013/08/28	ND, RDL=0.20		ppbv	
			Ethylbenzene	2013/08/28	ND, RDL=0.20		ppbv	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Leon T. Mah
Client Project #: 12-435
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: GB3D8051

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3333448	DVO	Method Blank	p+m-Xylene	2013/08/28	ND, RDL=0.37		ppbv	
			o-Xylene	2013/08/28	ND, RDL=0.20		ppbv	
			Styrene	2013/08/28	ND, RDL=0.20		ppbv	
			4-ethyltoluene	2013/08/28	ND, RDL=2.2		ppbv	
			1,3,5-Trimethylbenzene	2013/08/28	ND, RDL=0.50		ppbv	
			1,2,4-Trimethylbenzene	2013/08/28	ND, RDL=0.50		ppbv	
			Chlorobenzene	2013/08/28	ND, RDL=0.20		ppbv	
			Benzyl chloride	2013/08/28	ND, RDL=1.0		ppbv	
			1,3-Dichlorobenzene	2013/08/28	ND, RDL=0.40		ppbv	
			1,4-Dichlorobenzene	2013/08/28	ND, RDL=0.40		ppbv	
			1,2-Dichlorobenzene	2013/08/28	ND, RDL=0.40		ppbv	
			1,2,4-Trichlorobenzene	2013/08/28	ND, RDL=2.0		ppbv	
			Hexachlorobutadiene	2013/08/28	ND, RDL=3.0		ppbv	
			Hexane	2013/08/28	ND, RDL=0.30		ppbv	
			Heptane	2013/08/28	ND, RDL=0.30		ppbv	
			Cyclohexane	2013/08/28	ND, RDL=0.20		ppbv	
			Tetrahydrofuran	2013/08/28	ND, RDL=0.40		ppbv	
			1,4-Dioxane	2013/08/28	ND, RDL=2.0		ppbv	
			Xylene (Total)	2013/08/28	ND, RDL=0.60		ppbv	
			Vinyl Bromide	2013/08/28	ND, RDL=0.20		ppbv	
			Propene	2013/08/28	ND, RDL=0.30		ppbv	
			2,2,4-Trimethylpentane	2013/08/28	ND, RDL=0.20		ppbv	
			Carbon Disulfide	2013/08/28	ND, RDL=0.50		ppbv	
			Vinyl Acetate	2013/08/28	ND, RDL=0.20		ppbv	
		RPD - Sample/Sample Dup	Dichlorodifluoromethane (FREON 12)	2013/08/28	5.3		%	25
			1,2-Dichlorotetrafluoroethane	2013/08/28	NC		%	25
			Chloromethane	2013/08/28	NC		%	25
			Vinyl Chloride	2013/08/28	NC		%	25
			Chloroethane	2013/08/28	NC		%	25
			1,3-Butadiene	2013/08/28	NC		%	25
			Trichlorofluoromethane (FREON 11)	2013/08/28	NC		%	25
			Ethanol (ethyl alcohol)	2013/08/28	10.1		%	25
			Trichlorotrifluoroethane	2013/08/28	NC		%	25
			2-propanol	2013/08/28	NC		%	25
			2-Propanone	2013/08/28	4.0		%	25
			Methyl Ethyl Ketone (2-Butanone)	2013/08/28	NC		%	25
			Methyl Isobutyl Ketone	2013/08/28	NC		%	25
			Methyl Butyl Ketone (2-Hexanone)	2013/08/28	NC		%	25
			Methyl t-butyl ether (MTBE)	2013/08/28	NC		%	25
			Ethyl Acetate	2013/08/28	NC		%	25
			1,1-Dichloroethylene	2013/08/28	NC		%	25
			cis-1,2-Dichloroethylene	2013/08/28	NC		%	25
			trans-1,2-Dichloroethylene	2013/08/28	NC		%	25
			Methylene Chloride(Dichloromethane)	2013/08/28	NC		%	25
			Chloroform	2013/08/28	NC		%	25
			Carbon Tetrachloride	2013/08/28	NC		%	25
			1,1-Dichloroethane	2013/08/28	NC		%	25
			1,2-Dichloroethane	2013/08/28	NC		%	25
			Ethylene Dibromide	2013/08/28	NC		%	25
			1,1,1-Trichloroethane	2013/08/28	NC		%	25
			1,1,2-Trichloroethane	2013/08/28	NC		%	25
			1,1,2,2-Tetrachloroethane	2013/08/28	NC		%	25
			cis-1,3-Dichloropropene	2013/08/28	NC		%	25

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Leon T. Mah
Client Project #: 12-435
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: GB3D8051

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3333448	DVO	RPD - Sample/Sample Dup	trans-1,3-Dichloropropene	2013/08/28	NC		%	25
			1,2-Dichloropropane	2013/08/28	NC		%	25
			Bromomethane	2013/08/28	NC		%	25
			Bromoform	2013/08/28	NC		%	25
			Bromodichloromethane	2013/08/28	NC		%	25
			Dibromochloromethane	2013/08/28	NC		%	25
			Trichloroethylene	2013/08/28	NC		%	25
			Tetrachloroethylene	2013/08/28	NC		%	25
			Benzene	2013/08/28	NC		%	25
			Toluene	2013/08/28	2.4		%	25
			Ethylbenzene	2013/08/28	NC		%	25
			p+m-Xylene	2013/08/28	0.5		%	25
			o-Xylene	2013/08/28	NC		%	25
			Styrene	2013/08/28	NC		%	25
			4-ethyltoluene	2013/08/28	NC		%	25
			1,3,5-Trimethylbenzene	2013/08/28	NC		%	25
			1,2,4-Trimethylbenzene	2013/08/28	NC		%	25
			Chlorobenzene	2013/08/28	NC		%	25
			Benzyl chloride	2013/08/28	NC		%	25
			1,3-Dichlorobenzene	2013/08/28	NC		%	25
			1,4-Dichlorobenzene	2013/08/28	NC		%	25
			1,2-Dichlorobenzene	2013/08/28	NC		%	25
			1,2,4-Trichlorobenzene	2013/08/28	NC		%	25
			Hexachlorobutadiene	2013/08/28	NC		%	25
			Hexane	2013/08/28	6.6		%	25
			Heptane	2013/08/28	NC		%	25
			Cyclohexane	2013/08/28	NC		%	25
			Tetrahydrofuran	2013/08/28	7.2		%	25
			1,4-Dioxane	2013/08/28	NC		%	25
			Xylene (Total)	2013/08/28	0.03		%	25
			Vinyl Bromide	2013/08/28	NC		%	25
			Propene	2013/08/28	NC		%	25
			2,2,4-Trimethylpentane	2013/08/28	NC		%	25
			Carbon Disulfide	2013/08/28	2.0		%	25
			Vinyl Acetate	2013/08/28	NC		%	25
3333554	DVO	Method Blank	Aliphatic >C5-C6	2013/08/28	ND, RDL=5.0		ug/m3	
			Aliphatic >C6-C8	2013/08/28	ND, RDL=5.0		ug/m3	
			Aliphatic >C8-C10	2013/08/28	ND, RDL=5.0		ug/m3	
			Aliphatic >C10-C12	2013/08/28	ND, RDL=5.0		ug/m3	
			Aliphatic >C12-C16	2013/08/28	ND, RDL=5.0		ug/m3	
			Aromatic >C7-C8 (TEX Excluded)	2013/08/28	ND, RDL=5.0		ug/m3	
			Aromatic >C8-C10	2013/08/28	ND, RDL=5.0		ug/m3	
			Aromatic >C10-C12	2013/08/28	ND, RDL=5.0		ug/m3	
			Aromatic >C12-C16	2013/08/28	ND, RDL=5.0		ug/m3	
		RPD - Sample/Sample Dup	Aliphatic >C5-C6	2013/08/28	NC		%	25
			Aliphatic >C6-C8	2013/08/28	6.2		%	25
			Aliphatic >C8-C10	2013/08/28	6.3		%	25
			Aliphatic >C10-C12	2013/08/28	6.6		%	25
			Aliphatic >C12-C16	2013/08/28	NC		%	25
			Aromatic >C7-C8 (TEX Excluded)	2013/08/28	NC		%	25
			Aromatic >C8-C10	2013/08/28	NC		%	25

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Leon T. Mah
Client Project #: 12-435
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: GB3D8051

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3333554	DVO	RPD - Sample/Sample Dup	Aromatic >C10-C12	2013/08/28	NC		%	25
			Aromatic >C12-C16	2013/08/28	NC		%	15
3337413	VLA	Method Blank	Oxygen	2013/09/04	ND, RDL=0.1		% v/v	
			Nitrogen	2013/09/04	ND, RDL=0.1		% v/v	
			Carbon Monoxide	2013/09/04	ND, RDL=0.1		% v/v	
			Carbon Dioxide	2013/09/04	ND, RDL=0.1		% v/v	
		RPD - Sample/Sample Dup	Oxygen	2013/09/04	0		%	20
			Nitrogen	2013/09/04	0		%	20
			Carbon Monoxide	2013/09/04	NC		%	20
			Carbon Dioxide	2013/09/04	NC		%	20
3338537	VLA	Method Blank	Acetylene	2013/09/05	ND, RDL=0.1		ppm	
			Ethane	2013/09/05	ND, RDL=0.1		ppm	
			Ethylene	2013/09/05	ND, RDL=0.1		ppm	
			Methane	2013/09/05	ND, RDL=2		ppm	
			n-Butane	2013/09/05	ND, RDL=0.2		ppm	
			n-Pentane	2013/09/05	ND, RDL=0.1		ppm	
			Propane	2013/09/05	ND, RDL=0.1		ppm	
			Propene	2013/09/05	ND, RDL=0.1		ppm	
			Propyne	2013/09/05	ND, RDL=0.2		ppm	
		RPD - Sample/Sample Dup	Methane	2013/09/05	14.9		%	20

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

REPORT OF ANALYSIS: Maxxam Analytics - B3D7417- Selected Siloxanes (TIVA)

REPORT: 13045si (Method - SCAN ATD-GC-MSD Cryogenic Oven Control)

	DESCRIPTION	13091207	13091207	13091207	13091207
CAS #	COMPOUND	SS4575-01R VW-01 (RIVERSIDE HEAVY) V=200mL	SS4575-01R VW-01 (RIVERSIDE HEAVY) V=200mL	Silicon Equivalent	Silicon Equivalent
		mg/m³	ppm	mg/m³	ppm
420-56-4	Trimethylsilyl Fluoride	0.0011	0.0003	0.0003	0.0003
75-76-3	Tetramethylsilane	<0.0001	<0.0001	<0.0001	<0.0001
1825-61-2	Methoxytrimethylsilane	<0.0019	<0.0004	<0.0005	<0.0004
1825-62-3	Ethoxytrimethylsilane	<0.0018	<0.0004	<0.0004	<0.0004
1066-40-6	Trimethylsilanol	0.0526	0.0143	0.0164	0.0143
1825-64-5	Isopropoxytrimethylsilane	<0.0008	<0.0001	<0.0002	<0.0001
1185-55-3	Trimethoxymethyl Silane #	ND	ND	ND	ND
107-46-0	Hexamethyl Disiloxane - L2	0.0006	0.0001	0.0002	0.0002
1825-63-4	Propoxytrimethylsilane	<0.0021	<0.0004	<0.0004	<0.0004
1825-67-8	1-Methylbutoxytrimethylsilane *	ND	ND	ND	ND
1825-65-6	Butoxytrimethylsilane *	ND	ND	ND	ND
2768-02-7	Trimethoxyvinyl Silane #	ND	ND	ND	ND
541-05-9	Hexamethyl Cyclotrisiloxane - D3	0.0111	0.0012	0.0042	0.0037
107-51-7	Octamethyl Trisiloxane - L3	<0.0001	<0.0001	<0.0001	<0.0001
78-08-0	Triethoxyvinyl Silane #	ND	ND	ND	ND
78-07-9	Triethoxyethyl Silane #	ND	ND	ND	ND
556-67-2	Octamethyl Cyclotetrasiloxane - D4	0.0090	0.0007	0.0034	0.0030
141-62-8	Decamethyl Tetrasiloxane - L4	<0.0002	<0.0001	<0.0001	<0.0001
78-10-4	Tetraethylsilicate #	ND	ND	ND	ND
541-02-6	Decamethyl Cyclopentasiloxane - D	0.0236	0.0016	0.0089	0.0078
141-63-9	Dodecamethyl Pentasiloxane - L5	<0.0018	<0.0001	<0.0006	<0.0006
540-97-6	Dodecamethyl Cyclohexasiloxane -	0.1655	0.0091	0.0627	0.0546
	Sum	0.2722	0.0288	0.0985	0.0858

< (ND) = Characteristic ions are not present therefore Not Detected
< (TRACE) = Characteristic ions present but too low to be quantified
V = Volume of air/gas sampled
* = Semiquantitative (Response Factor set at 5)
# = Unstable, poor detectability, commercial standards tested

APPENDIX B

TESTHOLE LOGS

TERMS USED ON BOREHOLE LOGS

Terminology Common Soil Genesis

Rootmat	vegetation roots and moss with organic matter and topsoil typically forming a mattress at the ground surface.
Topsoil	mixture of soil and humus capable of supporting good vegetative growth
Peat	fibrous aggregate of visible and invisible fragments of decayed organic matter
Loam	silty sand or sand mixed with silt and organics
Till	unstratified glacial deposit which may range from clay to boulders
Fill	any materials below the surface identified as placed by excavation activities (excluding buried services)

Common Soil Structure

Slickensided	Having inclined planes of weakness that are slick and glossy in appearance.
Fissured	Containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	Composed of thin layers of varying color and texture.
Interbedded	Composed of alternate layers of different soil types.
Calcareous	Containing appreciable quantities of calcium carbonate.
Well Graded	Having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded	Predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.
Homogeneous	same color and appearance throughout
Stratified	composed of alternating successions of different soil types, eg. silt and sand
Lensed	inclusion of small pockets of different soils
Laminated	alternating layers of varying material or color with the layers less than 6 mm thick
Layer	thickness > 75mm
Seam	thickness between 2 mm and 75 mm
Parting	thickness <2 mm

Grain Size and Plasticity

Description of soils on the basis of grain size and plasticity is based on the Unified Soil Classification System (USCS) (ASTM D-2487). The classification excludes particles larger than 76 mm (3 inches). This system provides a ground symbol (eg., SM) and group name (eg., silty SAND) for identification. Note: terminology describing materials in the absence of laboratory analysis is based on a visual method (ASTM D-2488).

Descriptors for soil materials outside the USCS (eg., particles larger that 76 mm, visible organic matter, construction debris) is based on the (visually estimated) proportion of these materials present:

Trace, or occasional	Less than approximately 10%
Some	Approximately 10 – 20%
Frequent	Greater than approximately 20%

Solid lines between soil strata indicate the interpreted boundary between different soil types. Dashed line between soil strata indicates the contact between different soil units has been inferred.

Consistency of Cohesive Soils (Fine-Grained Soils)

Fine-grained soils (major portion passing 0.075mm sieve): includes (1) inorganic and organic silts and clays. (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in-situ tests.

The standard nomenclature to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by in situ tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Standard Penetration Test 'N-Value'

The Standard Penetration Test provides an "N-value; the number of blows of a 64 kg (140 pound) hammer falling 760 mm (30 inches) required to drive a 51 mm (2 inch) O.D. split spoon sampler 305 mm (one foot) into the soil. For split spoon samples where insufficient penetration is achieved and 'N' values cannot be determined, the number of blows is reported over sampler penetration in millimeters; e.g. blows/penetration = 50/75.

Consistency	Unconfined Compressive Strength (kPa)	N-Value
Very Soft	<25	<2
Soft	25-50	2-4
Firm	50-100	4-8
Stiff	100-200	8-15
Very Stiff	200-400	15-30
Hard	>400	>30

NOTE: Slackened and fissured clays may have lower unconfined compressive strengths than shown above, because of naturally occurring planes of weakness or cracks in the soil.

Density of Cohesionless Soils (Coarse-grained Soils)

Coarse-grained soils (major portion retained on 0.075 mm sieve): includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in-situ tests.

The standard terminology to describe cohesionless soils includes the compactness (former "relative density"), as determined by laboratory test or by the Standard Penetration Test 'N-Value'.

Density	N Value (Blows per 0.3m)	Relative Density - % Compactness
Very Loose	0-4	0-20
Loose	4-10	20-40
Compact	10-30	40-75
Dense	30-50	75-90
Very Dense	>50	90-100

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 871.813 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Groundwater Monitoring Well is located at southwest corner at the top of the hill

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) - loam, sand, silty, trace rootlets, trace wood fragments, damp to moist, olive.						
	concrete debris at 0.1 m.						
	Sandy clay (fill) - firm, silty, trace fine rounded gravel, trace organics, trace wood fragments, moist, dark olive.						
1.0							
2.0							
3.0	No obvious waste material below 3.1 m.						
	Clay (fill) - firm, trace silts, trace oxides, moist, light olive brown.						
4.0							
5.0							
6.0	some organics at 6.1 m.						
	Clay (lacustrine) - soft to firm, medium plastic, trace silt, trace sand, moist, olive.						
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 14.9
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 2

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 871.813 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Groundwater Monitoring Well is located at southwest corner at the top of the hill

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
13.0	Sand - compact, some clay nodules, wet, olive grey.							
14.0								
15.0	End of hole at 14.9 m. 51 mm diameter 3 m length 010 PVC screen. Aboveground lockable steel casing set in concrete.							
16.0								
17.0								
18.0								
19.0								
20.0								
21.0								
22.0								
23.0								
24.0								
25.0								

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 14.9
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 2 of 2

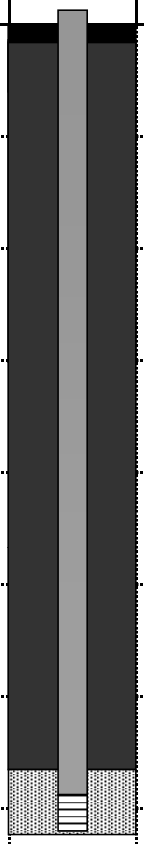
PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 871.261 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Soil Vapour Well is located about 125 m north of MW-01 in the central portion, on the west side of the site at the top of the hill.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) - loam, sand, silty, some organics, moist dark olive. (~ 15 cm.)						
	Sand - loose, trace silt, trace gravel, damp, light grey.						
1.0							
2.0	Clay (fill) - firm, silty, some sand, moist, light olive brown.						
3.0	becomes stiff, trace silt, trace sand, trace oxides, trace coal, moist, olive at 3.7 m.						
4.0							
5.0							
6.0	some grey clay at 6.7 m.						
7.0	No obvious waste material.						
	End of hole at 7.3 m. 25 mm diameter 020 PVC screen. Aboveground lockable steel casing set in concrete.						
8.0							
9.0							
10.0							
11.0							
12.0							



Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 7.3
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-03
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 868.951 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Testhole is located about 49 m southeast of VW-01 on the slope, in the west central area of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) - loam. (~ 15 cm.) Sand & Clay (fill) - firm, trace organics, trace gravel, moist, olive.							
	Clay (fill) - stiff, trace silts, trace gravel, damp, olive brown.							
1.0	Sand (fill) mixed with MSW - heavy wire, brick fragments, concrete fragments, gravel, some clay, trace organics.							
2.0								
3.0	refusal on concrete debris at 3.4 m. TH-03 relocated ~ 2 m north and re-drilled.							
4.0								
5.0	Clay mixed with MSW - some glass fragments, plastic pieces, trace wood fragments, soft to firm.							
6.0								
7.0	No obvious waste material at 7.3 m.							
	End of hole at 7.6 m. Backfilled with ~ 50:50 bentonite and silica sand.							
8.0								
9.0								
10.0								
11.0								
12.0								

Tiamat Environmental Consultants Ltd.

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

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-04
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 868.686 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Testhole is located ~ 45 m southeast of TH-03 on hill slope within the south half of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) - loam, sand, gravel, some organics. (~ 5 cm thick).							
	Sand (fill) mixed with MSW - brick fragments, trace masonry, trace plastic, trace concrete fragments, trace wood fragments, silty, loamy, trace gravel, damp to moist, light grey to dark olive.							
1.0	plastic bits at 0.8 m.							
	concrete rubble at 1.1 m.							
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								

Tiamat Environmental Consultants Ltd.

Slough :

Depth to Groundwater :

Logged By: LTM

Completion Depth (m): 18.3

Checked By: LTM

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-04
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 868.686 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Testhole is located ~ 45 m southeast of TH-03 on hill slope within the south half of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
13.0	becomes wet at 13.1 m.							
14.0								
15.0	No obvious waste material below 15.2 m.							
16.0								
17.0								
18.0	Clay (till) - stiff, trace silt, trace sand, trace gravel, trace coal, trace carbonates, moist, olive.							
	End of hole at 18.3 m. Backfilled with ~ 50:50 bentonite and silica sand.							
19.0								
20.0								
21.0								
22.0								
23.0								
24.0								
25.0								

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 18.3
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 2 of 2

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-05
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 869.951 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/12/2013

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

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

Notes: Testhole is located about 24 m east of MW-01 on the hill slope near the south margin of a steep slope.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) - compact, loamy, sandy, silty, trace gravel, moist, olive.							
	Sand (fill) - loose, silty, silty, loamy, moist, dark olive.							
	some clay at 0.9 m.							
1.0								
2.0	heavy wire and plastic bits at 2.1 m.							
3.0								
4.0								
	refusal on concrete debris at 4.9 m.							
5.0	End of hole at 4.9 m. Backfilled with ~ 50:50 bentonite and silica sand.							
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 4.9
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-06
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 866.315 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

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

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

Notes: Testhole is located about 48 m northeast of VW-01 in the north central portion of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) - loamy, sandy, moist, dark olive. (~ 15 cm thick).							
	Sand mixed with MSW - trace wood fragments, masonry brick, concrete pieces, organic loam, wire, firm, loamy, sand, some clay, trace gravel, trace organics, moist, dark olive.							
1.0								
2.0								
3.0								
	Clay (fill) - soft, silty, trace sand, moist, olive.							
4.0								
	Sandy clay (fill) mixed with MSW - brick, concrete pieces, trace glass, firm, silty, some loam, moist, dark olive.							
5.0	some blue foam at 5.5 m.							
6.0	moderate slough and humic odour at 6.4 m.							
7.0								
8.0								
9.0	pockets of loam at 9.1 m to 10.7 m.							
	Sand (fill) - soft, loamy, silty, clayey, trace gravel, moist, olive.							
10.0	light grey sand appears partially cemented at 10.1 m to 13.4 m.							
	Clay (fill) - firm, silty, loamy, moist, olive brown. No obvious waste material below 10 m.							
11.0								
12.0								

Tiamat Environmental Consultants Ltd.

Slough :

Depth to Groundwater :

Logged By: LTM

Completion Depth (m): 19.5

Checked By: LTM

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-06
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 866.315 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

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

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

Notes: Testhole is located about 48 m northeast of VW-01 in the north central portion of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
13.0								
14.0								
15.0								
16.0								
17.0								
	Clay (till) - stiff, trace silt, trace sand, trace gravel, trace coal, moist, olive.							
18.0								
19.0								
	End of hole at 19.5 m. Backfilled with ~ 50:50 bentonite and silica sand.							
20.0								
21.0								
22.0								
23.0								
24.0								
25.0								

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 19.5
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 2 of 2

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-07
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 863.026 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

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

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

Notes: Testhole is located about 42 m north of TH-06 within the north half of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details	
0.0	Loam - sandy, silty, trace rootlets, moist, dark olive. (~ 45 cm.)							
	Loamy sand - silty, trace gravel, trace wood fragments, moist, dark olive.							
1.0	trace clay at 1.1 m.							
2.0								
3.0	refusal (possibly on concrete) at 3.7 m. TH-07 relocated ~ 2 m north and re-drilled.							
4.0	No obvious waste material at 4.6 m.							
5.0								
6.0	End of hole at 6.1 m. Backfilled with ~ 50:50 bentonite and silica sand.							
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								

Tiamat Environmental Consultants Ltd.

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

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-02
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 848.556 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

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

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

Notes: Groundwater Monitoring Well is located at the base of the hill, near the northeast corner of the site.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) and loam - sand, silty, trace rootlets, moist, dark olive. (~ 15 cm thick).					
	Clay (till) - silty, trace sand, trace gravel, trace carbonates, trace coal, moist, olive.					
1.0						
2.0						
	Sand about 0.15 m thick.					
3.0	No obvious waste material.					
	Silt (till) - stiff, sandy, trace clay, trace gravel, trace oxides, damp, light olive.					
4.0						
	Siltstone (bedrock) - very weak, highly weathered, moist, light grey.					
5.0						
6.0	End of hole at 6.1 m. 51 mm diameter 3 m length 010 PVC screen. Aboveground lockable steel casing set in concrete.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Tiamat Environmental Consultants Ltd.

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

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-03
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Heavy Dry Waste Site	**GROUND ELEVATION:** 847.734 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

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

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

Notes: Groundwater Monitoring Well is located on the south side of the access road on the site, near the east perimeter.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Field vegetation(weeds/mixed grasses/prairie wildflowers) and loam - sand, silty, trace rootlets, moist, olive brown. (~ 10 cm thick).					
	Sand (fill) - firm, silty, trace fine rounded pebbles, moist, olive brown.					
1.0	wet from drainage ditch for rail track.					
	Silt (fill) - soft, some clay, some organics, moist, olive brown to grey.					
	No obvious waste material.					
2.0	Clay (lacusturine) - soft, silty, wet, olive grey.					
3.0						
4.0						
	Sand (native) - compact, silty, trace clay, moist, grey.					
5.0						
6.0	End of hole at 6.1 m. 51 mm diameter 4.6 m length 010 PVC screen. Aboveground lockable steel casing set in concrete.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Tiamat Environmental Consultants Ltd.

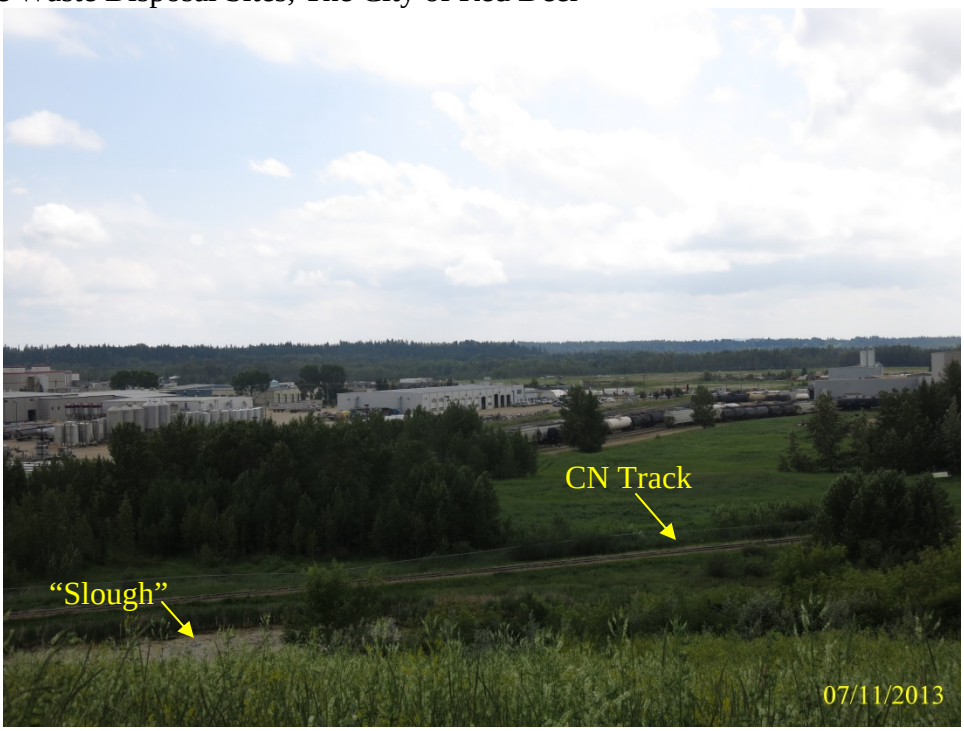
Slough : 1 m	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

APPENDIX C

SELECT PHOTOGRAPHS

Photograph No. 1: View of the site (hillside) looking west, access from the southeast corner of the Red Deer Fire Training Centre.

Photograph No. 2: View of the north perimeter (tree line) of site, facing east.



Photograph No. 3: View of the south perimeter of the site. Note slough located just north of the rail tracks.

Photograph No. 4: View of the west perimeter of the site along the top of the slope, facing south.

Photograph No. 5: View of MW-01, located on the southwest side of the site, looking south.

Photograph No. 6: View of MW-02, located on the northeast side of the site, looking northwest.

Photograph No. 7: View of MW-03, located on the east perimeter of the site, looking southeast.

Photograph No. 8: View of VP-01, located on the west perimeter of the site, looking southeast.

Photograph No. 9: View of the location of TH-03 and soil bag, looking northwest.

Photograph No. 10: View of MSW on the auger from a depth of 1.5 m to 3.0 m in depth at TH-03.

Photograph No. 11: View of drill rig at location of TH-06, looking north.

Photograph No. 12: View of soil bags after drilling, located by the entrance to the Fire Training Centre.